Trade-offs in sustainable intensification

Malawi country report

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Based on information collected by Chancy Kachamba, Ernest Banda, Bertha Katoma and Linda Masoapyola

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Total LandCare is a non-profit NGO in Malawi with a mandate to improve the livelihoods of smallholder farmers with a focus on community-based approaches to increase agricultural production, food security and incomes while ensuring sound management of their natural resources.

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About the project

SITAM (Sustainable Intensification: Trade-offs for Agricultural Management) was an action research project seeking to understand how smallholder farmers in Africa manage the trade-offs between production, sustainability, and other socioeconomic and environmental factors.

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Smallholder farmers in Malawi face a constant challenge: to choose between many, often competing, social, economic and environmental objectives while also meeting expectations to intensify their farming practices sustainably and produce 'more with less'. Farmers manage this situation by making trade-offs; choosing and prioritising goals based on household circumstances and by weighing immediate productivity/financial gains against long-term goals. This report presents findings from the SITAM project, which explored how farmers in Malawi manage these trade-offs. It draws conclusions and recommendations for what national and subnational government can do to support more sustainable choices at farm level in Malawi.

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Acronyms

ADD	Agriculture Development Division
ADMARC	Agricultural Development and Marketing Corporation
AECD	Agriculture Extension and Development Coordinator
ASWAp	Agriculture Sector-wide Approach
DCAFS	Donor Committee in Agriculture and Food Security
EPA	Extension Planning Area
FISP	Farm Input Subsidy Programme
MEL	monitoring, evaluation and learning
MGDS	Malawi Growth and Development Strategy
MOAFS	Ministry of Agriculture and Food Security, Malawi (formerly MoAIWD)
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MK	Malawian Kwacha
NAIP	National Agricultural Investment Plan
NAP	National Agricultural Policy
NGO	nongovernmental organisation
SAIRLA	Sustainable Agricultural Intensification Research and Learning in Africa
SAI	sustainable agricultural intensification
SITAM	Sustainable Intensification: Trade-offs for Agricultural Management
TLC	Total LandCare

Summary

This report summarises the findings of a research project on smallholder farmers' management of trade-offs in sustainable agricultural intensification (SAI) in Mwansambo Extension Planning Area (EPA), Nkhotakota District, central Malawi. The research was part of the Sustainable Intensification: Trade-offs for Agricultural Management (SITAM) project,¹ which aimed to address the challenges and opportunities smallholder farmers face in managing trade-offs between economic, social and environmental objectives.

We used a mixed-methods approach, combining literature review, participatory development of SAI indicators, a quantitative household survey (10% sample) and in-depth qualitative data collection from nine purposefully selected case study households in two villages, Mgombe and Chikango.

The in-depth study aimed to identify the types of tradeoff local farmers experience and the ways they manage them. Our case study households, which ranged from low to high SAI, helped us understand the perceptions and visions of different households and household members and the main influences on farmers' decisions.

Farming and livelihood systems

In common with most households in the area, our case study households' main crops are groundnut and maize. Some also grow tobacco, soybean, cassava, rice and cotton. The handheld hoe is their main land preparation tool, though some use zero/minimum tillage. Agricultural inputs are readily available, but poorer farmers with less land can rarely afford them. Farming is the main income source and many sell groundnuts to middlemen. Some households have invested in small businesses, selling firewood or other inputs and running grocery shops. Most male household members aspire to start a small enterprise to diversify their sources of income. Livestock is mainly goats and poultry; few households own cattle.

The average household landholding size is 4 acres, and the average household size 5.5 persons. Land is passed to the closest matrilineal male and many households have also bought or leased land. Male household heads tend to take most decisions on what and how much to farm. Although nongovernmental organisations and government projects have promoted conservation agriculture here for over ten years, only a few farmers have adopted all its components. Few practise zero/ minimum tillage and most still use traditional practices like ridging. Fertiliser and herbicide use is high and many believe that farming could fail without such inputs. Irrespective of whether they have adopted conservation agriculture, most farmers use herbicides.

Farmers' priorities

SAI aims to achieve economic, social and environmental objectives simultaneously. Our respondents' SAI objectives were increasing land productivity, farming profitability and household economic status, improving household food security and achieving environmental sustainability.

Economic factors and/or gains are the main driving force behind farmers' activities. In community and group discussions, they identified and understood the reasons behind negative environmental and social changes over the last decade. But they cannot prioritise the social and environmental impacts of their farming while they struggle with household economic and food needs.

Managing competing objectives

We identified the following trade-offs, strategies and synergies in Mwansambo EPA:

Trade-off 1: Meeting food or cash needs? Growing more cash crops increases household income at harvest but can reduce food sufficiency capacity later in the year. Case study households create a balance between both crop types, but are more inclined to grow cash crops to meet household needs. They grow food crops in moderation, considering storage, markets and household size.

Trade-off 2: Keeping or selling crops? Selling produce allows households to meet various needs, while storing it ensures food security. But storage is a challenge and most farmers sell their produce immediately after harvest, despite the benefits of storing some to sell later. Other influencing factors include proximity to selling points and food insecurity levels during lean periods.

1 www.iied.org/trade-offs-sustainable-intensification. The SITAM project is part of the SAIRLA (Sustainable Agricultural Intensification Research and Learning in Africa) programme https://sairla-africa.org/what-we-do/research/sustainable-intensification-trade-offs-for-agricultural-management-sitam/

Trade-off 3: Fast land preparation or environmental protection? Most households use herbicides to clear and weed land, to save labour and speed up land preparation. Although using herbicides saves time in the short term, there are many long-term disadvantages. Most respondents were unaware of the detrimental effects on the environment and health and do not follow basic health and safety precautions.

Trade-off 4: Prioritising own farm or cash income from piecework? In the short term, casual labour is an essential strategy that provides immediate food and cash. Case study households usually split their labour between their own and other farms. Although this prevents farmers from making long-term investments in their own farms, which would improve their livelihoods, it is a necessary sacrifice.

Strategy 1: Choosing low over high-input crops.

Growing more low-input crops like groundnuts rather than higher-input crops like maize reduces costs.

Strategy 2: Expanding production through loans.

Despite exorbitant interest rates, most farmers choose to incur informal loans to finance the inputs they need, often leading to debt and food insecurity.

Synergy 1: Complementing animal manure

with inorganic fertiliser, alongside soil and water conservation practices, increases soil fertility, reduces input costs and sustainably disposes of animal waste. Case study households have shown that combining these activities benefits household livelihoods and food security.

Several factors — from within and outside the household — drive the decisions farmers take. The main driver is usually household food security needs. But market reliability and access to resources, information, extension services, informal loans and markets also play a crucial role in influencing their trade-off management.

Cycle of indebtedness, hunger and low productivity

Most of our case study farmers are trapped in a never-ending cycle of indebtedness, hunger and low productivity. A combination of poor soil fertility, land degradation, droughts/unfavourable distribution of rainfall, pests, diseases and a shortage of livestock for manure production leads to low production. Having to dispose of a large proportion of produce immediately after harvest at a low price to repay high-interest debts puts them at a disadvantage in terms of food security. They then have to borrow again to buy food at high prices or work for food instead of labouring on their own farms. As a result, they cannot afford inputs in the next cropping season and need to buy on loan again.

Recommendations

To support the sustainable management of trade-offs at household and community level, we recommend that future SAI projects and programmes:

- Are designed and implemented based on evidence and previous experience to ensure that lessons about what does and does not work are learnt and applied, and project objectives are realistic rather than informed by political or donor interests
- Are informed by a clear understanding of contextspecific farm and household economics
- Enable a transition to farmer-led, less external inputdependent and agroecological systems that reward farmers for taking a long-term view
- Improve their targeting of farming households and avoid working with small sub-groups or creating dependency through free handouts
- Work through and with local leaders to create and enforce bylaws on burning residues, conservation agriculture, agricultural expansion, land degradation, deforestation and so on
- Strengthen women farmers' institutions and access to resources
- Support inclusive smallholder farmer group/ cooperative development to help poor farmers access inputs and practise conservation agriculture
- Support asset development for poor farmers, particularly livestock
- Adapt existing approaches to develop, pilot and roll out a community-based approach to storage facilities and warehouse receipt systems, and
- Enforce regulations around herbicide and pesticide sales, labelling and advice, and train farmers in responsible agrochemical use as part of an integrated control strategy.

"Permanent soil cover is one of the three pillars of Conservation Agriculture – as shown on this demonstration plot in Mwansambo EPA. But despite years of promotion of Conservation Agriculture, adoption of crop residue retention as surface mulch remains low for a number of reasons, including the need for residues as fencing, fuel and fodder, risk of bushfires, and fear of termites."

Demonstration field with crop residues in Mwansambo EPA. Photo credit: Barbara Adolph, IIED



Introduction

1.1 Background

In Malawi, agriculture is the main source of livelihood for over 90% of the population and constitutes almost 70% of national exports (FAO 2014). However, due to many factors — including environmental, economic and political changes — the agriculture sector has not thrived in recent years. To improve and develop the sector, the Ministry of Agriculture and Food Security (MOAFS,² formerly the Ministry of Agriculture, Irrigation and Water Development, MoAIWD) has put into place various actions, including the agriculture sector-wide approach (ASWAp) from 2011 to 2016 and the National Agricultural Investment Plan (NAIP), which runs from 2017 to 2023. But Malawi's policy environment still faces challenges and requires change (Dorward and Chirwa 2015).

The Sustainable Intensification Trade-offs for Agricultural Management (SITAM) project aimed to address the challenges and opportunities of smallholder farmers, specifically resource-poor and women farmers, in managing the trade-offs between production, sustainability and other socioeconomic and environmental factors.³ SITAM was part of SAIRLA (Sustainable Agricultural Intensification Research and Learning in Africa), a DFID-funded research programme that addressed sustainable intensification through eight research projects in six sub-Saharan African countries.⁴

This report summarises the study findings of a threeyear (2016–2019) research study on smallholder farmers' decision making in relation to sustainable agricultural intensification (SAI) in Mwansambo Extension Planning Area (EPA), Nkhotakota District, Central Malawi. There were four partners, with IIED providing overall project coordination as project lead. Practical Action Consulting provided national coordination services and oversaw and coordinated activities with national partners. Lilongwe University of Agriculture and Natural Resources provided research expertise, conducting and planning the research activities under during the first part of the project. Total LandCare (TLC), a nongovernmental organisation (NGO) that has worked in the area for over 10 years and is currently implementing activities in the study area, assisted in sampling and selecting study sites, planning and implementing field activities, and engaging with national-level stakeholders.⁵

The project's overall objective was to change the knowledge, awareness, attitudes and capacity of decision makers and other actors at local and national level, in support of proven pro-poor approaches for scaling up SAI that recognises farmers' perceptions of synergies and trade-offs. Through this objective, it aimed to inform policy development within the agriculture sector, creating an enabling policy environment for smallholder farmer development in Malawi. This is in line with current efforts under the National Agricultural Policy (NAP) and NAIP, which aim to foster coordination and investment by creating an enabling policy environment for the public and private sectors (Malawi Government 2018).

In most southern African countries, including Malawi, farmers' decisions about what to grow and when to grow it are influenced by several complex factors such as social relations, extension systems and messages, market access and resource availability. The lack of local infrastructure, poor extension services and lack of inputs also present a challenge to SAI in Malawi, with most smallholder farmers unable to afford fertiliser (Mungai et al. 2016).

² https://agriculture.gov.mw/

³ www.iied.org/trade-offs-sustainable-intensification 4 https://sairla-africa.org/

⁵ TLC is a non-profit NGO registered and operating in Malawi, Mozambique, Zambia and Tanzania. See www.totallandcare.org/

Our study emphasises the need for scientists and decision makers to work with marginalised farmers to strengthen agricultural development. The SAIRLA programme encourages research that creates an active learning and experimentation environment to identify feasible and implementable solutions (Mdee and Dedaa 2018).

1.2 Methodology and study objective

Our study used mixed research methods that complemented data collected from various stakeholders including EPA staff, community leaders and influencers as well as smallholder farmers. We used participatory methods, communicating project outputs to stakeholders through workshops, prioritising those directly affected by our findings.

The study had five main research steps (Figure 1).

- 1. Understanding the context: livelihoods analysis. A desk review of documents written about Mwansambo area, to understand the context and build a picture of social, cultural and economic life in the area and the foundational drivers of smallholder farmers' decisions.
- 2. Identifying the SAI indicators. Project partners with knowledge of the area and Malawi's agricultural sector held focus group discussions with farmers in the study area to identify community values that could form the basis for SAI indicators for Mwansambo. These values where then translated into indicators suitable for the local context and validated with community members (Annex 2).
- 3. Assessment of SAI performance. A quantitative survey of 142 households in two selected communities, Mgombe and Chikango, gave us an overview of the performance of the SAI indicators in these communities. The survey had two main objectives: to understand the existing farming and livelihood systems in the study area in quantitative

terms, thus adding value to the livelihoods analysis undertaken earlier by quantifying the phenomena described in these reports; and to inform the selection of case study households for the next phase of the SITAM project, by plotting households along a range of SAI indicators for Malawi.

