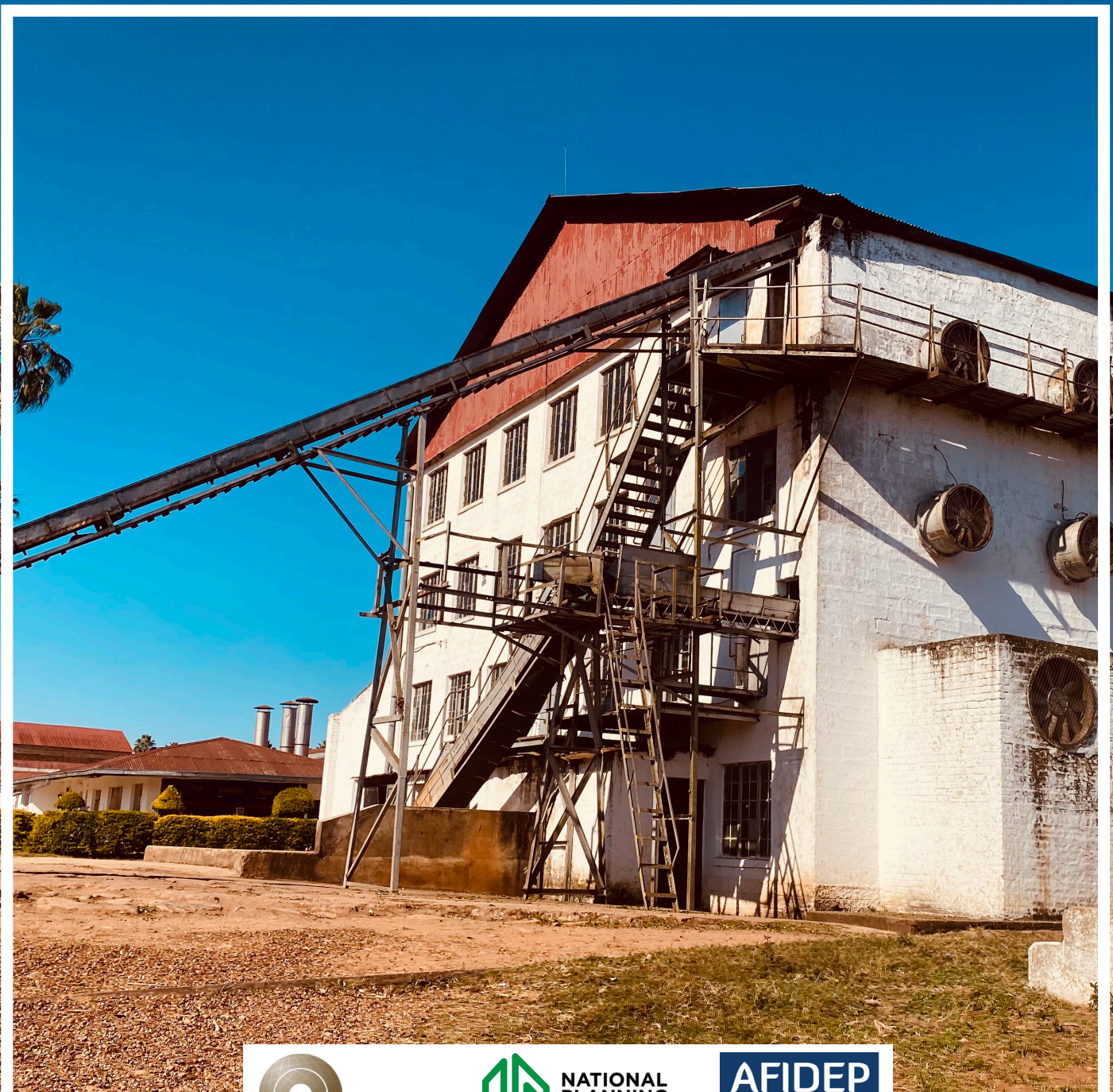


The Malawi Priorities Project

A Cost-Benefit Analysis of Industrialization and Youth Employment in Malawi - Technical Report

National Planning Commission Report with technical assistance from the Copenhagen Consensus Center and the African Institute for Development Policy



Report Contributors

Lindsay Wallace, MA, Director of Strategic Operations, Limestone Analytics
Bahman Kashi, Ph.D., President, Limestone Analytics
Sarah Carello, MA, Project Coordinator, Limestone Analytics
Brett Crowley, B.A.Sc., Project Coordinator, Limestone Analytics
Ben Kaluwa, Ph.D., Professor of Economics at University of Malawi
Brad Wong, Ph.D., Chief Economist, Copenhagen Consensus Center
Grace Kumchulesi, Ph.D., Director of Development Planning, National Planning Commission
Hope Chavula, Senior Development Planning Specialist, National Planning Commission

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www.copenhagenconsensus.com

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Malawi Priorities: Background

Malawi Priorities is a research-based collaborative project implemented by the National Planning Commission (NPC) with technical assistance from the African Institute for Development Policy (AFIDEP), and the Copenhagen Consensus Center (CCC) to identify and promote the most effective interventions that address Malawi's development challenges and support the attainment of its development aspirations. The project seeks to provide the government with a systematic process to help prioritize the most effective policy solutions so as to maximize social, environmental and economic benefits on every kwacha invested. Cost-benefit analysis is the primary analytical tool adopted by the project. Cost-benefit analysis will be applied to 20-30 research questions of national importance. Research will take place over the course of 2020 and 2021.

Research questions were drawn from the NPC's existing research agenda, developed in September 2019 after extensive consultation with academics, think tanks, the private sector and government. This sub-set was then augmented, based on input from NPC, an Academic Advisory Group (AAG) of leading scholars within Malawi, and existing literature, particularly previous cost-benefit analyses conducted by the Copenhagen Consensus Center. The research agenda was validated and prioritized by a Reference Group of 25 prominent, senior stakeholders. The selection of interventions was informed by numerous consultations across the Malawian policy space, and one academic and two sector experts provide peer review on all analyses.

Cost-benefit analyses in Malawi Priorities consider the social, economic and environmental impacts that accrue to all of Malawian society. This represents a wider scope than financial cost-benefit analysis, which considers only the flow of money, or private cost-benefit analysis, which considers the perspective of only one party. All benefit-cost ratios (BCRs) reported within the Malawi Priorities project are comparable.

The cost-benefit analysis considered in the project is premised on an injection of new money available to decision makers, that can be spent on expanding existing programs (e.g. new beneficiaries, additional program features) or implementing new programs. Results should not be interpreted as reflections on past efforts or the benefits of reallocating existing funds.

Inquiries about the research should be directed to Salim Mapila at salim@npc.mw.

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Acronyms

AAG	Academic Advisory Group
AFIDEP	African Institute for Development Policy
AVC	Agricultural value chain
BCR	Benefit Cost Ratio
CAGR	Compound Annual Growth Rate
CASA	Commercial Agriculture for Smallholders and Agribusiness
CBA	Cost Benefit Analysis
CCC	Copenhagen Consensus Center
CFA	Contract farming arrangement
CGS	Credit Guarantee Scheme
DOCs	Day-old chicks
FBS	Farmer business school
IBCF	Incentive-Based Contract Farming
ISFM	Integrated Soil Fertility Management
ISVAPs	Improved soybean varieties and agronomic practices
MAIWD	Ministry of Agriculture, Irrigation and Water Development
MITC	Malawi Industry and Trade Centre
SMEs	Small and medium-sized enterprises
NEET	Neither in education or in employment
NGO	Non-governmental organization
NOS	Nucleus-outgrower scheme
NPC	National Planning Commission
OECD	Organisation for Economic Co-operation and Development
SADC	Southern African Development Community
SCD	Systematic Country Diagnostic
SEZ	Special Economic Zone
SHF	Smallholder farmer
SMEs	Small and medium sized enterprises
SSA	Sub-Saharan Africa
TEVET	Technical, Entrepreneurial and Vocational Education and Training
TVP	Textured Vegetable Protein

Executive Summary

As part of the Malawi Priorities project, the team was posed the following two questions:

1. *Where should Malawi focus its resources to achieve industrialization?*
2. *Which policies can effectively address youth unemployment and underemployment?*

This report summarizes the research into the key challenges and opportunities for facilitating industrialization and increased youth employment in Malawi. The research team conducted a desk review and consultations with local sectoral experts in order to understand the structural issues that have hindered Malawi's ability to achieve its industrialization aspirations and provide employment opportunities for its growing youth workforce. The team then conducted cost benefit analysis (CBA) to quantify the impacts of a subset of interventions that could be pursued in Malawi to promote industrialization and create jobs for youth.

Based on the literature review and the policy recommendations for Malawi, the team identified possible interventions to address youth unemployment and promote structural change for sustainable growth and employment. The team prioritized interventions that aligned both with lessons from recent research on industrialization in Sub-Saharan Africa (Newfarmer, Page, and Tarp 2018; Mkwambisi et al. 2020) and the Government of Malawi's strategic priorities.¹ The team then used selection criteria to choose the final interventions to be further analyzed through cost-benefit analysis. The selection criteria included an expected high benefit-cost ratio, high expert priority, a significant gap in intervention coverage, and crucial data availability. The two interventions that were selected for the analysis are described below.

A poultry egg outgrower scheme: Malawi's agro-processing value chains are characterized by weak linkages and inefficient marketing channels, largely driven by infrastructure gaps and information asymmetries between stakeholders. There is often a mismatch between supply and demand for agricultural products, and it can be challenging for agro-processors to achieve profitable margins. The animal feed to poultry sector value chain is one such example of a value chain that could benefit from greater integration.