- 4. Community-level assessment of natural resources and SAI. Focus group discussions and group exercises such as community mapping in the two communities illustrated changes in natural resources over the last five to ten years. This helped us understand community-level interventions and participation that support SAI and natural resource conservation. The focus groups had 10 to 12 participants, including older and younger community members as well as community leaders such as village headmen, committee members and church elders. During the discussions, it was emphasised that participants must have extensive knowledge of the area and be able to fully describe changes in the past years.
- 5. In-depth household case studies. We purposefully selected nine case study households from the survey participants, representing a range of SAI, from low to high. These gave us a deeper understanding of household-level decision making and make up this report's major findings. An overview of the exercises conducted with each household is included in Annex 1.

The objective of the household case studies was to understand different households' and different household members' perceptions of SAI, particularly in terms of the main influences on farmer decisions. We were specifically interested in understanding the perception of women and youths (either as key decision makers or as observers excluded from decision making) and the barriers they experience in moving towards SAI. We used these findings to formulate recommendations on effectively supporting a transition towards SAI in the central Malawi context.

Figure 1 The SITAM research steps



2

Farming and livelihood systems in the study area

2.1 Study site characteristics

MOAFS has divided districts into eight agriculture development divisions (ADDs). In central Malawi, Salima ADD, made up of two districts - Nkhotakota and Salima - has 14 EPAs. In Nkhotakota district. Mwansambo EPA borders Ntchisi district and has 110 villages and 10,240 farming households. Our two study villages, Mgombe and Chikango, are five and 15 kilometres, respectively, from the Mwansambo Trading Centre - the EPA's main produce market where farmers buy and sell agricultural commodities. We selected these study areas based on the implementation areas of TLC, our implementing partner in Malawi. The main distinguishing factor between the two communities was their distance from Mwansambo Trading Centre - a characteristic that key informants at EPA level considered to capture a range of differences between communities in the district overall.

The EPA has a total area of 28,839 hectares, of which 7,574 are arable land, 9,274 non-arable land and 2,432 are suitable for winter cropping.⁶ The prominent soil type is sandy loam. Farmers in both our study villages agree that the quality of farmland has declined over time due to overexploitation and mismanagement. Most farmers are trying to improve the quality of their land through soil and water conservation and soil fertility management. Conservation agriculture is one of the most common sustainable land management interventions in the area, promoted by the Ministry of Agiculture and NGOs alike. Natural and man-made forests are common within the area and are managed to conserve natural resources. Within the EPA, there are bylaws to protect planted and naturally growing trees. In principle, there are penalties for flouting these laws, but they are not always enforced. Community members reported that, over time, the overuse of natural resources has depleted reserves, but in recent times, people have made efforts to regenerate trees, shrubs and grasses. Community understanding of sustainable tree management is important because this area borders the Ntchisi Forest Reserve, one of Malawi's major reserves.

The EPA's four main rivers — Lifuliza, Kavuma, Mcholi and Kasangadzi — are the main sources of domestic and agricultural water. The major economic activity alongside these rivers, winter irrigation farming, has decreased in the past decade due to land degradation, which has resulted in floods during the rainy season. Despite the observable damage to the riverbanks, community members said there are no laws to protect these water sources.

2.2 Crops and livestock

Crops grown in Mwansambo include maize, groundnuts (especially the CG7 variety), cotton, rice, tobacco, paprika, sweet potatoes, cassava, soybeans, cowpeas, vegetables and various fruits. Groundnuts are the most prominent crop, with most farmers allocating large portions of land to this cash crop. Maize, a staple

6 Data obtained from government extension staff at Mwansambo EPA / personal communication.

food, is the second-most preferred crop. Almost every household in the grows maize, mostly the local varieties, though some farmers use improved open pollinated varieties, which have a shorter growing period and are more resilient to climate change. A few farmers use hybrid seed. Table 1 shows the crops grown by farmers in the two research communities.

Of the 142 households interviewed, 70.4% reported owning livestock — mainly chickens and goats, with some keeping pigs (see Table 2). Very few have cattle.

2.3 Farm size and land tenure

The average landholding size is 0.4-0.6 hectares (1-1.5 acres) per capita.⁷ Our survey findings show that, in our two study communities — where the average household size is 5.5 — the average landholding size per household was 4 acres, with a minimum of 0.5 acres and a maximum of 14 acres (see Table 3). Within our case study households, the minimum landholding was

TYPE OF CROP	PROPORTION OF FARMERS GROWING THIS CROP (%)			
	CHIKANGO	MGOMBE	AVERAGE	
Maize	93.5	94.8	94.1	
Groundnuts	100.0	100.0	100.0	
Beans	4.3	0	1.4	
Tobacco	4.3	1.0	2.1	
Vegetables	2.2	3.1	2.8	
Cassava/sweet potato	0	8.3	5.6	
Rice	2.2	2.1	2.1	
Soybean	32.6	9.4	16.9	
Cowpeas/pigeon peas	0	16.7	11.3	
Paprika/other spices	2.2	2.1	2.1	
Cotton	0	1.0	0.7	

 Table 1
 Crops grown in Chikango and Mgombe

Source: SITAM household survey report (2017)

Table 2	Types of livestock owned b	y households in	Chikango and Mgombe
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TYPE OF LIVESTOCK	PROPORTION OF FARMERS OWNING THIS LIVESTOCK TYPE (%)		
	CHIKANGO	MGOMBE	AVERAGE
Chicken	58.7	57.3	57.7
Cattle	2.2	4.2	3.5
Goat	52.2	53.1	52.8
Pig	6.5	18.8	14.8
Pigeon	2.2	3.1	2.8
Duck	0.0	2.1	1.4
Guinea fowl	0.0	1.0	0.7

Source: SITAM household survey (2017)

⁷ Data from the EPA agricultural office.

2.5 acres and the highest over 8 acres. This illustrates that landholding size is varied across households in Mwansambo. Most of the households with more land lease out land to those with less.

Farmers in both villages said that their farms have decreased in size over time, as they divide and share their land between their children when they start their own families. Most farmers own the land they farm, which has been passed down to them within the family. It is possible to seasonally rent land in the study villages, and in some cases, farmers have leased land from the traditional chief. Few farmers have the economic capacity to buy land and they usually rent additional land during the farming season to increase production. Some of those who own more land rent out plots and use the rental income to buy farming inputs or invest in off-farm activities.

Mwansambo is a predominantly matrilineal society, meaning the line of inheritance is through the women of the family. Although this has long been the tradition here, family dynamics have changed and farmers tend to give their land to their children, regardless of gender. Even so, land tenure and security in the area favours men over women farmers (Kaarhus 2010). Although women may own the land, men tend to take control of land use and all decisions regarding it.

2.4 Farming methods

Most farmers use the traditional handheld hoe to prepare and till the land. In Mwansambo, traditional ridging is common and widely practised, although turning the soil has a negative effect on its physical and chemical properties, soil biological activities and even crop yield. Since the arrival of TLC and other NGOs, 11.7% of households in the two study villages have adopted zero/minimum tillage. The use of ploughs for land preparation is not common among farmers in Mwansambo; this is confirmed by the few households that own cattle. Community meetings also revealed that few farmers owned oxen in the area. Conservation agriculture principles and other soil and water conservation practices - such as ridging and using field or boundary bunds for erosion control - are common among Mwansambo's farmers (see Table 4).

NGOs and the ministry of agriculture have promoted conservation agriculture for over ten years. And, although farmers in the area have practised it for this time, they do not use the whole range of conservation agriculture methods. Most farmers refrain from burning crop residues, but low yields have inhibited crop residue retention. Weed infestation — as a result of insufficient mulching and unaffordable herbicides — has also hindered zero/minimum tillage. The government

GROUP VILLAGE HEADMAN	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION
Chikango	0.5	13	4.65	2.85
Mgombe	1	14	3.78	2.29
Overall	0.5	14	4.06	2.51

Table 3 Household and farm sizes in Chikango and Mgombe (in acres)

Source: SITAM household survey (2017)

Table 4	Use of conservation agriculture methods in Chikango	and Mgombe
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METHODS USED	PROPORTION OF HOUSEHOLDS USING THIS METHOD (%)		
	CHIKANGO	MGOMBE	TOTAL
Incorporating crop residue/leaving residues on field	40.2	41.2	40.8
Boundary bunds	15.6	4.9	9.1
Vegetative barrier	7.0	3.6	4.9
Zero/minimum tillage	8.2	14.1	11.7
Green manure	6.2	4.1	4.9
Crop rotation	22.7	32.2	28.4

Source: SITAM household survey (2017)

TYPE OF CROP	TYPE OF SEED USED (%)			
	HYBRID	LOCAL	RECYCLED	
Maize	41.7	25.7	31.3	
Groundnuts	31.3	4.2	63.2	

 Table 5
 Types of maize and groundnut seed used in Chikango and Mgombe

Source: SITAM household survey

has promoted crop rotation since the early 1970s, and all farmers in the area practise this — particularly groundnut/maize rotation — to restore soil fertility and reduce pests and disease. But as most farmers only grow maize and groundnuts, there is little scope for a more elaborate rotation.

The use of external inputs such as fertiliser, herbicide, pesticide and improved seed is widespread, with almost every farmer using some type of external input on some portion of their land. The most popular are herbicides and chemical fertilisers, though most farmers in Mwansambo struggle to afford these inputs.

Most farmers use recycled and local seeds (see Table 5). They cannot afford to buy new seed every growing season and prefer local varieties because they are not easily attacked by pests. They also said that maizemeal produced from local maize tends to last longer. Those who can afford it use hybrid varieties, with farmers attracted to improved varieties that are droughttolerant or have early maturity. The improved groundnut variety, CG7, is also popular among Mwansambo's farmers due to its linkages to local and international markets, which makes it more lucrative.

Only a few households benefit from government programmes such as the Farm Input Subsidy Programme (FISP)⁸ and NGO-led interventions that support farmers, which do not provide enough inputs to satisfy households' needs. Fertiliser application rates remain far below those recommended. The average fertiliser use per hectare in Malawi is estimated at 42kg per hectare, which is well below the recommended 142kg per hectare (Nalivata et al. 2017).

2.5 Processing, storage and marketing infrastructure

Smallholder farmers in Mwansambo face challenges in post-harvest handling due to lack of resources, expertise and support. During the community exercises, farmers and community leaders highlighted challenges around processing, storing and marketing their produce, with farmers experiencing losses when they cannot process and store produce appropriately to obtain a good market price. Farmers in the study villages say that economic challenges and needs regularly force them to sell their produce while it is still in the field or immediately after harvesting.

At the time of our study, there was no processing and storage infrastructure available for farmers in Mwansambo. Most households own locally made seasonal storage huts but they reported that these are insufficient and do not fully protect produce from damage. In most cases, farmers store crops in polythene bags in the house, which is expensive as they need to purchase these every growing season. Some households build temporary bamboo storage units.

The area has two government-owned storage facilities run by the Agricultural Development and Marketing Corporation (ADMARC), built with the aim of buying produce from farmers at a national set price, storing it then selling it back to them in the lean season when food is scarce. However, corruption has rendered this system ineffective: ADMARC does not work to the advantage of the farmers; well-to-do large farmers manipulate loopholes by creating advantage so only a handful of farmers sell to ADMARC (Sangala 2017). The government has also built the Mwansambo Trading Centre, a produce market where farmers buy and sell agricultural commodities. Interviews with the agricultural extension and development coordinator revealed that most of the produce sold is either exported to Zambia, Mozambique or Zimbabwe or processed into other products.

2.6 Social and community institutions, gender roles

As in most of Malawi, community leaders are at the centre of Mwansambo's rural social fabric. Pillars of the community, they play a major role in advancing technologies and interventions in different sectors, including technologies such as conservation agriculture. Community development approaches that aim to improve groups of people rather than individuals also play an important role in Mwansambo, ensuring that the

⁸ The FISP has been implemented in Malawi since 2005/2006 to increase resource-poor smallholder farmer's access to improved agricultural farm inputs. The government claims that it has enhanced food security in the country (https://www.malawi.gov.mw/agriculture/index.php/projects/fisp). However, many challenges have been reported in terms of targeting of beneficiaries, and the toll of this investment on other agricultural services. See https://www.future-agricultures.org/projects/malawis-input-subsidies/ for more details on these issues.

very vulnerable are not left behind. Clubs, cooperatives and even village savings groups have supported farmers. Most people in the study communities belong to clubs and savings groups, with women specifically benefiting from such arrangements. But the amounts saved through such mechanisms are not normally enough to cover farmers' cash and food needs during the lean season, so most still take out loans with moneylenders or wealthier farmers at exorbitant interest rates to buy food in the lean months.

In Nkhotakota district, average annual expenditure is higher in male-headed households, which tend to invest more resources into cash crops, while female-headed households normally favour food crops. Male farmers also have better access to financial resources, so they can invest more into their farm work than women. In recent years, changes in social norms have seen women owning land irrespective of traditional inheritance lines. However, men still tend to take most of the decisions within the household, from the types of crop grown to decisions around harvest, selling and storing produce. Women may have the opportunity to express an opinion, but the men ultimately make the decisions. Women are also solely responsible for all household chores as well as most of the manual farm labour. In some households, men do very little farm work and are instead engaged with other trades or what they deem to be more lucrative work. In some households, men simply leave most of the work to the women (Paul et al. 2017). Men and women also have different goals and needs (see Table 6).

More than 71% of householders in Nkhotakota own the house they live in; 42.1% live in semi-permanent housing and 29.5% in traditional houses with mud walls and grass-thatched roofs (NSO 2017). During our field visits, we observed that housing conditions in Mwansambo EPA appear to be improving, with most households living in permanent structures (fired bricks with an iron-sheet roof).

2.7 Off-farm opportunities / income

Mwansambo is the main agricultural producer in Nkhotakota and its neighbouring districts, Ntchisi and Salima. Farming is the main occupation (see Figure 2) and largest source of income, especially small-scale commercial groundnut production.

As well as farming their own land and selling produce, households generate income from working casually on other farmers' land (see Figure 3). Farmers, especially youths, do 'piecework' (temporary labour), building people's houses, tilling other people's fields and helping with crop harvesting and food crop storage. Households also engage in small-scale enterprises, selling different commodities to local people. The figure below shows that crop sales provide most the income for surveyed households.

Enterprises such as small restaurants and food stalls are popular in the area, catering to short-term visitors who flock to the area during the harvesting period. Selling fish is an important livelihood activity for some households, considering the study area's proximity to Lake Malawi. A larger proportion of households are involved in selling firewood, vegetables, livestock, processed/roasted groundnuts, sugarcane, bananas and locally butchered meat. The Ntchisi Forest Reserve also provides non-timber forest products such as fruits, mushrooms and honey. The main forest products sold include firewood and charcoal. Charcoal is mainly produced by men, while most women and children (mainly girls) collect firewood for sale at the local market

Table 6 Goals and aspirations of women and men in Chikango and Mgombe

MEN'S ASPIRATIONS

- Beneficial and productive work Owning assets such as a bicycle, furniture or motorcycle Building a good house Producing enough food for the household Owning a business enterprise Proximity to good markets Proximity to good schools for their children
- Easy accessibility to facilities such as hospitals

WOMEN'S ASPIRATIONS

- A good place to sleep (cement house with iron sheet roofing)
- Owning assets such as a motorcycle for easy transportation
- Having enough food available throughout the year Dressing and feeding their children well
- Owning livestock and poultry in their home compound, which could be a source of food - especially eggs and income
- Having functional boreholes and trees not far from their houses, for easy access to water and firewood

Source: Paul et al. (2017)

and household use.

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Figure 2 Respondents' main occupations



Source: SITAM household survey (2017)

 $Figure \ 3 \qquad \text{Annual income levels of respondent households who rely on the four main income-generating activities}$



Source: SITAM household survey (2017)

Note: MK=Malawian kwacha (£1 = 949 MK in February 2020)

2.8 Agricultural services, institutions and policies

Several agricultural services are available in the area, guided by different institutions and policies. The MOAFS provides services to smallholder farmers at district and EPA level via extension staff and projects. In Mwansambo EPA, an agricultural office managed by the agriculture extension and development coordinator (AECD) oversees all agricultural extension officers. Its mandate is to provide information, training and resources on emerging and available technologies for various smallholder crop and livestock production practices in the area. Most of these practices come from research stations or are promoted by projects and farmers have limited involvement in their design and testing. Some of the technologies are too risky for smallholder farmers, depend on inputs that they cannot afford or are not adapted to the local setting, making upscaling difficult (Knorr et al. 2007). In Mwansambo, limited resources are a major challenge to technology advancement in agriculture.⁹ As well as lacking access to up-to-date information about available technologies, extension officers do not have the capacity to engage with farmers in technology development and piloting. The farmer-to-extension worker ratio is high and extension officers do not always have the transport needed to mobilise farmers.

⁹ Personal communication with the AECD.

Government programmes currently running in the area are the FISP and the Green Belt Initiative, a largescale sugarcane production and processing venture that directly targets smallholder farmers, particularly resource-poor households and especially in terms of seasonal work opportunities. Several NGOs, including Concern Universal (now United Purpose), TLC and World Vision, have also implemented agricultural and livelihoods initiatives in the area. These NGOs and local institutions, in partnership with the government and traditional leadership, have established community bylaws to regulate natural forest management. NGOs such as TLC also promote conservation agriculture.

Agricultural activities in the area are implemented in line with several national policies, including the National Agricultural Policy, the National Seed Policy and the National Climate Change Management Policy. In 1998, the government adopted the Malawi Vision 2020, which provides a policy framework for the implementation of short- and medium-term plans for development sectors, with agriculture and food security as priority areas.

The Malawi Growth and Development Strategy II (MGDS II) was a long-term vision, translated into a medium-term policy that was in effect until the beginning of the SITAM project in 2016. Its main objective was reducing poverty through sustainable economic growth and infrastructure development by increasing agricultural productivity and diversification on a sustainable basis. MGDS II envisaged a Malawian population that is food secure and more resilient to climate shocks. MGDS III (2017–2022) prioritises agriculture, water development and climate change management, emphasising agricultural transformation via value chain development and agricultural productivity enhancement.

2.9 Social outcomes: education, health, food security and coping strategies

The area is served by a health centre, a secondary school, 15 primary schools and a post office. Despite having many schools, completion of formal education is not widespread in Mwansambo EPA. This could be due to several factors, including the demand for family labour in farming households, which keeps children out of school. School dropout rates are high, with most young people dropping out at primary school level. The SITAM household survey showed that, while more than 60% of community members in Chikango and Mgombe attended primary school (see Figure 4), 13% have no formal education. More than 20% attended secondary school but none have any form of tertiary education.

The community authorities have set up bylaws to ensure that younger children attend school, especially during the farming season. Most adults in Mwansambo EPA have basic vocational skills, such as carpentry and bricklaying. Local people have basic knowledge and experience in health and wellbeing, farming and managing small-scale businesses.

The area faces high rates of out-migration, especially during hunger periods. Some household members particularly men and youths — seek piecework in other parts of Nkhotakota district and beyond. Nearly 50% of households reported running out of food stocks before the next harvest. On average, households in the two study communities said they were food secure for up to seven months of the year, depending on factors such as rainfall and market availability of food.

70 60 50 Response 40 Chikango 30 Mgombe % Total 20 10 0 None Primary Secondary Adult literacy Level of education attended

Figure 4 Respondent households' level of education

Source: SITAM household survey (2017)

Note: School attendance does not imply completion.

In Malawi, most female-headed households only generate enough staple food of their own to last five to six months (NORAD 2009). Our survey also found that food insecurity was particularly acute among female-headed households due factors relating to land ownership, access to farm inputs and labour. Coping mechanisms in such situations include doing piecework, reducing the number of meals, depending on wild foods such as fruits, selling household assets or borrowing money (see Table 7). Food-insecure households often resort to selling their assets (particularly livestock). Some rely on food aid. To assess coping strategies during different times of the year, case study households were asked about these three times during the year (see Figures 5 & 6, and excercise P5.2 in Annex 1).

 Table 7
 Case study households' coping strategies during the lean season

HOUSEHOLD NUMBER	DURATION OF FOOD FROM OWN PRODUCTION	EATING NON- PREFERRED FOOD?	EATING SMALLER MEALS?	NOT EATING ALL DAY?	OTHER COPING STRATEGIES
1	Whole year	NO	YES	NO	Selling livestock Help from children
2	Whole year	NO	NO	NO	
3	April to September	YES	YES	YES	Casual labour Trade: selling bananas
4	April to October	YES	YES	YES	Casual labour Loans from friends and family Small-scale business: selling firewood
5	April to December	YES	YES	YES	Casual labour Gathering wild fruits and vegetables
6	March to December	YES	YES	NO	Selling livestock
7	April to December	NO	NO	NO	Selling livestock
8	April to November	YES	YES	NO	Casual labour Loans from friends and family
9	April to November	NO	NO	NO	Using money from casual labour to supplements months when own food is finished

Source: SITAM household case studies (2018/19)

3 Farmers' perception of sustainability

3.1 Economic dimension

Farmers in Mwansambo EPA have significantly invested in farming as a source of income and food for their households. All the case study households rely on farming as their main source of income, despite the challenges they face, particularly around access to and affordability of inputs and other resources. Although farmers want and need to increase productivity, they believe that they do not have the means to do so. Some of the common hindrances they face are small landholdings, lack of money to buy fertilisers (due to high input costs and low market prices for produce) and a decrease of soil fertility and productivity. The agricultural extension services are also poorly equipped, with several positions unfilled and operational resources lacking.¹⁰ The service providers do not necessarily have the skills and motivation to address farmers' priority needs, as they rely heavily on specific projects and programmes — often donor funded — for training and operational support.

Economic drivers pose challenges that are common across the households, as the little income they earn from crop sales is usually required for other household activities, including non-farm related expenses. Farmers lack enough money to buy fertilisers and believe that they cannot achieve high productivity for maize without it. As a result, most households have diversified to groundnuts, which they find more economically viable as they do not need to use fertiliser to grow groundnuts. Some households have even gone to the extent of not growing maize at all, to eliminate the purchase of fertiliser altogether. Most farmers believe that the profitability of their farming is directly linked to higher crop production — so, the more they produce, the higher the gains. Farmers have also realised that other crops that fetch higher prices on the market — such as groundnuts, soy bean and even tobacco (though the latter has been out of favour during the past years due to low and unstable prices) — are more profitable than maize. Farmers also believe that due to informal loans taken from better-off farmers during the farming period, repaying these at 100% interest immediately after harvest, they cannot make any profit and are at risk of being trapped in a spiral of debt that they will not be able to escape from.

Marketing and pricing are two of the many challenges farmers face. The Mwansambo area receives an influx of produce buyers — mostly middlemen — who buy commodities at reduced prices to sell on to wholesalers at higher prices or resell later in the season. Most households believe that this influx of vendors and middlemen into the area causes unfair prices. Because farmers have no access to the main markets and have other household needs, they feel forced to sell their produce wherever they can. Having other household challenges they need to spend money on immediately after harvest prevents them from storing produce to sell later when the prices have gone up.

Although value addition could economically benefit farmers, it might not be an easy activity for poor farmers considering their lack of resources and investment power. Farmers will grade their produce (by quality requirement) at buyers' request. Graded produce may fetch a slightly higher price, but this typically depends on the quality and sometimes the variety of the produce. Beyond shelling and grading, farmers do not engage in other forms of value addition. They will sometimes sell their groundnuts unshelled, to avoid incurring labour costs.

3.2 Social dimension

From the focus group discussions, it became clear that most households are concerned with the wellbeing of their family and community members in terms of being able to eat a variety of foods, living in a house with an iron sheet roof and having good clothes. A few — but not many — households are concerned about their status in the community. Most households send their children to primary school, which is free, but they may discontinue their children's education once they have to pay school fees at secondary level. Despite varied challenges, some households in Mwansambo have taken a positive stand towards education, with some selling livestock and farm implements or making other sacrifices to ensure their children complete secondary school.

Although communities are addressing gender inequality issues through awareness-raising activities, gender gaps remain at household level. In most cases, the husband makes all decisions in terms of what to grow on how much land, when and how to sell the produce and what to do with the money, mainly viewing the women and children as part of the labour force. Even though household members are aware of gender equality issues, they seem to not take a proactive stand in reducing inequalities, mostly because they believe their current roles are normal and work fine. During most interviews, the husband would lead the conversation and respond to the questions and the women would quietly agree with what the men said. It is part of Malawi culture that women must not interrupt or argue with their husband in public, which explains the lower level of interaction by women during interviews.

Because of women and youths' subordinate position in society, there is little conflict in terms of interests, decisions and ideas. Both women and youths will await the decision of the household head and make little or no resistance. Traditional authorities also influence household decisions — for example, the use of conservation agriculture in the area has increased under the influence of chiefs and other community leaders. They are instrumental in helping reduce conflict at community and household levels and preserve traditional culture and knowledge.

3.3 Environmental dimension

From the focus group discussions, we learnt that farmers in Mwansambo EPA are aware of the environmental damage that has been done in the area. Most households realise that continuous land, fertiliser and pesticide use has reduced soil productivity. In recent growing seasons, they have seen an improvement in the soil after adopting soil conservation measures. Although they understand the importance of preserving their soils so that future generations can farm the same land productively, they struggle to leave the land fallow. As they own little land, they have no choice but to cultivate it continuously. Many farmers are trying to increase the number of trees on their plots as a conservation measure and invest in community woodlots and forests. The two study villages have a natural community forest, which has shrunk in size over the last five years. They have taken the initiative to plant more trees.

Water sources seem to be the most degraded and are of greatest concern to the community. Farming along the riverbanks has led to a high level of siltation in and erosion along rivers and small streams. Large gullies have formed where small streams once existed and local farmers believe that, with knowledge of gully and tree management, they could reduce this degradation. Most households understand the impact this can have on their farming activities and have taken the initiative to reduce these effects to their best ability.

Most community members understand that, due to population increases in the past ten years, demand for natural resources such as trees, water and land has increased. Members also foresee that this demand might increase even more in the future. It is common understanding that previous use of natural resources was not very considerate of the fact that they might need the same natural resources in the future. NGO interventions have made the community aware of the effects of unsustainable resource use and there are now community-level measures to help conserve and replenish the natural resource base. These include bylaws that charge or fine farmers for using forest resources.

3.4 Farmers' aspirations: examples from case study households

Case study households were asked to envision their future and give an idea of what they would like their lives to be like in the next 5, 10 and 30 years. This exercise illustrated households' long-term plans and aspirations.

Case study household 3 expects to invest in irrigation technology, build a better house and increase the types of crop they grow in the next five years. In ten years, they want to be financially stable enough to be able to invest in new technologies, including new plant varieties. Finally, they believe that in 30 years' time they will be old and weak but would have taught their children, who will have taken over their land and farm. Case study household 9 — a younger couple would like to increase their farmland in the next five years so they can grow soybean as well as maize and groundnuts. They would also like to invest in livestock and start an off-farm business, possibly a grocery store. They said they had not thought as far as ten years ahead, but believed that in 30 years' time their daughter would be old enough to get part of their land and use it for her own farming.