The first intervention modelled in this study is a poultry farm outgrower scheme that aims to strengthen connections between small scale poultry farmers, commercial poultry firms, and soybean processors. The primary benefits of this intervention are the cost savings through increased efficiency of egg production, as well as the increased income to labour entering the soybean processing sector. Costs include start-up capital costs, recurring capital and operations and maintenance costs, and the social cost of carbon emissions.

A credit guarantee scheme (CGS) for small and medium enterprises (SMEs): Many SMEs in Malawi face barriers to accessing formal finance. These credit-constrained SMEs may be unable to invest in production-enhancing inputs, including hired labour. On the other hand, financiers are often unable or unwilling to lend to SMEs due to the relatively high risk of default compared to larger firms.

To help address these issues, the second intervention modelled using CBA is a credit guarantee scheme to provide SMEs with greater access to formal finance. The primary benefits of this intervention are the increased return on capital to SMEs who gain access to credit through the intervention, as well as the SME surplus that accumulates from a reduction in the cost of borrowing. The cost of the intervention is the opportunity cost of capital.

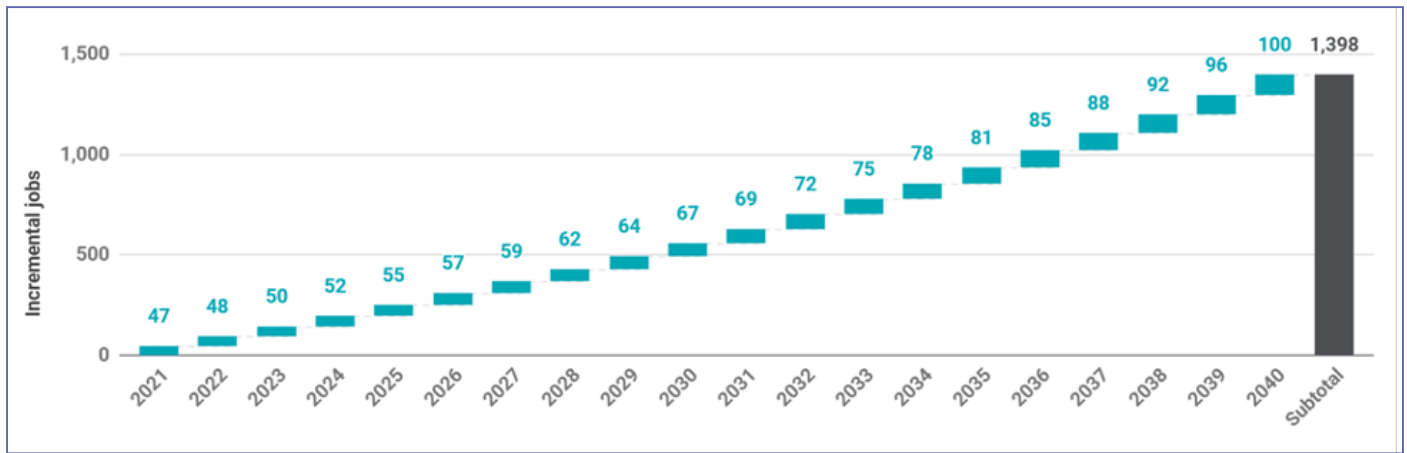
The benefit-cost ratio (BCR) for both interventions is greater than 1 (but less than 2), implying that **both interventions are expected to yield modest net benefits for Malawi's economy**. The poultry outgrower scheme is expected to directly create 1,398 jobs over 20 years, while the SME CGS is expected to directly create 2,944 jobs over 6 years. These numbers do not represent net job creation across the economy, but rather the estimated number of jobs that would be demanded as a result of each intervention. This is because we do not consider the number of jobs that would be created in the counterfactual scenario (i.e. if the intervention funds had been put to other productive use in Malawi's economy).

Intervention benefit-cost ratios

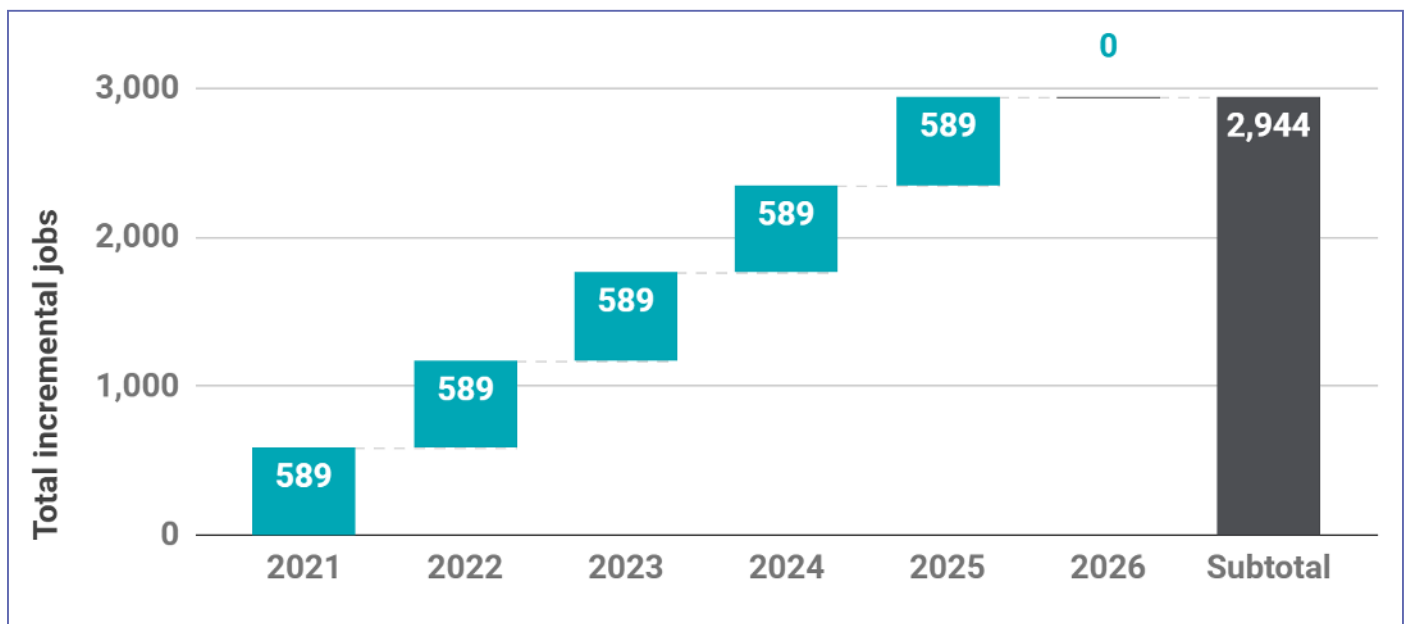
Intervention	Benefit-Cost Ratio		
	5% Discount Rate	8% Discount Rate	14% Discount Rate
Poultry outgrower scheme	1.36	1.37	1.36
SME CGS	1.05	1.05	1.05

¹ Priorities were established through consultations with local experts and relevant policy documents.

Jobs directly created by the poultry outgrower scheme over time



Jobs directly created by the SME CGS over time



Policy implications

Based on our desk review and CBA modelling, we offer the following policy implications for consideration.

The root cause of the youth underemployment and unemployment challenge in Malawi is a lack of jobs which itself is caused by limited structural transformation of the economy. While many youth employment programs cite a lack of skills as a constraining issue, skills development alone will not address the challenge of youth employment in Malawi. For this reason, the team explored interventions that would drive job creation.

Demand-driven education and skills development programs are still needed. Due to the mismatch of demand and supply in the labour market in Malawi, it is likely that economic growth will need to be accompanied by investment in education and infrastructure to connect youth to employers. These programs should be designed and funded based on the skills demanded by the job market.

Industrialization is defined more broadly than simply the growth of manufacturing services but rather as a process of economic transformation that results in employment creation. To that end, a number of tradable services industries share many characteristics as manufacturing, particularly the capacity to create better jobs. They benefit from productivity growth, scale and agglomeration economies.

Any intervention that might be designed based on this study should undertake a thorough assessment of considerations related to land tenure. Land tenure is an exceedingly complex and often contentious matter which should be a central consideration of any intervention that is designed to advance industrialization and youth employment in Malawi. Poorly designed interventions can cause more harm than good by excluding marginalized citizens from accessing benefits or, worse yet, further marginalizing people by dispossessing them of their livelihoods.

Mass employment requires a portfolio of targeted interventions: While the interventions modelled in this study are expected to yield net benefits for Malawi’s economy, they fall well short of the 1 million jobs that the Government of Malawi hopes to create during its term. When selecting these interventions, we did not anticipate that they would come anywhere close to generating 1 million new jobs. This level of job creation will require a larger portfolio of interventions, of which the two we have modelled can serve as examples.

The benefits of agro-processing value chain integration can be expanded through exports: The results of the poultry egg outgrower

scheme modelled in this study are based on projected domestic demand for poultry eggs. The Government of Malawi could work with entities such as the Malawi Investment and Trade Commission to identify opportunities to expand exports of poultry eggs to regional neighbours to expand and diversify the benefits of value chain integration.

Limitations

There are a number of limitations to this analysis. First, although the goal of industrialization is to achieve structural change, this analysis is based on production functions of Malawi's current economic structure, as well as the current state of technology. As such, we don't allow for any efficiency gains outside of those directly generated by the interventions. Moreover, the estimated impacts on labour income and employment are short-term, first-order impacts; longer-term impacts and spillover effects resulting from linkages between sectors (i.e. multipliers) are ignored in this study. Therefore, we expect that the intervention would also indirectly create a number of jobs which are not accounted for in the numbers reported here.

The results of the poultry outgrower scheme are explicitly linked to demand for poultry eggs, but the credit guarantee scheme assumes that domestic demand and exports would absorb incremental production facilitated by the increase in capital stock.

This study should not be interpreted as a detailed intervention design or plan. For example, it was beyond the scope of our analysis to determine the number of SMEs who should receive credit, and in what quantities. There may also be other, non-trivial costs associated with implementing these interventions (such as site selection for the poultry outgrower operations) which were beyond the scope of this analysis.

1. Introduction and Context

The National Planning Commission (NPC), with technical support from AFIDEP, and the Copenhagen Consensus Center (CCC) are implementing the Malawi Priorities Project during 2020 and 2021.. The Project is a research and advocacy exercise which aims to identify the most effective ways to address the nation's challenges using the framework of cost-benefit analysis. The goal is to inform both short and long term development priorities for the country, acknowledging that there are insufficient resources to address all of Malawi's challenges and that maximizing outcomes requires careful, evidence-based consideration of the costs and benefits of all policies.

The starting point of all research questions is the NPC's existing research agenda, structured around the six thematic areas of Sustainable Agriculture, Sustainable Economic Development, Human Capital and Social Development, Sustainable Environment, Demography, Governance, Peace, and Security, and Human Capital and Social Development.

The NPC's research agenda was developed by the Commission in September 2019 after extensive consultation with academics, think tanks, the private sector and government. Consequently, the Commission's research agenda contains questions of national importance. As a first step, Malawi Priorities drew questions from the NPC research agenda that could be answered using a cost-benefit methodology. Then, additional research questions were added based on input from NPC, an Academic Advisory Group (AAG) of leading scholars within Malawi, and existing literature, including previous cost-benefit analyses conducted by the Copenhagen Consensus Center. This process of identifying research questions for investigation generated a total of 38 potential research questions across all 6 thematic areas.

The research agenda was validated and prioritized by a Reference Group of 25 senior stakeholders from government, civil society and the private sector. The outcomes of the Reference Group exercise were used to inform which research questions to prioritize and which interventions to focus on within those 38 potential research questions. The validation process was completed in July 2020.

Research process

In October 2020, the research team at Limestone Analytics began investigation into two development questions:

1. *Where should Malawi focus its resources to achieve industrialization?*
2. *Which policies can effectively address youth unemployment and underemployment?*

The first question was ranked 4.8 out of 5 while the second was ranked 4.5 out of 5, according to national priority.

The research team conducted a literature review in order to understand the structural issues that have hindered Malawi's ability to achieve its industrialization aspirations and provide employment opportunities for its growing youth workforce. The team then participated in a series of consultations with an academic advisor in Malawi, Professor Ben Kaluwa, in addition to conducting a more thorough review of secondary data to identify key barriers to Malawi's industrialization and workforce development. Once these gaps were outlined, the research team explored interventions that have been implemented in Malawi or similar countries that address the most salient issues. The menu of barriers and interventions were reviewed by Professor Kaluwa, who provided feedback on additional considerations, as well as additional contacts from the sector who have been involved in market research, feasibility studies, and program design to foster industrialization and youth employment. The sector and academic experts were able to provide valuable insight into what interventions have had the greatest reach, impact, and data availability. The team used these insights to select a subset of interventions to include in the feasibility study.

Industrialization background

Since 1980, Malawi's growth has fallen behind the Sub-Saharan Africa average, with weak and volatile growth persisting. Over the past decades, there has been a decrease in the percentage of the population working in agriculture with people moving to services, construction, or manufacturing. The portion of employment in manufacturing has been small and stagnant the past decades around 10%. The economy is also limited by a challenging business environment which has undermined efforts to develop the private sector (World Bank 2018). The government has focused its attention on improving maize yields which has undermined efforts to diversify the sector, distorted the agriculture market, and impacted price volatility (World Bank 2018).

In 2014, the National Industrial Policy identified key issues limiting Malawi's industrialization. The issues included the high cost of doing business, inadequate infrastructure, limited access to export markets, low participation of SMEs, and low incentives for private sector investments. Since then, Malawi has attempted to overcome these challenges through improved policies including the National Export Strategy and National Trade Policy. These policies aim to enhance integration into regional and global markets, increase value addition to primary products, and increase exports. In the agricultural sector, issues identified included dependence on rainfed agriculture, soil erosion, inadequate infrastructure, and an uncondusive policy environment. The agriculture sector is further burdened by increased population density and rapid population growth, as well as the increasing weather variability due to climate change (Mkwambisi et al. 2020).

Macroeconomic instability is a large barrier to Malawi's economic growth. The World Bank's Systematic Country Diagnostic (SCD) finds that instability is caused partly by climatic and exogenous shocks and partly by policies and limited fiscal space. Macroeconomic instability is identified as a cause for the low accumulation and even decrease of capital in Malawi since the 1980s. Agriculture remains the largest source of employment in Malawi, although this has gradually decreased in the past decades (World Bank 2018). Growing sectors of employment include retail, construction, and government, however, these sectors have low productivity that has been declining over time. The growth in employment in these areas is a result of people wishing to leave agriculture rather than from growth in opportunities.

Youth employment background

Malawi's population is very young with 46% of the population under the age of 15. This large increase in working-age adults provides Malawi with an opportunity to take advantage of the demographic dividend but can also pose a threat to Malawi if there isn't an increase in job opportunities. Many youth participate in the labour force in Malawi, however, quality of work and underemployment remain a challenge. The percentage of young men that are neither in education or in employment (NEET) is 7%, for women the percentage is 20% (OECD 2018). Despite a large portion of youth in the labour force, many work in the informal sector and/or face underemployment. 25% of youth in Malawi are underemployed.

Almost all youth are employed in the 2 lowest skill tiers of employment including youth who have finished secondary and tertiary education. 43% of the highest skilled youth in Malawi are employed in the lowest skilled tier of employment. This disparity between supply and demand in the labour market highlights the need for more decent work for youth and investment in youth gaining skills relevant for these higher skilled jobs. The Malawi Priorities paper on child marriage and secondary education had similar findings.

Due to the high rates of poverty in Malawi, most youth can't afford to be unemployed and are therefore forced to take work wherever they can. This increases the risk of youth having to work in hazardous conditions and being underemployed. There is a need for more decent work in Malawi. Many youth in Malawi start their own business out of necessity due to their lack of options. These businesses are small, informal, mostly in agriculture, and have limited value added.

Another issue that exacerbates youth employment and economic growth is gender inequality. Gender inequality impacts agricultural productivity, opportunities in the non-farm sector, the demographic transition, and household resilience against shocks. Improving gender equality in Malawi will lead to quicker progress in growth, poverty reduction and sustainability (World Bank 2018).

Land tenure

A cross-cutting issue that affects both the industrialization process and youth employment relates to Malawi's land tenure system. Malawi's land system consists of three types of land - public, private, and customary. Many rural citizens reside on customary land, which is "all land which is held, occupied or used under customary law, but does not include any public land." As declared in clause 27 of the Land Act:

Wherever it appears to the Minister that any customary land is needed for a public purpose, that is to say a purpose which is for the benefit, direct or indirect, of the community as a whole, or a part of the community, he may declare, by notice under his hand and published in the Gazette, that such land is public land, and thereupon such land shall become public land.

For Malawians who do not possess a deed of title for the land on which they reside, it may be challenging or impossible to access the benefits of rural commercialization interventions. Land tenure is an exceedingly complex and often contentious matter which should be a central consideration of any intervention that is designed to advance industrialization and youth employment in Malawi. Poorly designed interventions can cause more harm than good by excluding marginalized citizens from accessing benefits or, worse yet, further marginalizing people by dispossessing them of their livelihoods. **It is beyond the scope of our analysis to consider the social, historical, and cultural dynamics of Malawi's land tenure system, but we would expect that any intervention that might be designed based on this study should undertake a thorough assessment of considerations related to land tenure.**

Overcoming the challenges

In order to analyze how best to improve market and employment outcomes, the team turned to the literature as there are multiple systematic reviews analyzing the impact of youth employment interventions.

Supply Side Interventions

Supply-side interventions target the youth through activities such as training and loans. The systematic review done by Kluve et al. (2017) finds that active labour markets programs on average have a positive impact on youth employment outcomes. They found that entrepreneur promotion and skills training had an impact that was statistically different from zero impact while employment services and subsidies did not. The impact on income followed a similar pattern. The authors highlighted that targeting disadvantaged youth and women lead to larger impacts. A great source of heterogeneity in the literature was the country context. This highlights the need for interventions to be tailored to the circumstances of the region they are working in.

Datta et al. (2018) conducted a systematic review of youth employment programs and their impact on employment across various measures. Interventions targeted at the supply side of the labour market such as targeting youth through training, subsidies, and job-finding services had mixed results. Projects that worked with employers and provided on the job training had the best results of these initiatives. **The small impact of many programs was attributed to not addressing the low demand for labour or lack of opportunities for entrepreneurship** (Datta et al. 2018). Supply-side interventions have had successes, however, the authors emphasized the importance of addressing the barriers most pressing to the context of a country or region and addressing both demand and supply

side issues. It is also important to address multiple constraints, particularly in low-income countries.