Overall, our case study farmers' priority objectives are:

- 1. Improving their household food security.
- 2. Increasing the profitability of their farming and improving their household's economic status, and
- 3. Increasing the productivity of their land.

For many households, food security was the number one objective and most farmers will work towards achieving this by any means. Farmers understand the need for socioeconomic progression as well as conserving the environment, but these are not a priority for them when they cannot sustain their food supply for a full year. There is a common belief that if they do not have enough food in their household, they cannot invest their time and resources in improving their economic or social status and effectively conserving their natural resources. But almost all households take part in community-level natural resource management activities and most agree that replenishing and conserving their natural resources is a priority objective they are working on together.

4

Managing competing objectives: trade-offs in SAI

4.1 Definitions and framework

For the purpose of this study, we define a trade-off as 'a compromise between two desirable, but to some extent incompatible, objectives.' Managing trade-offs is about maximising the overall level of achievement. Synergies exist where the achievement of one objective enhances the achievement of another. The overall achievement is

greater than if the two had been unrelated. The aim of farmers' livelihood strategies is to maximise synergies and minimise trade-offs within the confines of the resources available to them, including their own knowledge and understanding.

To analyse trade-offs, we used the Sustainable Intensification Assessment Framework (Musumba et al. 2017).

CATEGORY	DECISION	EXAMPLE TRADE-OFF	POTENTIAL SYNERGY
Within a domain	Land allocation	Legumes v maize	Intercropping increases harvest for both
Across domains	Crop residues	Fodder v soil fertility	Integrated system with effective manure use
	Level of input use	Production v pollution	Fertiliser stimulates improved soil carbon cycling
Across spatial scales	Land use – intensification or extensification	Farm-level profitability can lead to landscape level habitat loss via agricultural expansion	Investing in diversified agriculture expands habitat (land sharing)
Across time	Time preference in soil management	Immediate gain and long-term loss v short-term loss and long-term gain	Multipurpose legumes for food, fodder, fuel, income and / or soil fertility
Across farmer types	Community grazing norms during dry season	Crop growers control residues v herders with free access	Manure from herders enriches soils of farmers

Table 8 Types of trade-off and synergy

Source: Musumba et al. (2017)

4.2 Farm and householdlevel trade-offs and strategies

In this section, we explore in depth some of the decisions made by our nine case study households and the factors that influenced them. Regardless of the size and investment, their main objective in all these decisions is livelihood enhancement. Households work to meet their members' food and financial needs to the best of their abilities. Due to the detailed nature of the data we collected, we cannot present all households individually. We only present two of the case study households in detail to show the extreme differences in decisions, characteristics and influencing factors. Annex 4 shows an overview of some of the common decisions our case study households make, some of the trade-offs that exist and some of the synergies and opportunities that emerge from these competing objectives. It also illustrates the common influences of such decisions and compromises within the household.

4.2.1 Case study household 4: a poor, female-headed household

This is a female-headed household with five members: a woman and her four young children. Their main decisions are centred on securing food for the household. Their main occupation is farming but they depend heavily on piecework as an alternative source of income and coping strategy. Stocks produced from their own production are hardly enough to feed the household for the year. Although the study did not go in-depth into financial status and so cannot fully determine a household's economic status, at a glance, we could see this is a resource-poor household, which we categorised as a poor household. At the time of the study, they had few assets: only a radio and a few chickens (Figure 5). We later discovered that the household is polygamous and known to be the husband's second home. His other home was not part of this study.

In terms of food security, 2014 was the easiest year for this household. They were able to buy the fertiliser and herbicides they needed to sustain production because the husband got some money working at the sugarcane processing plant in Dwangwa. The most difficult year was 2015, when they had no money for fertiliser and herbicides and their maize was attacked by pests. Over the years, they have faced difficulties in accessing agricultural inputs due to the increased price of seeds and fertiliser. They considered getting a loan from finance lending companies but did not qualify as they had inadequate collateral. This household owns three acres of land. They grow maize on one acre and groundnuts on the other two (see Figure 7). Like most households in Mwansambo, they prefer local over hybrid seed, although they sometimes mistake local seed for recycled hybrid seed. Since this is a resource-poor household, they are more prone to using recycled seed and do not use external inputs such as herbicides. They use both manure and fertiliser but it is not clear how they acquire the manure as the livestock they own is not adequate to produce enough manure for the land size.

When asked how she envisions her household's future, the household head said that she did not expect her household to change much, because they usually harvest very little.

4.2.2 Case study household 7: a more established male-headed household

This household is older and better-off than Household 4, and their activities are motivated by producing enough crops for household food consumption. They would also like to have enough money to buy bicycles, radios and even a car. In the last five years, they have adopted sustainable farming methods such as conservation agriculture and observed that they are producing more. Their main occupation is farming, but they survive through piecework and selling livestock. They own several assets including furniture, an oxcart and a variety of livestock. Despite being better off than other case study households, they reported that their food security has declined in the past five years (see Figure 6). Their best year for food security was 2013 because they had enough inputs to support farming. But in the following years, erratic rainfall and low groundnut prices meant they struggled to buy inputs and faced food insufficiency challenges.

The household said they were farming eight acres of land but own around seven hectares. Due to a lack of inputs, they cannot use all their land. They grow groundnuts on five acres and maize on three. To manage the soil fertility, they use a combination of compost/ manure, inorganic fertiliser and crop residue retention, zero/minimum tillage and traditional ridging.

Their aim is to see a change in the family's livelihood, particularly for their children, as they envision improving their household through agriculture production. The household head would like to see his children enjoy the land that he has taken care of and wants to teach them the importance of conservation. As such, they are committed to conservation activities on their land. $Figure \, 5 \qquad Household \, 4: key \, demographic, asset \, and \, food \, security \, characteristics$



Source of data: 1. to 4.:SITAM household survey (2017); 5. & 6.: SITAM household case studies (2018/19)

Figure 6 Household 7: key demographic, asset and food security characteristics



Source of data: 1. to 4.:SITAM household survey (2017); 5. & 6.: SITAM household case studies (2018/19)

Figure 7 Household 4: land and agricultural practices



Source of data: SITAM household survey (2017). Note: Only shows relative plot sizes, not layout



Source of data: SITAM household survey (2017). Note: Only shows relative plot sizes, not layout

4.3 Discussion

We have already defined trade-offs for the purpose of the SITAM project as 'a compromise between two desirable, but to some extent incompatible, objectives.' In this section, we describe the competing objectives and the strategies that different types of household use to address them.

Trade-off 1: Growing more cash crops increases household liquidity at harvest but may reduce the household's capacity to be food sufficient later in the year

Competing objectives:

- 1. Increasing the months of being food sufficient through own production.
- 2. Growing cash crops that can be sold at harvest and using the money to buy food and meet other household needs.

Food sufficiency is an important aspect of farming in Mwansambo. Our study findings show that most homes are food insufficient, with farmers unable to feed their households for the entire year. They usually only produce enough for six to eight months of the year. As we saw in Table 7, farmers use various coping strategies to ensure that they meet their households' food demands. They usually face a dilemma involving choosing between food sufficiency and cash crops. Many factors affect their choices and they need to strategise to gain maximum benefit, while taking their households' food and financial needs into consideration. Although food is important, they cannot survive without money or another source of income. Farmers agree that it is economically viable to grow and create a balance between the cash and food crops. Farmers reported that they understand that both types of crop have potential benefits when rains and weather are favourable, but men usually make the farming decisions and are more inclined to grow cash crops.

There is also synergy between the competing objectives, as a balance between them provides households with both food and cash. Rotating between the two crop types also benefits the soil. It is therefore common to find farmers growing both but allocating more land to cash crops than maize, which they grow in relation to household size if inputs such as fertiliser and seed are available.

Households usually invest money from the sale of produce in assets, education (school fees, uniforms and so on) and business. Male farmers usually prefer having money for these uses, while women would rather have food in the home. Male household members also said that having accessible cash has its disadvantages, as women will usually ask them to buy items that they view as irrelevant or unnecessary. It is interesting to observe that while men would like to have cash to use as they please, they tend to view women's requests for spending as unimportant and a waste of money.

In the case of Household number 4, while dealing with the fact that they do not have enough land to grow their own food, the household realised that their land had lost its productivity or fertility and switched from maize to groundnuts to improve the output of their land. Upon further enquiry, we noticed that, despite low land productivity, the family was struggling to get even basic day-to-day sustenance. We asked why they grew only groundnuts if they did not have enough food.

BOX 1 A HISTORY OF CASH CROPS IN MWANSAMBO

Mwansambo has a long history of cash crop production – including tobacco, cotton, soybean, and, more recently, groundnuts. As in other parts of Malawi, farmers have been changing the cash crops they grow in response to changes in local market prices, which in turn are dependent on regional and global markets.

Cash crops account for the bulk of agricultural export revenues in Malawi. According to FAO (2017), unmanufactured tobacco, sugar and tea together accounted for more than 80% of Malawi's total agricultural export value between 2005 and 2011. Between 2005 and 2012 the overall agricultural exports growth was driven by the annual 10% export growth of tobacco (accounting for over 50% of export revenues) and cotton, mainly determined by favourable international prices for both commodities. Groundnuts were also increasingly exported during the same period, with an annual growth rate of 44%.

In Mwansambo, groundnuts are the preferred cash crop because they not only fetch a good price, but can be grown without inorganic fertiliser, which farmers find expensive. However, farmers in Mwansambo say that the prices are under pressure, with dealers using cartel-type arrangements to agree on farm gate prices. Both the Ministry of Agriculture and a number of NGOs have recently introduced new cash crops, such as soybeans, to diversify income opportunities for farmers.

The husband explained that, as they could not afford fertiliser to grow maize, they opted for the less resourceintensive crop of groundnuts.

Although several factors influence farmers' choice to increase maize production on their farms, the social factor is the biggest influence. Our study participants revealed that people in Mwansambo think it is wise to grow maize for your household, regardless of whether you have fertiliser. Several farmers told us: *"munthu osalima chimanga ndiye kuti mutu wake sugwira ndithu"* or 'if any household decides to not grow maize, they can plainly be assumed to be senseless'. This view ultimately pressurises farmers to grow maize even if it makes economic sense to diversify.

Markets also play a major role in farmers' decisions. The erratic nature of availability and pricing of commodities on the market has created uncertainties for farmers. In most cases, they believe that markets work against them in favour of the big buyers and exporters. Case study respondents and community meeting participants alike revealed that they cannot trust that maize will be available on the market when they need it or that it will be available at a price they can afford. This also puts pressure on farmers to secure as much in food reserves as they can from their own production, rather than struggle to buy maize on the market. The difference in market commodity pricing also influences their decision to increase groundnut production. Groundnuts will easily fetch five or six times the price of maize on the market on the worst days.

Trade-off 2: Using herbicides for land clearing and weeding saves time in the short term but there are long-term disadvantages, including impacts on health

Competing objectives:

- 1. Using herbicides to reduce the time spent on the farm.
- 2. Manual weeding to reduce the cost of farm inputs to the household.
- 3. Reducing environmental and health impacts on own and other farms.
- 4. Increasing the availability and nutritional value of local and wild vegetables.

Conservation agriculture is a popular practice among households in Mwansambo. Although it has many benefits, households have only adopted some of the principles and have not embraced all conservation agriculture practice. Conservation agriculture helps households reduce the time they spend on the farm because it eliminates activities such as ridging, raising field bunds for erosion control and weeding. Farmers say that their use of conservation agriculture is usually determined by their ability to afford herbicides, which is a challenge for poor farmers. Without herbicides, zero/minimum tillage is difficult to adopt and requires a lot of labour for manual weeding. Four out of the nine case study households use zero/minimum tillage or a combination of zero/minimum tillage and ridges, depending on herbicide availability. All nine have used herbicides at some point, regardless of whether they practise zero/minimum tillage.

Our case study households reported that they usually do not have enough money to buy the herbicides that they need. Our discussions with farmers show that they understand the positive effect that herbicides have on time spent on the farm, with respondents reporting that when they do not use herbicides, they need to spend more time weeding. Those who combine zero/minimum tillage with herbicide save even more time and money because ridging is time consuming and they usually need to hire in external labour, making it expensive. But farmers still choose to make ridges because they do not have the resources they need to buy herbicide to prepare their land.

Although herbicide use was originally linked to conservation agriculture (which aims to reduce soil disturbance as a result of ploughing and weeding), we observed that farmers use herbicides, regardless of whether they practise conservation agriculture. Our field observations show that even farmers who still use traditional ridging use herbicides to kill weeds. Farmers report that using herbicides saves them time and allows them to cultivate larger areas that they could not manage under manual weeding. The older farmers appreciate the use of herbicides even more, reporting that they cannot farm large areas without them.

But herbicide use is not entirely positive; there are many health risks that, while not immediately obvious, can seriously affect farmers with time (Wekesah et al. 2019). Deciding to use herbicides might provide shortterm benefits to the household but lead to long-term health challenges. This raises the question of whether using herbicide is environmentally and economically sustainable. Although information on the health impacts of herbicides is widespread, farmers in Mwansambo dismiss the idea that continuous herbicide use may affect their health. During a community discussion, one lead farmer even said: "mankhwala opha udzu ndi ofunika kwambiri, amatithandiza kwambiri, ndipo aliyense atati azigwirisa mankhwala zingakhale bwino *kwambiri*" or 'herbicides are very good; they help us a lot and should be promoted'. Women farmers, however, said that herbicide use has depleted the availability of wild and local vegetables, impacting household nutrition.