The government of Malawi has invested in training and education through interventions such as investment in Technical, Entrepreneurial and Vocational Education and Training (TEVET), however, these opportunities are not always available to disadvantaged youth due to high academic requirements, financial constraints, and cultural issues (OECD 2018).² Another issue with the current education system is the quality of the relevance to the private sector. Due to out-of-date teaching resources and lack of linking between training and the private sector there remain skill gaps in sectors such as mining, agro-processing, construction and tourism (OECD 2018).

Demand Side Interventions

Demand-side interventions target employers and encourage hiring youth through activities that lead to market growth and job creation. Malawi's youth face a lack of jobs and market opportunities for entrepreneurship.

In many other countries, increased growth of manufacturing has created many jobs for low-skilled workers, which has been beneficial to all ages, especially for youth. However, the Industries without Smokestacks research highlights that **the benefits of industrialization such as economic growth, improved employment, and reduced poverty can be realized in Africa through growth in sectors other than manufacturing.** By investing in sectors such as agriculture and services, countries can reap the benefits of industrialization by taking advantage of improved technologies. The paper highlights that the current global realities force policymakers in Sub-Saharan Africa to think of ways to promote structural transformation beyond manufacturing. In order to transform their economies, governments need to attract new firms able to compete in regional and global markets in services, tourism, and agro-industry, in addition to other manufacturers (Newfarmer, Page, and Tarp 2018).

The World Bank Systematic Country Diagnostic (2018) identified priorities for Malawi to improve economic growth and employment outcomes in Malawi. The first priority for growing Malawi's economy is improving agricultural productivity. Secondly, the economy needs to diversify outside of agriculture. Third, investments need to be made to improve human capital through improvements in health and education. Finally, Malawi needs to build resilience against climate change and improve environmental sustainability. Investing in diversifying within and outside of agriculture and addressing barriers to growth will lead to economic growth and improved employment outcomes as has been seen in other countries that have experienced industrialization. For countries such as Malawi, it is not whether they should invest in agriculture or invest in industries, it is through increased productivity in agriculture that Malawi can expand into further industries.

Malawi's National Youth Policy (2106) asserts that "The main contributing factor to the issues of unemployment and poverty among the youth is lack of employable skills resulting from very few skills training centres available in the country." However, we see the skills gap and low demand for skilled workers as two sides of the same coin. This study focuses on interventions that are aligned with the objective of the 'Youth Economic Empowerment Priority' of the National Youth Policy: "To create more and decent employment for the youth both in the formal and informal sectors and in urban and rural areas." This study differs from the National Youth Policy in that we focus on demand side interventions rather than supply side interventions.

² Priorities were established through consultations with local experts and relevant policy documents.

2. Literature review and intervention selection

As outlined in Section 1, Malawi's economy faces a wide variety of barriers to achieving industrialization and widespread youth employment. Table 2.1 presents a summary of the primary barriers, along with possible interventions to address each barrier.

Table 2.1: Key barriers in Malawi

Barrier	Possible interventions
Barriers to industrialization	
Infrastructure gaps	<ul style="list-style-type: none"> • Special Economic Zones (SEZs)
Access to finance	<ul style="list-style-type: none"> • Policies/programs that promote access to credit • Help firms produce better records • Help firms register/incorporate • Credit guarantees • Movable credit registries
Weak governance & regulations	<ul style="list-style-type: none"> • Reducing "red tape" and corruption
Inefficient market linkages and low value addition along supply chains	<ul style="list-style-type: none"> • Value chain integration • Contract farming arrangements (CFAs) • Digital value chain integrators
Gender inequality	<ul style="list-style-type: none"> • Gender equity is a cross-cutting consideration
Low agricultural productivity	<ul style="list-style-type: none"> • Investment in agricultural value chains • Access to improved inputs • Extension services
Exposure to shocks	<ul style="list-style-type: none"> • Resilience to shocks is a cross-cutting consideration
Barriers to youth employment	
Skills mismatch and gaps	<ul style="list-style-type: none"> • Skills training • Apprenticeships
Lack of opportunity for youth	<ul style="list-style-type: none"> • Entrepreneur promotion and training • Employment services and subsidies
Low quality work and weak labour laws	<ul style="list-style-type: none"> • The team did not consider any interventions to address this barrier.
Academic, financial and cultural barriers to participation in education	<ul style="list-style-type: none"> • The team did not consider any interventions to address this barrier.

Intervention options

A number of different interventions have been attempted with the intent of advancing industrialization and increasing youth employment. In this section, we review the evidence and impact of various interventions that have been implemented in Malawi and similar countries by each barrier identified in the previous section.

Barriers to industrialization

Special Economic Zones: A review of SEZs across Africa noted that zones across the continent were generally unable to replicate the successes of SEZs in Asia (Mösle, 2019). Inadequate planning and implementation, characterized by "(d)efficient infrastructure, suboptimal location with poor access to markets, high regulatory uncertainty, political instability, a top-down focus on noncompetitive industries, insufficient implementation capacity and coordination problems between actors", are the main reasons for these failures.

Nevertheless, there have been some isolated examples of successful SEZ programs such as the Kigali Special Economic Zones in Rwanda. Steenbergen and Javorcik (2017) used firm-level data to analyze how Special Economic Zones impacted firm behaviour. They found that the impact on firms of being in the Special Economic Zones vs. not was a significant increase in value-added, permanent employees, and productivity overall.

Access to finance: Access to finance is a key barrier to business development in Malawi. The systematic review of the impacts of access to finance conducted by Kersten et al (2017) found significant impacts of access to finance on firm production and employment, but insignificant impact on firm productivity.

Studies by Bist (2018) and Inoue and Hamori (2016) reveal positive impacts of financial development on economic growth amongst African countries. Nizam et al (2020) find a threshold effect in the financial inclusiveness-growth nexus, where countries with higher levels of financial inclusion achieve higher economic growth than countries with lower levels of financial inclusion. On the other hand, Effiong (2015) and Bandura and Dzingirai (2019) suggest the quality of local institutions is a moderating factor in the impact of financial development on economic growth.

Reducing “red tape” and corruption: Amos and Doungahire (2019) find that “Red tape” as an institutionally induced policy distorts labour allocation due to increase in time spent dealing with authorities and significantly lowers labor productivity. A one percent reduction in time spent dealing with authorities would lead to a substantial reduction in bureaucracy and increase in MRPL by 1.9 percent.

Using three different measures of corruption, Bbaale and Okumu (2018) find evidence that corruption “sands the wheels of commerce” and hence dampens firm-level productivity even when the endogeneity of corruption is controlled for. On the other hand, using the same data Williams and Kedir (2016) find that corruption significantly enhances rather than harms annual sales, employment and productivity growth rates. In their systematic review, Ugur and Dasgupta (2011) find that a one-unit increase in a country’s perceived corruption index is associated with a 0.89 percent decrease in the per capita GDP growth rate.

Agricultural value chain integration: The systematic review of contract farming arrangements by Ton et al (2017) states: ‘Contract farming is a container concept that covers a wide range of contractual arrangements. This heterogeneity makes it difficult to draw general conclusions from the literature published on this topic. The studies have a marked publication bias. All studies report at least one case of contract farming that has a positive and statistical significant income effect. Moreover, due to limits inherent to the (cross-sectional) study designs used in these investigations, the estimated effect size is upward biased. The lack of studies on ‘failed treatments’ leads to an overestimation of the effectiveness of contract farming.’ Meemken and Bellemare (2019) similarly find heterogeneous and upwardly biased impacts of contract farming in the literature.

Improved access to agricultural inputs: Tufa et al (2019) found that the use of improved soybean varieties and agronomic practices (ISVAPs) is associated with an average of 61% yield gain and 53% income gain for adopters. Van Vugt et al (2016) found that a combination of inoculation, inorganic fertiliser, and compost manure increased yields from 0.86 tons/ha under farmers’ traditional practice to 1.56 tons/ha and resulted in average profits of \$222 USD/ha.

Agricultural extension services: In their case study of the impacts of Malawi’s farmer business schools (FBS), Chilemba and Ragasa (2019) report: ‘The study finds a positive yet very small impact of FBS participation on crop income... and no significant difference in crop income and production for farmers who graduated from FBS versus those who dropped out. While most participants reported gaining improved knowledge from the training, it did not seem to translate into new business ventures and improved incomes. Insights from the qualitative research component of this study suggest that this is primarily due to the limited financial resources that smallholder farmers have to implement the agricultural management practices and business skills taught in FBS.’ Maertens et al (2020) provide some evidence of increased Integrated Soil Fertility Management (ISFM) practice adoption among Malawian soybean farmers who participate in demonstration plot clubs, but no significant impacts on yields or farmers’ incomes.

Increased diversity of agriculture: Analysis conducted by Keyser et al. (2007) looked at countries impacted by the shrinking tobacco market and identified crops that could be grown in similar environments and provide farmers with increased profits. They found that alternatives to tobacco that would offer similar or greater profits per hectare include paprika, tomato, rice, cassava, groundnuts, and coffee as options.

Barriers to youth employment

Skills training: The systematic review done by Kluve et al. and Datta et al. found that skills training had a positive impact on incomes and employment outcomes.³ The systematic review also found that some of the most effective skills training interventions included on-the-job training.

Entrepreneur training: The systematic review done by Kluve et al. and Datta et al. found that entrepreneur training had a positive impact on incomes and employment outcomes. Further, the research by AfIDEP (2016) found that entrepreneurs’ business skills were a barrier to their management capacity.

The selection of interventions to include in the feasibility analysis does not necessarily deny the importance of the other options, or suggest that they do not have impact.

³ Although there is a skills mismatch in Malawi, skills training is unlikely to have a large impact on employment in Malawi without an improvement in the supply of decent work.

Table 2.2: Summary of evidence for interventions addressing each barrier

Key Barrier	Evidence of Impact?
Barriers to industrialization	
Special Economic Zones	Mixed
Access to finance	Yes
Reducing “red tape” and corruption	Split
Agricultural value chain integration	Yes, biased
Access to improved inputs	Yes
Extension services	Yes
Increased diversity of agriculture	Yes
Barriers to youth employment	
Skills Training	Yes
Entrepreneur Training	Yes

Selection Criteria

The research team used a number of criteria to screen and select a subset of interventions to include in the feasibility analysis. These criteria have been applied to other CCC pre-feasibility research projects as well.

Sector expert priority: Sector experts identify the intervention as important and relevant to the local context. Experts can provide input through several channels: the Reference Group questionnaire, inferences from the NPC research agenda, the academic advisory group, and during individual interviews.

High benefit-cost ratio or cost-effectiveness in similar previous research: The purpose of the Malawi Priorities project is ultimately to identify interventions of outsized benefits relative to costs. Input into this factor is determined from the economics literature, particularly previous research conducted by the Copenhagen Consensus Center. In the Center’s experience, BCRs above 15 are among the highest across all interventions. Due consideration is given to contextual differences between previous research and the current situation in Malawi in determining the effect of this criterion.

Addresses a problem of sufficient size – some interventions could be considered highly effective but only address a small percentage of a given problem, limiting the overall net benefits of the approach. To avoid focusing on solutions that are too small, each intervention must have the potential to address a problem that is significant.

Significant gap in current levels of intervention coverage – all analysis conducted in Malawi Priorities focuses on marginal benefits and costs. Therefore if an intervention already has high coverage rates, then additional resources provided towards that intervention are unlikely to be effective or will suffer from the ‘small-size’ problem.

Availability of crucial data or credible knowledge of impact – due to time and resource constraints, all analyses conducted by Malawi Priorities are based on secondary data. No primary research is conducted, such as field experiments or trials. Therefore, each intervention is constrained by the availability of data. In many cases, one key constraint is knowledge concerning the impact of a given intervention. It is typical to formally deal with uncertainty via sensitivity analyses. However, in some cases, the uncertainty is so great that it precludes even researching the intervention at all.

Table 2.3 summarizes each of the interventions along these criteria, based on the existing evidence.

The interventions chosen to be further analyzed through Cost-Benefit Analysis include:

- Investment in agro-processing value chain integration
- Improving access to finance for SMEs

Table 2.3: Selection of final interventions for inclusion in CBA

Intervention	Sector Expert Priority	High BCR or cost-effectiveness	Sufficient size	Gap in current coverage	Availability of data	Overall
Investment in agro-processing value chain integration	High	High	Yes	Yes	Yes	Yes
Improving access to finance	High	High	Yes	Yes	Yes	Yes
Special Economic Zones	High	Low	Yes	Yes	No	No
Entrepreneur training	High	Low	No	No	No	No
Skills training	Low	Low	No	Yes	Yes	No
Apprenticeship programs	High	Low	No	Yes	No	No

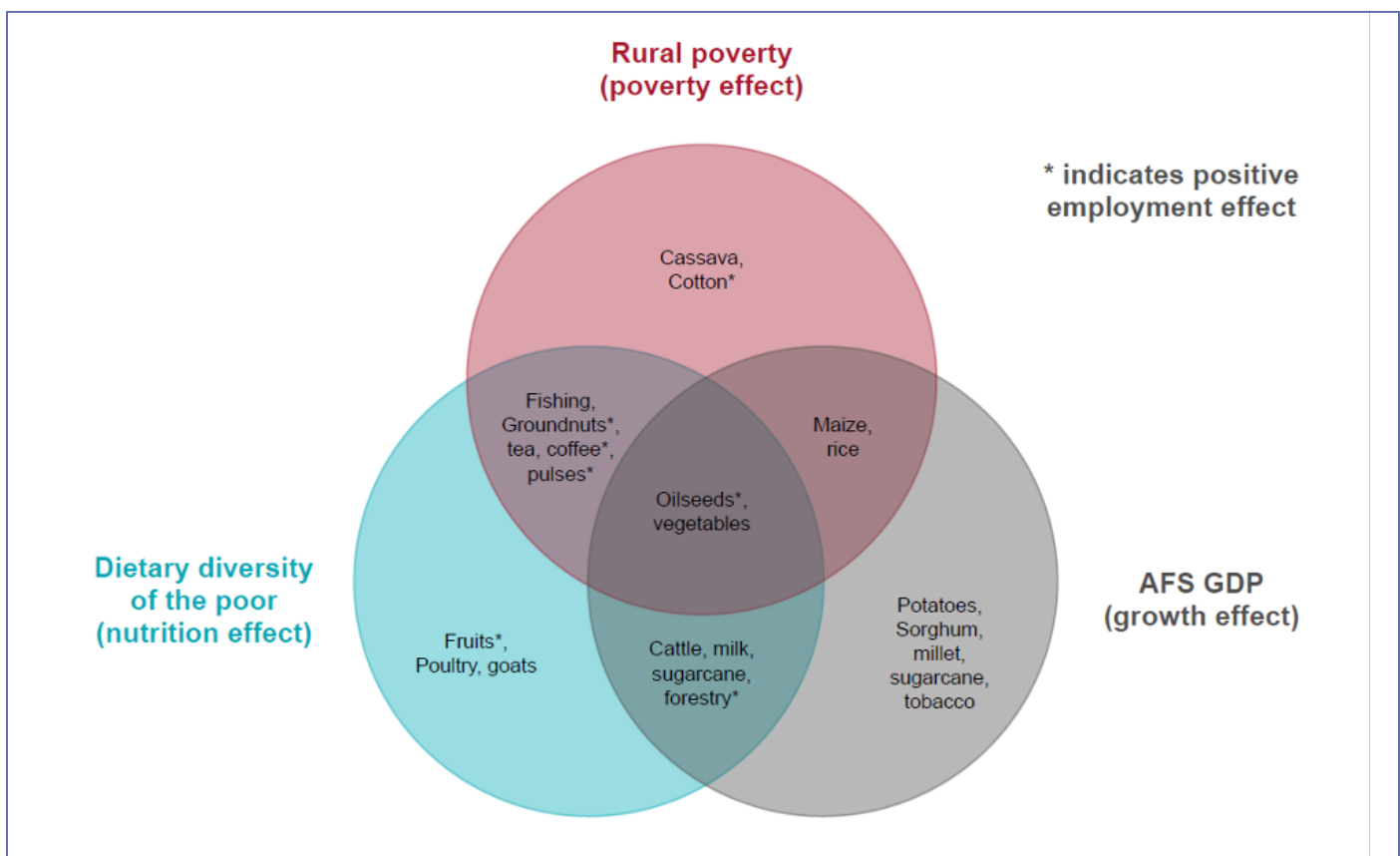
Intervention logic

Within the selected high-level interventions, there are a multitude of intervention models and leverage points to target. In this section, we outline the evidence used to ‘narrow in’ on the specific interventions to be modeled with CBA.

Investment in agro-processing value chain integration

It was decided that this intervention should support the enhancement of supply chains for the production of soybeans and soy-based products. Soybeans are one of the four oilseeds prioritized for export in Malawi’s National Export Strategy, along with sunflower, groundnut, and cotton. Soybeans were selected because they already constitute a significant portion of Malawi’s agricultural export basket,⁴ yet there is significant scope for increasing domestic capacity value-addition.⁵ There are a number of strategic opportunities that support the decision to strengthen the soybean value chain as shown in Table 2.4.

Figure 2.1: Potential of various agricultural products (Benfica and Thurlow 2017)



⁴Although there is a skills mismatch in Malawi, skills training is unlikely to have a large impact on employment in Malawi without an improvement in the supply of decent work.

⁵Although there is a skills mismatch in Malawi, skills training is unlikely to have a large impact on employment in Malawi without an improvement in the supply of decent work.

Table 2.4: Strategic opportunities in the soybean value chain

Strategic opportunity	Drivers	Source
Strong and growing demand	Expansion of the poultry and fish industries in Malawi and the South African Development Community (SADC) region.	TechnoServe 2011
	The SADC region as a whole faces a negative trade balance in soybeans, oilcake and edible oil, so there is ample opportunity for Malawi to expand its exports to regional trade partners.	Markowitz 2019
	Rapid growth in demand for soya pieces.	Dzanja et al 2016
Captive market	Because of its high protein content, soy cake has no competitive substitute from other crops.	TechnoServe 2011
	NGOs use soy flour to enrich meals provided to captive audiences such as school lunch programs, hospitals, orphanages and refugee programs. ⁶	Yohane et al 2013
Competitiveness	On a pure cost basis, trade within the region has been competitive against Argentine beans. ⁷	TechnoServe 2011
Institutional support	Recent formation of the Soybean Association of Malawi that is equipped to drive the soybean industry and establishment of Legumes Development Trust to support partnership and promote the market.	Yohane et al 2013
	Political will and government initiatives in place to enhance soybean production.	Yohane et al 2013
Agronomic suitability	Availability of suitable varieties adaptable to almost all agro-ecological zones in Malawi.	Yohane et al 2013
Socioeconomic benefits	Optimal combination of positive poverty reduction, nutrition enhancement, and economic growth effects (Figure 2.1 above).	Benfica and Thurlow 2017
	Opportunities to empower women through value-add activities along the soybean value chain.	USAID 2014

That said, there are a number of barriers hindering the development of well-functioning soybean value chains in Malawi. Of the general barriers to industrialization listed in Table 2.1 above, those that are most relevant to Malawi's soybean value chain are:

- Low agricultural production;
- Inefficient market linkages and low value addition along supply chains;
- Underutilized processing capacity.