The Malawi government (2017) acknowledged that indiscriminate use of agro-chemicals risks degrading soils, poisoning non-target species, polluting the environment and has other risks to health and safety, including accidental poisoning. The Malawi Pesticides and Control Board was established with the mandate of ensuring the safe and controlled use of chemical products for agriculture. Although the board has been accused of failing to fulfil its mandate in the past years (Mphatso 2015), the government has made efforts to ensure that farmers do not incur damages from chemical and biological pest management. In 2017, the MoAIWD's draft pest management plan under the ASWAp Support Project II stated the challenges of chemical use by smallholder farmers learnt from ASWAp Support Project I. These included the lack of protective gear, misinformed chemical use and the limited role of the ADD, which is simply regulatory, preventing them from impounding illegal chemicals on the market. This explains why traders can get away with selling banned agricultural chemicals at Mwansambo market, just minutes away from the agricultural office.

One of the major influencing factors of this trade-off is access to herbicides. Responses show that most farmers would manage zero/minimum tillage with adequate access to herbicides. We could not fully verify this claim, though, because other farmers continue to use ridges even when they have access to herbicides. Deciding to adopt a soil conservation measure goes beyond simple access to inputs. Such decisions are also affected by mindsets, household dynamics and peer influences. When asked about land preparation, farmers said they use ridges because they have always done so, as their parents and grandparents did before them.

It is clear that the influence of organisations like TLC goes a long way towards changing mindsets. The case study households that have adopted zero/minimum tillage did so because of the training and knowledge they got from TLC. Social influences are also at play. Farmers reported that they began to use conservation agriculture practices such as zero/minimum tillage after observing the benefits on someone else's farm. Similarly, most of the households that use herbicides started to do so after seeing the benefits that others have obtained. Despite the challenges in purchasing them, using herbicide for weed control is popular among farmers in the Mwansambo area.

Trade-off 3: Selling produce enables households to meet various needs of the home but storing produce ensures their food security

Competing objectives:

- 1. Selling crops from harvest to generate income for other household activities.
- 2. Refraining from selling crops to ensure a longer period of food availability for the household.

Farmers find themselves having to decide whether to store produce after harvest for household consumption until the next season or sell the produce to pay for several household needs. Many will sell their crop to pay school fees or buy external inputs such as fertiliser for the next cropping season, leaving them without enough food to last until the next growing season. Most of the households depend heavily on farming as a source of food and income and few have livestock that they could sell in times of need. Even fewer have off-farm businesses to sustain other household needs. So farmers are always in a dilemma about whether to keep the little they have harvested so they have food for the next couple of months or sell the produce so they have money at hand.

Seven out of the nine case study households reported that the food they produce cannot sustain them for the whole year. Of these seven, up to three sell part of their maize despite not having enough to last them till the next season. The others choose to store the food because the prices go up during the lean period. So, if they do not store and manage their produce properly, they will not have anything to eat. While having money may seem more appealing - enabling them to buy a variety of foods — it seems to be less economically sustainable in terms of food security. It is interesting to note that the older households usually store their produce to consume slowly over some months; if needs be, they will also sell some of this to help meet small household needs. The younger households, however, are more prone to selling a large portion of their produce to gain money.

Learning from the case study households, we found that farmers have created a balance in terms of how much produce they sell and how much they keep. During community meetings, farmers agreed that they need to plan to take into consideration their household size and needs, which should dictate how much they sell and keep. In many cases, farmers will sell a small amount to meet an immediate need. Most farmers do not really have a choice when there is an emergency. If a household member is ill, someone has passed away or they need money for school, they will usually sell whatever they have. This means that later in the season they will most likely experience problems and will need to earn money (usually through piecework) to buy food.

Household 8 in Chikango is an elderly couple who live alone. All their children have completed their education, moved away to cities and now help their parents with inputs such as fertiliser, other chemicals and seed. The couple reported that they have not had a food shortage in their home for many years, even when the rains are bad. They survive by managing their harvest and making sure that they plan for the maize they need to sustain them through to the next season. This has always worked for them, and they usually go the whole year eating the food their own produce. They have had to supplement their reserves with bought food very few times. They only sell some of their crop when they want to eat something that they do not have; in an emergency, they have livestock they can sell. They do not believe that selling their food can do them any good.

Although many factors influence a household's decision to sell or keep maize, the most common is a lack of resistance to shocks such as illness, death and disaster. Many of these are influenced by dynamics that they cannot control, including global economic or environmental change. Most households are unable to withstand a shock within the home due to their lack of alternative income sources. When they cannot find an alternative solution to an emergency, they end up using or selling crops from their reserves.

Storage capacity is another major influencer in this decision or trade-off. Many households lack the necessary technologies and resources to store their produce for a long time. They would rather as much produce as they can to minimise damage and reduce storage costs. Most households use polythene bags for storage; these are unsustainable and expensive as they need to buy new bags every growing season to ensure proper storage. At the same time, these bags are not durable enough as mice and other pests can destroy the grain stored in them. Some farmers build maize silos from bamboo, but these can only hold grain for a short period, while maize is still available in the community. When food becomes scarce, the silos are prone to theft as well as rain damage. Farmers then have to remove the maize, treat it and store it in sacs or bags, which is an expensive option.

Past initiatives have addressed the storage issue. For example, NGO Concern Universal (now United Purpose) introduced a community storage system, whereby famers stored their produce at one central warehouse and agreed when they would access the produce. This system works well as long as farmers adhere to standards and grading, thus making sure that they store similar quality of produce. But storage costs (including both costs for fumigation of facilities and administration of stocks) may still be high - potentially higher than the difference between market prices after harvesting and later in the season. In the Concern Universal case, farmers did not have to pay for storage because they owned the warehouse, but if this is not the case, the cost may be prohibitive. It may also be difficult for farmers to transport their produce to the warehouse.

Farmers are also influenced by market price increases and accessibility of markets or selling points. While prices are lower at the beginning of the harvest season, they go up as commodities become scarcer. Households reported that an increase in prices will usually convince them to sell produce that they had stored to make a profit. They also have easy access to middlemen or vendors in their villages, as they tend to move around communities looking for produce. This is a major influencing factor, as farmers do not have to walk far to sell their produce. Although farmers know that vendors offer lower prices, it is quite appealing to sell to someone standing at your door.

Market constraints play a major role in limiting the incentives for and ability of smallholder farmers to increase their agricultural activities (Malawi Government 2016). This may also affect smallholder farmers' practice of conservation agriculture, which is a long-term investment. Malawi's NAP lists the major marketing constraints as including inadequate infrastructure for efficient agricultural marketing, limited access to marketing service provision and policy incoherence. Smallholder farmers lack the appropriate market environment to achieve profitability in agricultural practices and solutions are beyond local capabilities, requiring higher-level decision makers to make changes in policy and infrastructure development. Malawi's NAIP outlines how the government plans to improve market access and trade through value addition and access to finance (Malawi Government 2018) - which is crucial for smallholder farmers.

Trade-off 4: In the short term, piecework is an essential strategy that provides farmers with immediate food and cash needs but it distracts them from long-term investment in their own farm, which improves their livelihoods.

Competing objectives:

- 1. Investing labour in conservation activities to ensure long-term benefits for farmers.
- Using household labour for piecework to generate immediate returns (money and food) to the household.

Household labour is an essential input for most smallholder families in Malawi. Without adequate and available cheap labour, these households are unlikely to achieve maximum benefits. Soil conservation practices need adequate investment of labour to make progress in the long run. These households continually find themselves deciding between ensuring shortterm food security by earning piecework wages and longer-term food security by investing in soil quality or productivity via conservation agriculture or soil and water conservation.

Conservation agriculture helps farmers increase yields in the long term, as shown by those who practise it under TLC. Many farmers in Mwansambo attest to its positive effects and in the past three years there has been an increased practice of conservation agriculture by smallholder farmers. But to be successful, farmers need to invest additional labour — a limited resource — in their own farms. And, while they are aware that it takes time for conservation agriculture to show significant positive results, most farmers are unwilling to make the investment due to their immediate needs. Rather, they are only willing to take it on once they have seen significant damage to the land and observed other farmers practise the technology for several years.

As well as working on their own land, most farmers will work on other people's farms to earn extra income for their household. Seven of the nine case study households said they invest time in doing piecework on other people's farms, especially during the lean period. When we consider that conservation agriculture requires farmers' input and dedication, this shows that they are trading off investing in their own farm for future benefit to earn money for their immediate needs.

Appropriately practised, conservation agriculture can be a win-win technology that enables farmers to produce more in the long run while maintaining soil fertility and health. But the initial labour investment required for managing residues and weeds makes it incompatible with hiring out one's manual labour. Farmers have reported that they are too tired after working on another farm to work on their own farm and that this usually affects their farming activities.

Doing piecework is an important coping strategy in Mwansambo. It is easy to assume that households make the decision to work on other farms because they have no other choice, but the division of labour is a dynamic choice with various influences. For example, female household members are more likely to divide their labour between their own and other farms. Male household members, on the other hand, usually prefer to incur loans to repay the next season over working on someone else's farm. Some men move to different districts to look for work, leaving the women to feed the children by taking on piecework.

Differences in access to resources also play a role in the division of labour. Households with limited access to inputs invest much time in labour on other farms to earn money to spend on inputs such as seed and fertiliser. Once households have sources of income that are more lucrative than farming, they usually prefer engaging in those other activities. One woman from Chikango village (Household 7) told us that she did not farm her land for a whole year. She was ill and could not work the land and did not have the resources to hire in labour. To feed her household that year, she had to walk a considerable distance to find piecework, for which she was paid in maize. We were surprised that, despite being too ill to farm her own land, she was prepared to walk to work someone else's land for what seemed to be a small amount of food. At the time the household head had gone to another town to work, leaving the wife to fend for herself. Later in the study, we discovered that this household also earns an income from selling locally brewed alcohol, hence the reluctance to farm their own land. Community meetings also revealed that some

farmers were sometimes simply too lazy to farm their land and took piecework as a primary source of income and food generation that provides ready cash.

Our respondents were clear that insufficient food in the household is the major driver of decisions to work on other farmers' land. Inadequate production during the normal season can force farmers to take on extra activities to find money to purchase more food. Some also said that being faced with an immediate need for food creates a reluctance to invest in their own land. Another reason is having inadequate farm inputs, as most of the farmers that resort to piecework cannot access the inputs they need to invest in their own farms. Believing there are no other alternatives, they abandon their land and work for food on someone else's land instead.

It was clear that most farmers do not yet grasp the importance of conservation measures for long-term soil productivity. Rather, they are concerned with achieving food security and economic stability. Farmers' ideals echo the NAP objectives, which emphasise the importance of growth in the agricultural sector to ensure household food security and increased incomes and exports (Malawi Government 2016). But despite using the term 'sustainable agricultural transformation', environmental sustainability is not the NAP's highest concern.

Policies should not sideline the important role that natural resources play in agricultural development, and the way these resources — especially soils have been depleted (Dorward and Chirwa 2015). Therefore, conserving and replenishing such resources is paramount for medium and long-term agricultural development.

Strategy 1: Choosing between high and low external input crops (maize and legumes)

In Mwansambo, groundnuts are the most-grown crop, with maize coming second, despite being essential for many households' food security. This also applies to the case study households, as shown in Figure 9.

Households in Mwansambo are reducing the amount of maize they grow because the cost of maize production — including the expensive fertilisers — is too high for many farmers (especially those with poor soils). So, despite their sustenance needs, farmers tend to base maize production on the availability of fertiliser and other inputs. Ideally, farmers would prefer to grow enough maize for their household's consumption, but this can prove difficult at times. As most households have strained financial resources, farmers usually have very little money left to spend on fertiliser and other inputs. Most of our case study households cannot afford to buy the fertiliser they need for maize production, despite maize being a necessary commodity for food security.

 $Figure \, 9 \qquad Crops\,grown\,by\,case\,study\,households$



Source of data: SITAM household survey (2017)

Figure 10 Soil fertility management in case study households



Source of data: SITAM household survey (2017)

In the 2017/18 growing season, only one of the nine case study households used 50% of their farmland for maize production and had enough fertiliser for that land. That household also used manure and got a considerably satisfactory return for their investment. Most allocated less than 30% of their farmland to maize production and five of the case study households did not have the recommended amount of fertiliser for the land they cultivated. Farmers should use both top and base fertiliser, but in most cases can only afford to buy one type or inadequate amounts of both types. Even when minimising other household expenses in favour of input supplies, few farmers could get enough fertiliser for their maize. So, if they cannot afford the crop, why invest in it in the first place when they could invest in what appears to be a less input-intensive commodity?

Most of Mwansambo's farmland is sown with groundnuts; small portions are growing tobacco (one case study household) and soybean (two case study households). Seven of the nine households do not have enough food for the whole year but still prefer to use most of their land to grow groundnuts as they have limited inputs to grow maize. Groundnut cultivation uses fewer inputs while returning a higher income. But success depends on rainfall patterns and pests and disease controls. If farmers consider growing less maize to reduce fertiliser costs, they must also consider the risk of growing groundnuts without pesticides. Some households said that in the 2017/2018 growing season, their groundnut harvest was not up to expectation following an attack by pest and disease. In most cases, these farmers could not afford the pesticides they needed to resolve the problem. Despite these challenges, they perceive groundnuts as performing better than maize without external inputs.