Low agricultural production

Soybean is a relatively new crop in Sub-Saharan Africa (SSA), and there are relatively few high-yielding varieties available to smallholder farmers. As a result, yields are lower in SSA relative to the rest of the world (Santos 2019). Yohane et al (2013) found that average soybean yields in Malawi were just 800 kg/ha compared to theoretical maximum yields of 2,000 - 3,000 kg/ha. Goldsmith and Dall'Erba (2020) report yields in Malawi had increased to 980 kg/ha by 2018, but noted that extensification was the primary driver of increased soybean production in Malawi rather than intensification. Other salient causes of low productivity include (Government of Malawi 2013):

- Environmental factors such as diseases, pests, drought, and poor soil fertility;
- Limited access to improved inputs (inoculant, fertilizers);
- Low access to research and extension services and limited knowledge of best crop management practices;
- Trade distortions;
- Unclear land tenure;
- Cultural barriers.

Inefficient market linkages and low value addition along supply chains

Figure 2.2 shows the key stakeholders in the soybean agricultural value chain (AVC) in Malawi. The arrows represent representative pathways through which value might be added to soybeans, but there exist other pathways between stakeholders. For example, smallholder farmers might sell directly to large traders rather than first selling to small traders. Tinsley (2009) suggested that procurement of soybeans from farm communities appears to be mostly done by the large processors directly and not via contractors or other middle persons. Nzima and Dzanja (2015) examined the marketing efficiency⁸ of alternative soybean market channels. They identify five

⁶Tinsley cautions: 'It should be noted that relying on NGOs for long term marketing has to be done with caution. NGOs should be considered as only a temporary market associated with different development or relief projects and not as a permanent part of society. Thus, it should be anticipated that NGOs will have a life expectancy of 10 years or less. Thus, while they can be used as an initial market, diversification away from NGOs should be a reasonable priority to assure the continued sustainability of any value chain, soybeans or otherwise.'

⁷This is, however, partially attributable to the non-tariff protection offered by high inland transportation costs that raise the price of deep-sea imports.

⁸Marketing efficiency was measured as the ratio of net price received by the farmer to the total marketing cost plus total margins incurred by intermediary traders before the end product is sold to consumers.

profitable marketing channels (Figure 2.3) but find that Malawi’s soybean market is overall inefficient, with traders earning supernormal profits due to market power and minimal integration between regional markets. Various methods of cheating have been documented at various points along the supply chain⁹ (Tinsley 2009; Agar 2014). On the other hand, farmers and traders have been observed to employ highly sophisticated trading strategies, such as forms of stock futures management, to manage risk and increase profits.

Figure 2.2: Stakeholders in the soybean value chain (Agar 2014)

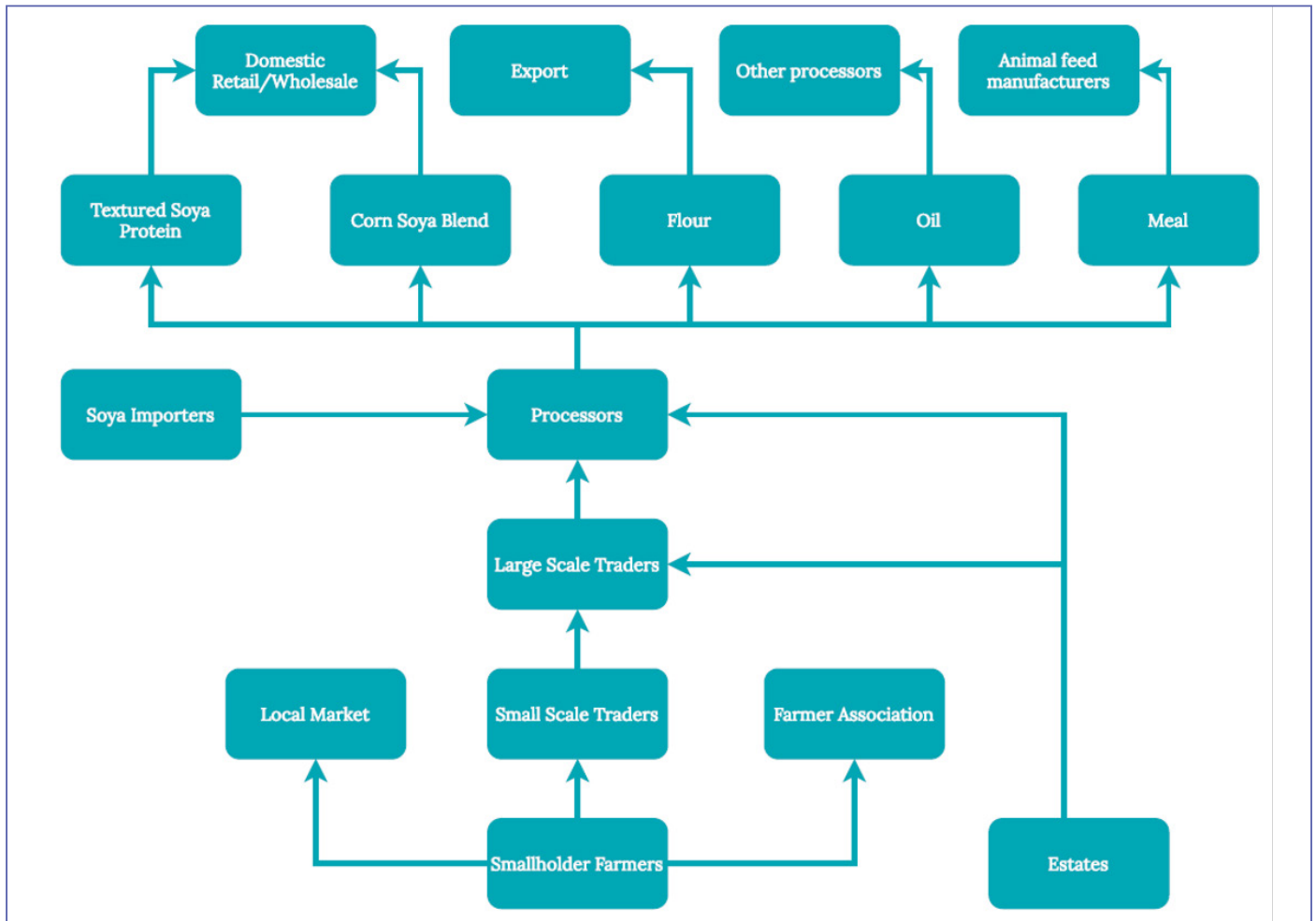
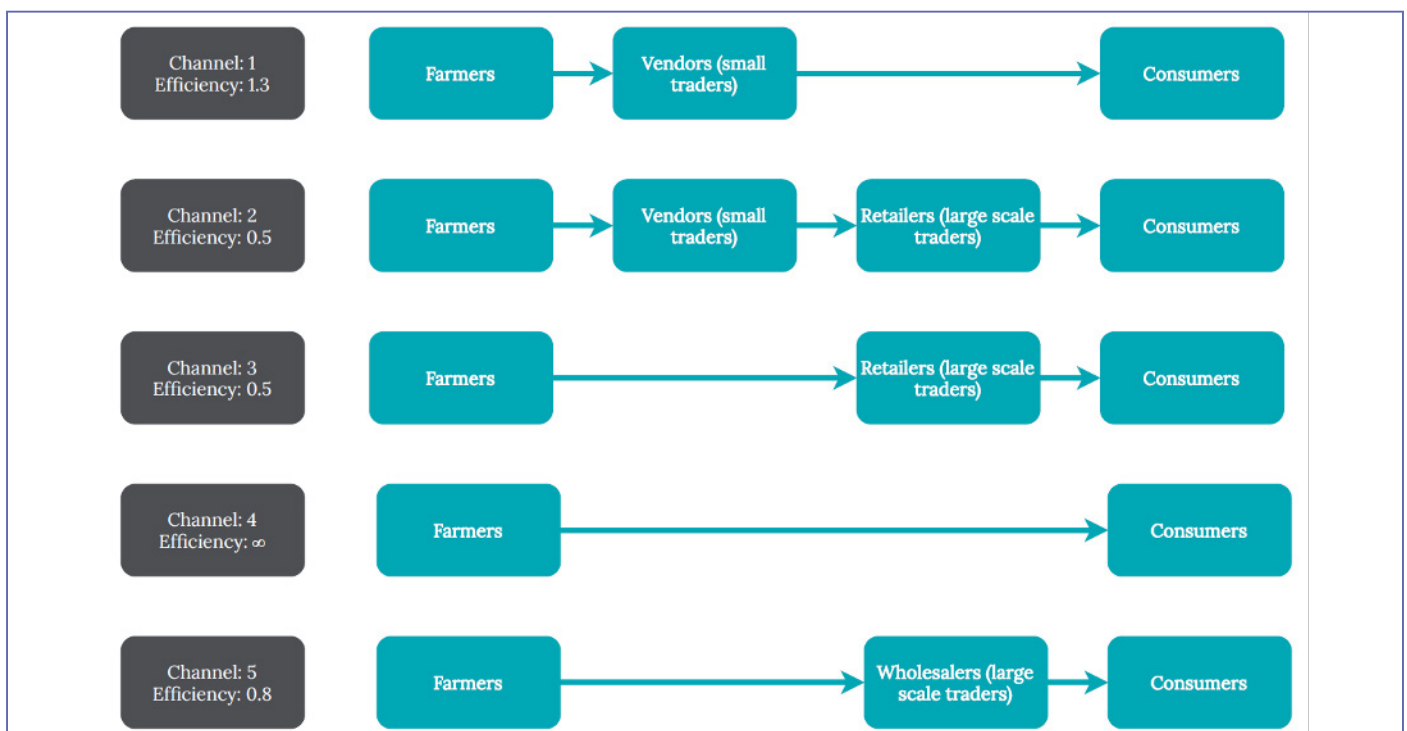


Figure 2.3: Profitable soybean marketing channels (Nzima and Dzanja 2015)



⁹ Methods of cheating include sale of counterfeit, diluted and expired inputs; use of rigged scales to weigh and price crops; wetting of crops or addition of additional non-crop material by farmers to increase weight.