Using external inputs such as fertiliser seems to be the best or most favourable option for farmers to grow the food they need. However, maize production does not simply rely on fertilisers; the quality of the soil and rainfall patterns also affect crops. In recent years, farmers have also faced the fall armyworm, which has damaged maize production. And although farmers need external inputs, they are also making trade-offs between short-term and long-term benefits. In the short term, using fertiliser, pesticides, herbicides and so on (discussed in the next section) provides increased yields, which benefit the farmer. But in the long run, external inputs have been known to reduce soil fertility and productivity and lead to the extinction of natural and indigenous species of shrubs and vegetables even biological organisms. This has future environmental impacts that will influence yields and household food sufficiency.

As well as the environmental impacts, external inputs are a constant source of debt for smallholder famers. In Mwansambo, farmers have access to informal input loans, which place most farmers in a vicious borrowing cycle. As maize is a rainfall-dependent crop, changes in weather and climate make such loans a very high risk for smallholder farmers. Despite this, their high dependency on fertiliser drives them to take the risk, leaving them with the burden of having to repay the loan.

Fertiliser affordability is the main influence of this decision. Farmers struggle to buy fertiliser and have no access to loans and other financial resources. The FISP has been one of the country's most influential farming programmes, with lessons learnt and used to successfully implement similar programmes in other countries. It has also been criticised for discouraging farmers from using organic soil amendments (Komarek et al. 2017). But our respondents said they had benefited very little from the programme, with only three or four people receiving a subsidy coupon in a village of possibly more than 50 households. Even with the coupon, they struggled to gain access to service providers and had to pay a considerable amount to do so. Our study, however, did not verify these concerns.

Strategy 2: Expanding production through loans

It is quite common for farmers to take out input loans from microcredit facilities during the planting season. Some require the farmer to begin repaying the loan immediately after harvesting their crops, forcing them to sell their produce earlier when prices are lower. The loans can take a long time to come through, meaning farmers get their inputs late or at the wrong time, which affects the yield. So, while they are willing to incur loans to expand or improve production, farmers do not benefit that much from taking out the loans. They might produce more, but this does not necessarily result in a higher income.

In Mwansambo, agricultural activities are governed by informal input and produce loans, including cash loans, that have no significant benefit to farmers. Farmers usually borrow produce, money and fertiliser from agrodealers and other farmers, almost always at 100% interest. So, if a farmer borrows one bag of fertiliser, they are obliged to repay two bags of fertiliser or cash equivalent. This leaves farmers in a constant state of debt. These loans are disadvantageous for most farmers, because they end up repaying most of what they harvest, with some claiming that in a bad year they have to pay back everything they harvest. Given the choice, most farmers would not incur any loan, but due to monetary constraints, they find themselves having to do so to invest in production.

Case study household 4 (see Figure 5, Figure 7) had to borrow seed for the 2017/18 season due to unforeseen events that left them with no other means to source the seed. Even more unfortunate was that, due to bad rains, they were unable to repay the loan. They lost all that they produced that year repaying the loan and are still suffering the consequences. Figure 11 Case study households' assets



Source of data: SITAM household survey (2017)

Microcredit facilities are the only source of loans available to farmers here. If they are unavailable, farmers are forced to find other means. When they lack the inputs they need or the means to source these inputs, some farmers take up unfavourable loans to invest in their farms or for their household's survival. And while they take out these input loans to expand their agricultural activities, many find that they have the opposite effect, slowing down their progress instead.

Synergy 1: When added to soil and water conservation practices, complementing animal manure with inorganic fertiliser increases soil fertility, reduces the cost of inputs and sustainably disposes of animal waste

Farmers agree that using external inputs such as organic manure alongside soil and water conservation practices has a positive impact on production and soil quality. Many farmers use organic manure to reduce the cost of fertiliser inputs, often to make up for inadequate amounts of fertiliser. Five of the nine case study households reported that in the last season they used a mixture of fertiliser and manure, improving the yield of crops on the previous season despite not having enough fertiliser. Conservation practices have also improved soil water retention, ensuring that crops such as maize do well in times of inadequate rainfall. This synergy was highly influenced by the manure and soil conservation training the community received. Positive results from other farmers also encourage others: manure use has become popular in both study sites because farmers have observed positive gains on other farms. However, this synergy is challenged by many households' lack of animal ownership (see Table 2). Most of the households do not own enough livestock to produce the amount of manure they need (see Figure 12).

Conclusions

5.1 Scaling out conservation agriculture will take time

Farmers in our research sites, who have seen their landholding capacity reduced over the years, are driven by two factors: economic need and food security considerations on the one hand and NGO interventions and markets on the other. SAI can help farmers meet both their economic and food security needs, but they are struggling to sustainably intensify their production due to several internal and external factors. Some of these — including the impacts of climate change, the price of inputs and other commodities and access to credit — are broadly beyond their control.

The main conservation agriculture practices farmers use locally are traditional crop rotation and retaining rather than burning — crop residues on their fields. Few farmers practise zero/minimum tillage. But smallholder farmers in Malawi are also used to implementing indigenous systems — such as ridging and burning of residues — that MoAIWD promoted in the past to improve land and food quality (Mungai et al. 2016). These activities are part of their culture and still widely practised, despite NGOs like TLC contesting the effectiveness of ridging to reduce soil erosion on the basis of excessive labour requirements.

A small proportion of farmers practise mulching, incentivised by training and exchange visits, lead farmers with demonstration plots and free herbicides from previous NGO interventions, but adoption rates have remained low. We found that even farmers who use maize residues for mulching do not extend these methods to other options — such as groundnut shells or agroforestry — which they could also use to increase organic soil matter. Most also seem unaware of the benefits of using organic matter other than manure. During focus group discussions and farmer meetings, community members in both our study sites indicated the need for more training and awareness raising, including through group-based approaches and local bylaws to prohibit the burning of residues. They stated that changing farmers' attitudes and farming practices is a long-term process that requires ongoing follow-up and message reinforcement, which NGOs cannot do at scale. At the same time, there are few agricultural extension staff and they often lack the operational resources for community mobilisation, as well as the skills and resources for co-developing technologies with farmers to ensure they are adapted to local context.

5.2 Indebtedness is a major challenge for smallholder livelihoods

While many years of NGO interventions do not seem to have made significant changes to farming systems in the EPA, the development of local, national and regional markets for maize, groundnuts, tobacco, fertiliser and herbicides has had a significant impact on farmers' practices. Almost all smallholder farmers in the EPA grow groundnuts, which have replaced cotton and tobacco as the main cash crop. Groundnut production is driven by market demand, including from neighbouring countries, with a proportion of Mwansambo's produce taken by lorry to Tanzania and beyond. Groundnuts have no current value addition, which reduces employment and income opportunities for local people. Selfsufficiency in maize, the staple food, is still a desirable outcome for farmers, particularly women, who see it as the best strategy for achieving household food security. But because they cannot afford the fertiliser they need to produce enough maize to feed their households, most farmers have adopted a maize-groundnut rotation to balance cash and food crop needs.

Farmers in the study area believe that they need fertiliser and herbicides to get adequate maize yields and prepare their land. But this dependency on external inputs is not working for many poorer households who regularly have to sell their crop immediately after — or even before — harvest, at a relatively low price to pay back loans and meet other cash needs.

The monetisation of the economy and commercialisation of agriculture in the EPA has clearly benefited betteroff households, with some earning off-farm income through trade. The state-owned ADMARC tends to buy commodities from vendors (some of whom are farmers themselves) rather than directly from smallholder farmers.

FISP only reaches a small proportion of farmers in the study sites and agricultural inputs remain expensive. Combined with low commodity prices and existing loan burdens, this locks many poorer households into unproductive and unsustainable farming practices, relying on daily wage work for food during the lean season. Dependency on external inputs is at least partly the result of aggressive marketing campaigns by

Figure 12 Vicious cycle of indebtedness and low productivity

agrochemical corporations, with Monsanto supplying about half of Malawi's commercial maize seeds (Wise 2019).

In this situation, environmental sustainability is not top of these farmers' priority lists, even though it might be a more productive approach in the long term. Farmers are more concerned with short-term solutions and this is an indication of the level of poverty within the area.

All case study farm households are trapped, to different extents, in a never-ending spiral. Low yields force them to sell a large proportion of their harvest at a low price to pay back the exorbitant loans they took out to buy farm inputs and food. Having sold their produce after harvest, they run out of food later in the season and have to borrow food at high interest when food prices are high. As a result, they do not have the resources they need for inputs for the next cropping season, so they need to buy inputs on loan again (see Figure 12).



This cycle is aggravated by:

- Poorly functioning institutions and markets, particularly the lack of formal and affordable credit
- High prices of agricultural inputs, particularly fertilisers
- Low market prices for agricultural produce and high buyer power due to cartels
- Inadequate agricultural extension services, and
- A lack of community-level storage facilities and warehouse receipt systems that would enable farmers to avoid selling their produce at a low price and buying it back at a high price.

5.3 Agricultural intervention design: considering the complexity of livelihoods

To date, multiple projects and programmes have promoted a range of technologies and institutions in a bid to address some of the challenges facing smallholder farming systems in the EPA. But our research shows that local livelihoods strategies and farming systems are very complex and closely interconnected, so any changes in farming practices have a knock-on effect on the rest of the system. Farmers' choices are based on a complex web of objectives and expectations, which vary from individual to individual, but show some common patterns. Male farmers prioritise increasing cash income to invest in agricultural and off-farm activities, whereas women tend to prioritise household food self-sufficiency over cash income. Households choose their livelihood strategies to meet multiple and sometimes conflicting objectives and interventions need to take such complexities into account to anticipate undesirable outcomes such as supporting one objective over another, equally desirable one. For example, promoting improved crop varieties and conservation agriculture has increased productivity; but it has also increased farmers' dependency on external inputs and agro-input dealers, contributing to indebtedness.

We found a high farmer-to-agricultural extension staff ratio, with each staff member covering a large number of farmers and depending on projects to cover their operational costs. This makes it difficult for them to develop and implement a coherent operational strategy and work plan, in line with local priorities. While this is common across much of sub-Saharan Africa, it is clearly an obstacle to SAI, which is highly knowledge-intensive. Depending on donor-funded programmes, which are often accompanied by ambitious outcome and impact targets, also encourages NGOs and extension staff to focus their attention on farmers who are already fairly advanced, better educated, easier to reach (for example, located along a road) and have some extent of power and influence. This exacerbates the gap between successful and less successful farmers, leaving many of the poorest behind. As 'lead farmers' are often given inputs and support, it also reinforces the impression among poorer farmers that they can only adopt sustainable farming practices with external (financial and technical) support.

5.4 Environmental sustainability is not a priority

As a result of this indebtedness, we found that many farmers focus on short-term economic gains, trying to optimise production by limiting inputs to what they can afford, based on their understanding of the inputoutput relationship and their own household resources in terms of labour, land and assets. Many projects in the EPA have delivered training in conservation agriculture, integrated soil fertility management, integrated pest and disease control and other agricultural practices to more than 2,000 farmers. But this training has not necessarily responded to farmers' needs and has not always been delivered by qualified people.

Although some farmers are aware of the benefits of techniques such as not burning crop residues and using organic soil amendments alongside fertiliser, most continue to practise traditional land management methods such as ridging, burning residues and relying on chemical fertilisers alone. Some believe that retaining crop residues in the field or mulching fields with organic matter brought in from other areas will increase pests and diseases, so they refrain from adopting this practice. Others do not have the livestock to produce the manure they need. Many farmers depend on piecework, which prevents them from investing enough time in sustainably managing their own farm.

In terms of agro-input use, farmers are generally unaware of the long-term health and environmental impacts of herbicide use. Glyphosate — banned in the country since May 2019 (Sustainable Pulse 2019) — is still widely available in the Mwansambo Trading Centre and usually applied with minimum or no safety precautions. Because the impacts of herbicide abuse are not immediately apparent, farmers are not aware of them. There are no bylaws regulating the production of vegetables along streams and in wetlands, to protect banks from erosion and avoid agrochemical leakage into water bodies.

During our visits to the EPA between 2016 and 2019, we saw clear signs of agricultural expansion and degradation of natural vegetation. Population growth and shortage of off-farm employment opportunities mean that farming households are expanding and children will eventually require farm land of their own. Farmers are increasingly cultivating steep slopes in valleys and cutting down trees to make way for farmland. Poorer farmers also cut trees to sell as firewood, and charcoal production — nominally banned by local chiefs — is ongoing, as we saw on a visit in November 2019. Farmers are aware of the negative impacts of deforestation, but in the absence of viable alternative livelihood options, they are likely to continue with the practice, endangering key ecosystem services such as water retention and erosion control provided by the natural vegetation. There are currently no coordinated interventions to address the environmental impacts of agricultural expansion and agrochemical use.

Recommendations

Our ten recommendations fall into three broad groups:

- Evidence and practice-informed programme design
- Technical and process factors related to SAI programme design and implementation, and
- Law enforcement and capacity development around the sale and use of agrochemicals.

In this section, we provide concrete actions for each recommendation, outlining who should be responsible for ensuring they are carried out as well as suggested timeframes and resources required.

6.1 Evidence and practiceinformed programme design

1. Ensure that NGOs, donor-funded and government projects and programmes are designed and implemented based on evidence and previous experience

Justification: A more systematic and transparent system of reviewing and sharing experiences to inform programme design would address the challenges of fragmented, target-driven and poorly designed development interventions.

Many projects and programmes in the EPA and other parts of central Malawi have tried to promote conservation agriculture, integrated soil fertility management, integrated pest and disease control, livestock integration and asset development, community-based grain storage, community savings and loans schemes, value chain development and so on. But it is not easy to ascertain what these interventions did and how successful they were. Project reviews and evaluations — if carried out at all — are rarely in the public domain. Even core ministry staff do not have systematic access to them.

While the donors who fund development interventions and the government agencies that implement them are in principle interested in assuring they are effective and sustainable, they may also be under pressure to deliver on unrealistic targets, which can hinder evidence-based decision making and learning.

Malawi has endorsed the Paris Declaration of Aid effectiveness and the Accra Agenda for Action,¹¹ which specify aligning aid with partner countries' priorities, eliminating duplication of efforts and encouraging shared analysis of what does and does not work. But there is no evidence that these mechanisms have filtered down to the design and implementation of SAI or conservation agriculture programmes in Mwansambo. We found no reviews or evaluations of the numerous past interventions in the area.

There needs to be a systematic review of agricultural (and arguably other sector) interventions. These reviews must then be made available — ideally in the public domain — to ensure that new interventions incorporate lessons and experiences from the past. Donor programmes must align better with local priorities, and district agricultural development offices and local communities given more ownership of agricultural development plans.

¹¹ www.oecd.org/dac/effectiveness/parisdeclarationandaccraagendaforaction.htm

Table 9 Specific actions for ensuring evidence-based programme design

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Design legislation that obliges all projects and programmes that are funded by external donors and the government to carry out external reviews or evaluations and make these publicly available — for example, through an online portal	egislation that obliges all and programmes that are y external donors and the ent to carry out external reviews tions and make these publicly — for example, through an ortalGovernment of Malawi, with support from the Donor Committee in Agriculture and Food Security (DCAFS) and trade, industry and private sector development partners in MalawiA A MalawiIl farm and household-level data t via such programmes and ews are anonymised and made via the portal to avoid survey nd support evidence-based makingGovernment of Malawi, 	A year to draft and consult on policies, time to get through parliament	Political will External advice and support from donors and consultants
Ensure all farm and household-level data collected via such programmes and their reviews are anonymised and made available via the portal to avoid survey fatigue and support evidence-based decision making			
Require new interventions to show that they take experiences and lessons from earlier interventions into account			
Foster a culture of learning and adaptive management in donor-funded projects	DCAFS, donors, NGOs and international	Immediately	Political will
Ensure project reviews have a short and easily accessible summary with the main points	(I)NGOs commissioning programme / project reviews		
Request that all district agricultural development officers to have short and long-term development and work plans that are co-developed with local stakeholders after a detailed analysis of specific needs and opportunities in the EPA. All donors or NGOs should contribute to these plans	Government of Malawi (MOAFS)	Immediately	Political will

2. Ensure agricultural development interventions are informed by a clear understanding of context-specific farm and household economics

Justification: There is a lack of macro and farm-level economic analysis to inform the design of SAI or conservation agriculture programmes and interventions to ensure that such analysis informs the feasibility of interventions. This is directly linked to the top-down approach of NGO-led projects, which rarely involve local institutions in designing their programmes in an inclusive way.

Although several interventions have aimed to break the vicious cycle of poverty and indebtedness through value chain development, cooperatives and conservation agriculture promotion, it seems almost impossible for poorer smallholder farmers in the study area to escape it without off-farm income opportunities. The success of such interventions often depends on their understanding

of the micro- (household-level) and macroeconomic factors determining the financial viability of the farming system under the current set of drivers and of options for value addition to increase rural incomes and employment.

Malawi's Civil Society Agriculture Network has developed tools for gross margin calculations, to help farmers and their organisations assess the economic and financial feasibility of specific commodities.¹² Similarly, the GIZ project 'Green innovation centres' has worked with farmer groups to support them in economic analysis of their enterprises.¹³ Donors and researchers working on an economic assessment of the groundnuts and maize enterprises of farmers in Mwansambo can learn a lot from such tools and experiences. Table 10 Specific actions for ensuring the context specificity of interventions

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Work with local and national-level actors to co-design and undertake an economic assessment of smallholder farming systems to determine whether it is possible for farmers to escape from the cycle of debt and poverty and inform assumptions of development programmes operating in the area	Agricultural development and research organisations (in Malawi and possibly overseas) Donors funding such research	One calendar year for data collection Three months for preparation	Political will If this forms part of MSc studies for agricultural economics students from institutions such as Lilongwe University of Agriculture and Natural Resources, the only requirement would be funding for field work costs
Ensure the results of this study are available to local stakeholders (District Agricultural Development Offices, NGOs), national-level stakeholders (agricultural decision makers) and donors	Agricultural research organisations and their partners	Ongoing during the research process Three months after study completion	Publication of results in a report and a short briefing Presentation to DCAFS and trade, industry and private sector development partners in Malawi
Use existing agricultural development scenarios (see, for example, GCRF AFRICAP 2019) to explore how macro-level drivers are likely to change the economic viability of the current farming system	Agricultural and policy research organisations and their partners	Could be in parallel to the study	Staff time and operational costs for research

Table 11 Specific actions for enabling a transition to agroecological farming systems

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Review experiences with farmer- led innovation and agroecological intensification and adapt or use these for programme design	Programme designers, including government, donors and (I)NGOs	Immediately	Political will Hardly any, as this would be part of programme development costs

6.2 Technical and process factors related to SAI programme design and implementation

Although the recommendations in this section highlight issues that are generally known to agricultural and rural development organisations operating in Malawi, there is no consensus on how to address them in an inclusive and sustainable way. There is a clear need to share and build on experiences while developing new and innovative ways of addressing the challenges encountered so far. 3. Enable a transition to farmer-led, less external input-dependent and agroecological farming systems that reward farmers for taking a long-term view of agricultural productivity

Justification: Farmers in the study areas are too poor and hungry to invest in locally adapted sustainable farming practices. This is the result of Malawi's emphasis on short-term productivity in its agricultural policies, which rely on high external inputs and do not consider long-term impacts on land quality, ecosystem services and human wellbeing. Experiences from the Prolinnova network¹⁴ have shown that farmer-led, ecologically oriented agriculture can produce locally adapted innovations that increase resilience without high levels of external input. Successful initiatives such

¹⁴ www.prolinnova.net

as the FAO's Malawi Farmer-to-Farmer Agroecology Project¹⁵ have promoted innovation and farmer-to-farmer learning on SAI, offering lessons for future programme design.

 Improve targeting of farm households for interventions and avoid working with small sub-groups or creating dependencies from free handouts

Justification: In Mwansambo EPA, different development projects seem to target the same households, usually better educated households and those that are more easily accessible. The lead farmers projects select for conservation agriculture demonstrations are almost always also receiving support from other development initiatives. This concentrates benefits in the hands of a few, without clear responsibility and accountability for supporting other community members. The rationale seems to be that these farmers are proactive, perhaps respected members of the community and are therefore more influential in promoting specific practices.

This approach does not work. Farmers told the SITAM team that the lead farmers can only adopt the recommended practices because they receive additional support, such as training and free inputs. Selecting households that are better off than average for the target area seems to undermine adoption, particularly when combined with extra support that most farmers cannot access. The poorest and most marginalised farmers are likely to be the most difficult to work with, and when projects are target-driven and have to demonstrate value for money, field coordinators are incentivised to select 'easy' targets.

5. Work with and through local leaders to create and enforce bylaws — for example, on burning residues, conservation agriculture, agricultural expansion, land degradation and deforestation

Justification: Farmers from this study recommended that local chiefs should promote conservation agriculture and sustainable agricultural and natural resource management practices and fine farmers who do not adopt them. This is a step up from fining farmers for burning their neighbours' crop residues, which already happens in some communities that promote conservation agriculture. TLC is exploring the use or adaptation of community-based or local governance mechanisms for sustainable natural resource management and agriculture in the Malawi-Zambia Nyika Transfrontier Conservation Area project, in collaboration with Community Markets for Conservation.¹⁶ It is important to share and build on such experiences, whether they are positive (ideas to replicate or adapt) or negative (approaches to avoid).

 Table 12
 Specific actions for improving intervention targeting

ACTION RE			REQUIRED
Review experiences of targeting farmers for conservation inclu- agriculture, SAI and climate-smart agriculture interventions and build on these when designing programmes	gramme designers, uding government, ors and (I)NGOs	Immediately	Hardly any, as this would be part of programme development costs

Table 13 Specific actions for working with local leaders

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Review experiences with local governance for conservation agriculture, SAI and climate-smart agriculture interventions and build on these when designing programmes	Programme designers, including government, donors and (I)NGOs	Immediately	Hardly any, as this would be part of programme development costs

15 www.fao.org/3/a-br095e.pdf 16 www.peaceparks.org/tfcas/malawi-zambia/

6. Strengthen women farmers' institutions and access to resources

Justification: Women do most of the agricultural work in Malawi, yet men make most of the decisions about resource allocation and farming practices. At the same time, rural women are growing in confidence and independence, as education levels increase and support programmes target women farmers.

Women in the study sites were more interested in practising conservation agriculture and more concerned about using agrochemicals; they also prioritised family food and nutrition security over cash income. It is important that development programmes address these and other needs of women farmers.

Many local institutions are working well, serving the needs of smallholder farmers, including women and youths. New development interventions — such as women's labour groups and other informal communitybased institutions — must not undermine such institutions, for example, by competing with them for membership and time.

 Support inclusive smallholder farmer group/ cooperative development to help poor smallholder farmers access fertiliser and other inputs and practise conservation agriculture Justification: Most smallholder farmers in the study area cannot bulk-buy agricultural inputs because they are not members of an eligible farmer group. Their bargaining power with input dealers and commodity traders is weak and the FISP does not reach many farmers. Buying fertiliser at retail rates reduces the profitability of agriculture and increases farmers' indebtedness.

TLC and other NGOs are forming cooperatives in the area with support from NORAD, the Norwegian Agency for Development Cooperation. To date, only better-off farmers have joined, but if this model could be made more inclusive, it would be worth scaling it out.

8. Support asset development for poor farmers, particularly livestock

Justification: Enabling poor smallholder farmers to escape the debt trap by building up assets could help them move beyond short-term economic interests and adopt agricultural practices that will, in the longer term, improve the productivity of their land. Most farmers in the study are keen to build up their livestock assets. The Ministry of Agriculture and NGOs, including Concern Universal and TLC, have implemented several livestock 'pass-on' projects in the area, where farmers receive goats or chickens and pass on kids or chicks the next household after their reproduce. This has benefitted around 1,000 farmers in the Mwansambo

Table 14 Specific actions for strengthening women's institutions

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
At programme development stage, ensure that women's role in the farming system and their institutions are well understood and that the intervention does not sideline them	Programme design	Ongoing	None

Table 15 Specific actions for improving access to inputs

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Closely monitor and evaluate experiences with cooperatives, making the findings available for future programme design	Donors Programme implementers	Immediately	Build into existing monitoring, evaluation and learning (MEL) systems
Explore and pilot innovative types of cooperatives, such as transformative agricultural cooperatives, which are managed by graduates and have farmers as shareholders	Donors Researchers (Malawi University of Science and Technology)	Immediately	Funding for pilot projects

Table 16Specific actions for asset development

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Review experiences of previous pass-on projects and share lessons, ensuring findings are available	TLC Other NGOs implementing such initiatives	Immediately	Build into existing MEL systems

$Table\,17 \qquad Specific \,actions\,for\,community-based\,grain\,storage$

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Review and share experiences with grain storage initiatives to make sure findings are available	NGOs implementing such initiatives	Immediately	Build into existing MEL systems
Train farmers in grain management and storage	Government NGOs	Immediately	Build into extension staff work plans

area. In some cases, they are passing on the third and fourth generation of goats. This is a useful pro-poor intervention that would ensure farmers have access to livestock manure, thus supporting integrated soil fertility management and reducing their reliance on inorganic fertilisers.

Adapt existing approaches to develop, pilot and roll out community-based storage facilities or granaries and warehouse receipt systems or inventory credit

Justification: To escape the debt cycle, farmers will need to manage their produce well, so they do not need to sell their grain when prices are low and purchase more when prices are high. In some parts of central Malawi, community grain storage interventions and warehouse receipt systems store grain from smallholder farmers and sell it when prices increase. But TLC's managing director reported that "such systems can be costly to operate because they need to meet minimum quality standards and deduct transport and storage costs from payments to farmers. If such a system could be made to work, it would benefit farmers who currently sell their grain straight after harvesting."

However, this will not provide a solution for all farmers. Some small farms of less than an acre cannot feed their households adequately, no matter how well they manage the land. For such farmers, off-farm employment or income generation opportunities will remain essential.