The most significant 'pull-factor' in the soybean supply chain regionally is the demand from the poultry feed industry, but due to challenges associated with Malawi's investment environment, Malawi's poultry feed industry is smaller and less competitive than the poultry feed industries of neighbouring Zambia and South Africa (Markowitz, 2019). Another 'pull-factor' is the demand for soy products for human consumption, which is relatively larger in Malawi than in neighbouring markets (TechnoServe 2011).

Underutilized processing capacity

Soybean can be processed in a number of different ways, as shown in Table 2.5 below. All of the processes are capital intensive and some, such as solvent extraction, require the use of chemical inputs. As a result of these requirements and the constraints to production competitiveness outlined in the previous section, Malawi's existing soybean processing facilities are relatively small, domestically financed and concentrated in urban areas (Agar 2014). Opperman and Varia (2011) report that soybean processing facilities must operate in excess of 90% utilization to be profitable, but capacity utilization was reportedly at 66% in Malawi in 2011. Meyer et al (2018) report that although the capacity for Malawi as a whole was estimated at around 400 thousand tonnes, only about 60 thousand tonnes were processed in 2016, and production was only projected to reach 112 thousand tonnes by 2027 (albeit with high uncertainty around these estimates).

Table 2.5: Soybean production processes (Opperman and Varia 2011)

Process	Primary product	Secondary product	Use	Description
Crushing	Full fat soy cake		Animal feed ingredient	Process involves crushing the soybeans into a cake without removing the oil
Chemical / solvent extraction	Oil	Low fat soy meal	Oil for human consumption, meal for animal feed; typically required very high volumes to be economical	Process involves crushing the beans into thin flakes, then percolating these with a hexane solvent to extract oil from the meal/cake
Pressing (Mechanical Extraction)	Oil	Low fat soy meal	Oil for human consumption, meal for animal feed; typically required very high volumes to be economical	Process involves the use of continuous screw presses to expel oil from the beans
Extrusion	Textured Vegetable Protein (TVP)	Byproduct	Food ingredient	Process that raises the temperature of the high-oil cake enough to denature the inhibitory enzymes (does not expel oil)
Micronizing	TVP	Byproduct	Food ingredient	Process which uses infra-red heating to denature inhibitory enzymes in soybeans, producing soy flour which is then extruded into TVP shapes
Fermentation	Soy sauce		Food ingredient	Process that ferments soybeans with specific moulds, water and salt to produce a paste which, when pressed, produces soy sauce
Cooking / Grinding	Soy milk	Okara	Human consumption	Process that raises the temperature of beans to dry them, crushes them and then mixes the output with water to produce milk

Goldsmith and Dall'Erba (2020) shed light on the reasons for the underutilization of Malawi's soybean processing capacity. The key challenge is that edible oil and oilcake / meal are complementary products (i.e. produced through the same process) but there is an imbalance in domestic demand for these two products. As data from the ITC Trademap shown in Figure 2.4 below demonstrates, Malawi is a net importer of edible oil and a net exporter of oilcake. Although domestic supply has satisfied an increasing share of domestic demand for oil since 2003 (see Figure 2.5), domestic supply of oil in 2017 was still far below domestic processing capacity,¹⁴ and the 71,000 MT of soybean-equivalent imported in the form of oil represents missed economic opportunity all along the soybean value chain in Malawi. Goldsmith and Dall'Erba remark that 'the apparent contradictory reality of an industry that imports soybean oil while simultaneously operating over capacity reflects the underlying poor state of crush margins at the processor stage of the value chain.' Recently, corrupt labelling¹⁵ and smuggling¹⁶ of cheap edible oils from Mozambique has also undermined local oil processing.

Between 2014 and 2017, domestic production of soy meal exceeded domestic demand by 23% on average (Goldsmith and Dall'Erba 2020). Malawi's poultry industry is nascent and dominated by two commercial producers - Central Poultry and Kamponji Enterprises Limited (Kelfoods) collectively hold about 80% of the domestic market share (CASA 2020). The remaining share of the market is held by small-scale poultry farmers. Central Poultry has historically domestically sourced oil cake Sun Seed Ltd to produce its own feed,¹⁷ but small-scale poultry producers tend to use cheaper, lower-quality feed or rely on chickens to self-feed through scavenging. An industry

¹⁴ Assuming 18% oil content and perfect extraction efficiency, the quantity of domestic crush in 2017 suggests the total volume of soybeans processed domestically was around 150,000 tons.

¹⁵ Refined oils are labelled as crude to avoid taxes on refined oils.

¹⁶ <https://www.nyasatimes.com/blantyre-markets-flooded-with-smuggled-cooking-oil-from-mozambique/>

¹⁷ <https://spore.cta.int/en/dossiers/article/integrating-poultry-and-poultry-feed-sid0a2517554-a666-460d-af0c-0928e6f2ac24>

Figure 2.4: Malawian trade balances of soy-based products 2018 (ITC Trademap)

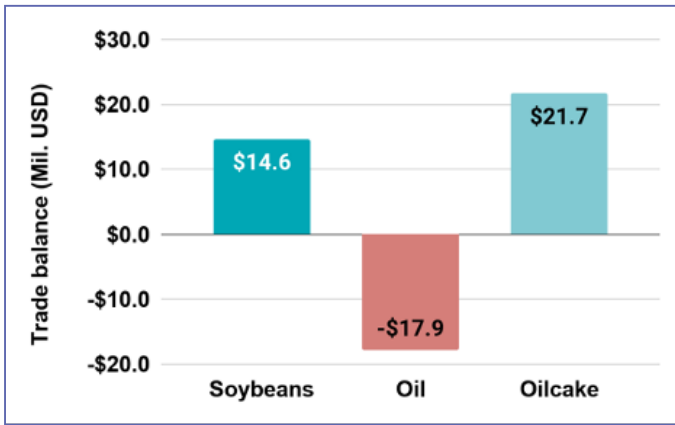
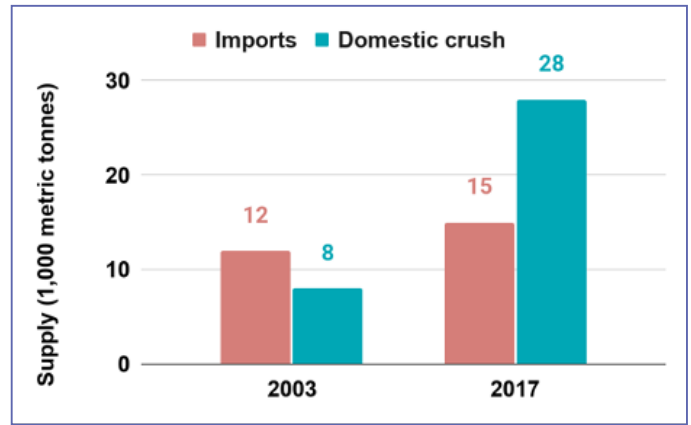


Figure 2.5: Sources of edible soy oil in Malawi (Goldsmith and Dall’Erba 2020)

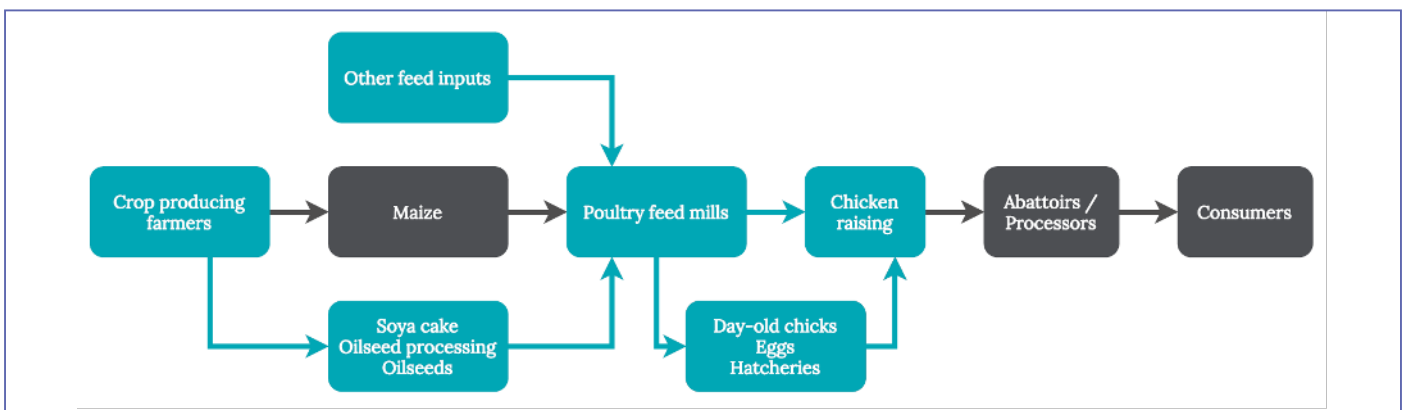


report published by CASA (2020) notes that ‘Despite contributing 42% of the total chicken population in Malawi and supplying nearly all the poultry meat and eggs consumed in rural areas, the potential of the indigenous poultry industry remains largely untapped,’ implying that ‘Scope exists for smallholder farmers (SHFs) to step up through the emerging commercialisation of indigenous and dual-purpose chickens.’ Demand for local chicken is rising and local chicken earns a significant price premium on the market due to its perceived superior taste.