6.3 Law enforcement and capacity development on agrochemical sale and use

10. Enforce regulations around herbicide and pesticide sales, labelling and advice and train farmers in responsible use of agrochemicals as part of an integrated control strategy

Justification: Despite being banned since early 2019 (Sustainable Pulse 2019), glyphosate is still widely available in Malawi, including in Mwansambo Trading Centre. We found that farmers are unaware of the toxicity of the agrochemicals they use and do not follow basic health and safety precautions. Nor are they aware of their long-term environmental effects — for example, farming close to river banks pollutes the water source. Some of the women farmers, however, pointed out that using glyphosate kills off local wild vegetables, which they use to make a relish to accompany nsima, a staple dish.

Table 18
 Specific actions for enforcing herbicide and pesticide regulations

ACTION	RESPONSIBILITY	TIMEFRAME	RESOURCES REQUIRED
Enforce the glyphosate import ban	MOAFS	Immediately	Political will
Enforce existing agrochemical regulations to ensure that only permitted products are sold, that these are properly labelled and that dealers can advise farmers on responsible use			
Update regulations regularly, in line with research findings	MOAFS Research organisations in and outside Malawi	Immediately and ongoing	This is a core role of MOAFS, should not require additional resources
Train agricultural extension staff in pesticide and herbicide safety	MOAFS	Immediately and ongoing	Funds for training
Undertake an agrochemical awareness campaign via radio and other media	MOAFS	Annually, before the cropping season starts	Funds for message development and airtime

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Annex 1 Household case study exercises

PHASE/	EXERCISE	UNIT OF
NUMBER		ENGAGEMENT
Phase 1	Setting the scene	
P1.1	Community feedback on main findings of the quantitative survey	community
P1.2	Community analysis of key findings with respect to SAI	community
Phase 2	Community context and trends	
P2.1	Village physical map	community
P2.2	Trends in community environmental resources	community
P2.3	History and sources of agricultural technical services and inputs	community
P2.4	Community feedback on trends and influences on farming systems	community
Phase 3	Present and future farming system	
P3.1	Household history (timeline)	household
P3.2	Household farm map and production trends	household
P3.3	Assessment of the present farming system from a SAI perspective	household
Phase 4	Food security, income and interventions	
P4.1	Farming system history and change	household
P4.2	Household history of engagement with agricultural services and access to inputs	household
P4.3	Trends in household food security	household
P4.4	Trends in farm household income and loans	household
P4.5	Household case study – feedback session	community
Phase 5	Farm operations, coping mechanisms and key decisions	
P5.1	Record and assess major farm operations by plot (3 visits over one season)	household
P5.2	Monitoring of coping mechanisms to address hunger during the lean season (3 visits during the year)	household
P5.3	Household assessment of farming decisions and trade-offs	household
Phase 6	Enabling / disabling factors and recommendations	
P6.1	Focus group discussion on enabling/-disabling factors to manage trade-offs	community
P6.2	Feedback session, validation of findings and recommendations	community

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Annex 2 SITAN	M Malawi SAI indi	cators		
INTENSIFICATION	ECONOMIC/ PRODUCTION	SOCIAL	HUMAN	ENVIRONMENTAL
1. Values to measure (based o	on the question 'What would "ideal"	SAI look like in the context of the st	tudy communities?')	
Farmers can feed their families without taking more land under cultivation	Farmers produce enough to feed their families and meet their basic needs	Farmers support and influence each other in their farming operations (ie extension access to inputs, access to finance)	Productive household members are in good health	Soils are productive and healthy to support sustainable intensification
Farmers can produce more in a year through rain-fed and irrigation	Access to fair and profitable markets to farmers in the area	The ability of local leaders to influence farming practices in the community	Farmers have access to expert knowledge about sustainable farming practices	Reduced use of harmful inorganic inputs in farming
Production from a given area of land is stable or increasing as well as profitable to the farmers despite shorter fallow periods	Farmers can recover from shocks such as prolonged droughts or illnesses in the family	Farmers are in control of their means of production		There are high levels of fertiliser trees naturally regenerating on- farm
		A good number of youth can be empowered as farmers		Availability of natural water sources during the dry season
2. Indicators (expert judgem	ent and validated by farmers)			
Total production per area cultivated	Number of months on-farm crop production feeds the family	Proportion of farmers that belong to community farmer groups	Number of extension workers	Proportion of increase in production of land under conservation agriculture in the past five years
Average family size per farming household	Coping strategies during food deficit periods	Number of community groups attended	Number of trainings attended in the past year	Number of fertiliser trees on-farm
Average amount land under winter cropping (residue/ irrigation)	Volume of sales in the past season	Relationship of farmers to the chief	Number of extension visits in the past growing season	Proportion of land that is not cultivated

INTENSIFICATION	ECONOMIC/ PRODUCTION	SOCIAL	HUMAN	ENVIRONMENTAL
Average area of land under cultivation per household	Average distance to markets	Proportion of community members aged 18 and 30 involved in farming	Number of days ill in past 12 months	Quality and availability of water sources in the area
Number of seasons the land is left under fallow	Availability of informal market providers	Number of young farmers' groups or youth clubs engaged in farming	Numbers of days taken off productive work in the past growing season	
Size of land put under fallow per farming household	Proportion of farmers with access to credit	Proportion of farmers belonging to other business groups	Proportion of children in school	
	Average income levels per household			
	Value of productive assets sold in the lean season			
	Number of productive assets acquired in the past season			
	Number of farmers accessing credit			
	Proportion of farmers selling their produce while still in the field			
	Number of farmers saving their incomes			

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Annex 3 Malawi trade-off tracker

THREATS	High dependency on farming for both food and income		Debt if interest is too high or enterprise fails
POSSIBLE SYNERGIES/ OPPORTUNITIES			If loans can contribute to productivity increase, they could set off a positive cycle of growth
TO EXPLORE FURTHER	Are there any other off- farm income generating options that can be explored? Are farmers willing to take these up?		What are the loan terms? Can farmers pay back later? Could the loan system be linked to a warehouse system to store grain collectively until prices
WHO IS AFFECTED AND HOW (+ OR -)	Losers: Farmers who sell produce when they need money and have to buy the same produce at a higher price later on when they need food	Winners: Farmers who plan ahead to use other farmers for labour during the lean season	Winners / losers: Farmers who choose to take a loan — although this can have positive impacts if the investment increases productivity, it can also lead to indebtedness
OTHER INFLUENCES	Household financial needs	Low or insufficient yields	Lack of finances to buy inputs such as fertilisers
EXTERNAL INFLUENCES	Economic factors		Promotion of external inputs Promotion and/ or availability of loans
CATEGORY	Across time: Short-term vs long-term benefits Across domains: food security vs other financial needs	Across time: Short-term vs long-term benefits	Across domains: Production vs income
TRADE-OFF/ SYNERGY	Use of produce for subsistence and for sale	Investing household labour into own farming activities or as an income generating opportunity for the household	Expanding production by incurring a loan which may need to be repaid immediately after harvest when market prices are lower
DECISION	Main use of produce harvested	Income generation through labour	To use loans to finance and expand production

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eason	HOUSEHOLD 9	Allocated 2 acres to groundnuts and 1 acre to maize	Had enough fertiliser for the amount of maize grown	Used herbicides and ridging for all plots
rowing se	HOUSEHOLD 8	Allocated 2.5 acres to groundnuts and 1 acre to maize	Had enough fertiliser to produce maize for consumption only	Used herbicides as part of conservation agriculture, using zero/ minimum tillage
ie past gi	HOUSEHOLD 7	Allocated 5 acres to groundnuts and 3 acres to maize	Did not have enough fertiliser for the amount of maize grown	Used herbicides as well as ridging
offs in th	HOUSEHOLD 6	Allocated 3.5 acres to groundnuts and 4 acres to maize	Had enough fertiliser to produce maize for household consumption and sale	Did not use herbicides at all Used ridging for all plots.
d trade-	HOUSEHOLD 5	Allocated 5 acres to groundnuts and 2.5 acres to maize	Had enough fertiliser but not enough pesticide to protect against fall armyworm	Used herbicides on fields where they practised zero/minimum tillage as part of conservation agriculture Used ridging on other portions of land
isions an	HOUSEHOLD 4	Allocated 1.5 acres to groundnuts and 1 acre to maize	Had enough fertiliser to grow the maize that they produced but nothing more Did not have enough pesticide to protect against fall armyworm.	Did not use herbicides at all. Used ridging for all plots
hold dec	HOUSEHOLD 3	Allocated 3 acres of land to groundnuts and 1 acre to maize	Had enough fertiliser for their maize	Used herbicides on fields where they practised zero/minimum tillage as part of conservation agriculture Used ridging on other portions of land
dy house	HOUSEHOLD 2	Allocated 5 acres to groundnuts and 1.25 to maize	Did not have enough fertiliser to apply to the maize they grew	Used herbicides on fields where they practised zero/minimum tillage as part of conservation agriculture Used ridging on other portions of land
Case stud	HOUSEHOLD 1	Allocated 0.5 acres to maize and 2 acres to groundnuts	Did not have enough fertiliser to apply to the maize they grew	Used herbicides for weed control and land clearing, in combination with ridging
Annex 4 (DECISION	Decision 1: Food crop versus cash crop production	Decision 2: High external input use crops	Decision 3: External inputs: herbicides

OUSEHOLD 8 HOUSEHOLE	id not sell Sold almos ny of their half of their raize maize ad enough Had enough eat for the to eat for th hole year whole year	wo household Three lembers household orked around members ve hours a worked arou ay on the four hours irm Hired 20 a day Hired eople. Did eight peopl eight peopl who workey liecework for five hour s a coping a day echanism Did not do any piecew	ook a cash Have never an to buy taken out a srtiliser in Ioan 018 epaid in 019 at arvest
HOUSEHOLD 7 HG	Did not sell D any of their ar maize m Still had H trouble feeding to their family for w the whole year	Four Tv household m worked four w hours a day fiv Hired 16 da people who fa worked for pe three hours no each but also pi had to work do as piecework on m another farm	Have not taken To out a loan in lo recent years fe Ra Ra Ra
HOUSEHOLD 6	Sold one-third of their maize	Five household members spent around two hours a day working on their own farm Hired in 45 hours of labour to help them	Have not taken out a loan in recent years
HOUSEHOLD 5	Sold one-third of their maize	Three household members spent around eight hours a day working on their own farm Did not do any piecework	Borrowed MK100,000 to buy fertiliser in 2018 Repaid MK 200,000 at harvest in 2019
HOUSEHOLD 4	Did not sell any of their maize	Two household members spent five hours a day working on their own farm during the busy season Spent a lot of time working on other farms and looking for firewood to sell	Borrowed three buckets of groundnuts in 2018 Were due to repay nine buckets after the 2019 harvest, but have not repaid in full
HOUSEHOLD 3	Did not sell any of their maize	Two household members spent around nine hours in a day working on their farm Did piecework on another farm once because they needed money to process their maize	Has never taken out a loan
HOUSEHOLD 2	Did not sell any of their maize Still did not have enough to feed them for the whole year	Six household members spent seven hours a day working on their own land Did piecework on other farms three times to supplement food during the lean period	Borrowed three buckets of groundnuts in 2018 Repaid nine buckets in May 2019
HOUSEHOLD 1	Sold part of their maize Stored the rest for consumption	Two household members spent around five hours a day working on their farm during the busy season Used labour as a coping mechanism, working in other farms for food and money	Took out a cash loan to buy fertiliser and groundnut seed from a local farmer
DECISION	Decision 4: Produce	Decision 5: Labour use	Decision 6: Taking out loans

ision 7: Used fe ig manure and mar gside but did	ertiliser								
manure and mar ide but did		Used only	Used a	Used fertiliser	Combined	Used fertiliser	Used fertiliser	Combined	Used only
side but did r	nure	fertiliser	combination	and manure	fertiliser	and manure	and manure	fertiliser,	fertiliser but
	not	Yield has	of fertiliser,	but did not	use and	together	but only	manure and	in adequate
rvation incorpo	rate	continuously	manure and	incorporate	conservation	but no	in small	conservation	amounts
ulture conserv	vation	decreased	conservation	conservation	agriculture	conservation	quantities	agriculture	Yield improved
ces agricultu	ure	over the years	agriculture	agriculture	practices	agriculture	Yield	practices	because
practice	Se		practices	practices	Yield	practices	decreased	Yield improved	rainfall was
Yield im	proved		Yield has	Yield	decreased due	Yield improved	Did not use		also adequate
but not	as		improved to	decreased but	to attack of the	more than	conservation		
expecte	þ		expectations	attributed this	fall armyworm	anticipated	agriculture		
				in part to an			practices		
				attack of the					
				fall armyworm					

Note: MK=Malawian kwacha ($\mathfrak{S}1 = 949$ MK in February 2020)

Smallholder farmers in Malawi face a constant challenge: to choose between many, often competing, social, economic and environmental objectives while also meeting expectations to intensify their farming practices sustainably and produce 'more with less'. Farmers manage this situation by making trade-offs; choosing and prioritising goals based on household circumstances and by weighing immediate productivity/financial gains against long-term goals.

This report presents findings from the SITAM project, which explored how farmers in Malawi manage these trade-offs. It draws conclusions and recommendations for what national and sub-national government can do to support more sustainable choices at farm level in Malawi.

IIED is a policy and action research organisation. We promote sustainable development to improve livelihoods and protect the environments on which these livelihoods are built. We specialise in linking local priorities to global challenges. IIED is based in London and works in Africa, Asia, Latin America, the Middle East and the Pacific, with some of the world's most vulnerable people. We work with them to strengthen their voice in the decision-making arenas that affect them — from village councils to international conventions.



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