Financially viable soybean processing requires demand from both oil and meal markets, but in Malawi the historically low demand for soybean meal has resulted in weak margins for processors as they must rely disproportionately on income from oil, which constitutes only 18% of soybean volume. An analysis conducted by the Malawi Industry and Trade Centre (MITC) in 2014 found limited opportunities for Malawi to compete in the soybean oilcake markets in Zambia, Zimbabwe and South Africa, but Dzanja et al (2016) report that there is a ‘lucrative’ opportunity to export soybean oilcake to Botswana,¹⁸ ‘which has a large livestock sector but poor conditions for crop production.’ However, soybeans have at times been subject to export restrictions imposed by the government.

The low productivity of small-scale, extensive poultry production and the excess supply of domestically produced soybean oilcake represents an opportunity to improve linkages between soybean farmers, soybean processors, poultry feed producers and small-scale poultry farmers. Figure 2.6 presents a simplified representation of the ‘animal feed to poultry sector’ value chain, with nodes of relevance to this study highlighted in teal. However, there is a gap in the literature related to the ‘uncommon approach’ of linking crop and livestock value chains. One recent study in Ghana explored ‘whether improvements in domestic maize productivity and production levels can drive growth in domestic poultry production and, in turn, whether boosting domestic poultry production can serve as a demand pull for domestically produced maize’ (Andam et al 2017). The study showed that dramatically expanding domestic production of feed would result in a substantial increase in demand for soybeans and exports of eggs.

Figure 2.6: Animal feed to poultry sector value chain (Karnani and McKague 2016)



In its 2017 Agriculture Sector Performance Report, Malawi’s Ministry of Agriculture, Irrigation and Water Development (MAIWD) notes that domestic consumption of livestock products, including chicken and eggs, is low relative to other countries and dietary recommendations. However, the report highlights some positive recent and projected trends in Malawi’s poultry sector:

‘The largest production increase [for all the livestock products between 2015/16 and 2016/17] was recorded for eggs, which saw a 69.2 percent increase. This was closely followed by the increase in chicken meat production, which registered a 69.1 percent increase... The increased production of eggs and chicken meat can be partially attributed to the shorter production cycle and lower investment costs associated with these poultry products. At the same time, there are new investments in the poultry subsector, both formal and informal. For example, CP Feeds and Kamponji Investments are two private companies that have expanded their egg production operations... Likewise, in the informal subsector, communities and cooperatives are increasing their production of local chicken breeds, which are preferred over exotic breeds by local consumers. These investments are

¹⁸ Botswana imported \$11M USD in soybean oilcake from Zambia and South Africa in 2019 (ITC Trademap 2020).

projected to further increase production of eggs and chicken meat products in the next few years.'

The report also notes:

'Real prices of eggs have been declining over time, making eggs more accessible to consumers. In part, this decline in egg prices is a result of increased supply on the domestic market. At the same time, volatility in egg prices has declined making the domestic egg market a relatively stable one.'

A sector report by Commercial Agriculture for Smallholders and Agribusiness (CASA 2020) provides some more context:

'The growing market demand for poultry products in Malawi is being driven by rapid urbanisation and a growing middle class with increasing disposable income. This increase in demand has in turn given rise to commercial poultry production systems (and the supposed need for a dual-purpose bird production system). Poultry farming is still predominantly traditional, and inputs remain a challenge or non-existent for most smallholders... The transition from backyard production to more-commercial production is expected to increase rapidly over the coming years in response to demand and market forces. In addition to market forces, biosecurity and other public health issues are compelling regulators to enforce strict controls and standards for poultry keeping. External factors such as rules and regulations, the availability of (quality) inputs and knowledge and skills strongly influence the production potential of good quality poultry products.'

SME access to finance

There are several major barriers to SMEs accessing bank credit. Information asymmetry often exists because SMEs do not maintain the financial records that commercial lenders typically require to assess potential clients' creditworthiness. SME owners may also demonstrate low financial literacy compared to more sophisticated borrowers. Similarly, SMEs are often unable to provide the level of collateral required by commercial lenders to secure the loan. Because SMEs are relatively small (by definition), the unit cost of administering a loan to SMEs tends to be higher than the unit cost of administering a loan to a larger firm. SMEs may also be perceived as being more vulnerable to shocks in the economy. As a result of these barriers, an SME may represent a much riskier customer to commercial lenders than a larger firm with detailed financial records and sufficient collateral. The elevated level of risk (whether real or perceived) associated with lending to an SME is managed by commercial lenders through the imposition of a risk premium on the interest rate charged to SME borrowers. However, risk premiums effectively increase the risk of lending to SMEs through adverse selection.¹⁹ This dynamic can fuel a reinforcing feedback loop of elevated defaults fueling lenders' perception of elevated risk. These issues are often greater when lending to the Agriculture sector.

The IMF's May 2018 Malawi Country Report notes that Malawi's ratio of private sector credit to GDP is at least 6% below the expected level based on the structure of Malawi's economy (IMF 2018). One of the supply-side drivers of this gap is the concentration of loans provided by commercial banks:

Banks tend to favor large enterprises and government assets to minimize risk. Their business model is not well-suited to SMEs and microagents. Lending to smaller businesses is costly due to the lack of information on creditors and perceived default risk. As a result, the financial system is fragmented with a large part of the population lacking access to formal financial institutions (IMF 2018).

The 2019 Finscope Malawi survey of SMEs found that two thirds of Malawi's SMEs are credit constrained. As such, it is clear that providing these credit-constrained firms with access to finance has the potential to expand the level of investment and employment among SMEs. However, simply increasing the amount of capital available to SMEs in Malawi doesn't guarantee optimal results. There are a number of factors that must be considered when designing an access to finance intervention. Bearing in mind this study's focus on increased youth employment, Table 2.6 summarizes the key considerations for narrowing in on a suitable access to finance intervention model for Malawi.

Interventions that aim to facilitate increased SME access to finance typically target one or more of the aforementioned barriers. For example, financial technology companies have developed mobile applications designed to help SME owners maintain better financial records. Other institutions provide financial literacy training to SME borrowers as a means of improving record-keeping and reducing the risk of default. However, even with such interventions operating, the onus is ultimately on commercial lenders to design and originate loans to SMEs. Until lenders have experience lending to SMEs, lenders lack the detailed information needed to accurately assess and price the risk. The challenge, then, is to create the conditions in which commercial lenders can lend to SMEs at more affordable rates, without compromising the lenders' bottom lines.

Credit guarantee schemes (CGS) are a widely adopted mechanism for reducing the risk commercial lenders face in lending to SMEs. In a CGS, a third party guarantor promises to compensate a lender for some portion of the defaulted value of a loan. In exchange, the lender agrees to lend to the target customer (SMEs) at a lower interest rate than would have been charged without the guarantee. The lower interest rate is feasible given the reduced risk afforded by the guarantee, which effectively serves as collateral for the borrower. The reduced cost of credit is a benefit to SMEs that would otherwise have been rationed out of the credit market.

The choice of guarantor and nature of the relationship between the guarantor and the lender are both critical to the success of a CGS. One approach that we would recommend would be for the Government of Malawi to approach a third party intermediary such as Guarantco or the African Guarantee Fund to manage the scheme as this would help to address a number of the challenges such as elite capture or capacity issues that can sometimes challenge the success of these schemes. The US-funded Development Finance Corporation (DFC) is another option. All of these approaches require the guarantor to work directly with the lending bank to understand

¹⁹ Higher interest rates can dissuade more responsible borrowers from applying for a loan, meaning that the lender's portfolio of 'risky' SMEs may disproportionately include less responsible borrowers.

Table 2.6: SME CGS intervention design considerations

Intervention consideration	Implications for this study	
Credit conditions	<p>Arulraj and Annamalai (2020) find that in India, despite lenders preferring highly efficient firms, external finance was detrimental to firm productivity. The interest of the formal lender is in the quick and safe repayment of the loan whereas the return on productivity improvements can only be realised in the long-term. This mismatch causes finance to hamper funded firm's productivity.</p> <p>Brixiová et al (2020) find that larger loans, smaller collateral sizes, and longer maturity periods are all associated with a stronger and more significant impact on employment. Primary research conducted for USAID found that it was possible for small enterprises to borrow up to MK 500k (\$1,250 USD) from a business friend for one month at no interest (Agar 2014).</p>	The selected intervention model should allow for, and ideally incentivize SMEs' investment in expanded employment. One strategy to achieve this would be to target employment-intensive medium-sized firms. The lender may consider innovative forms of collateral, and may reduce collateral requirements by shifting some of the risk of lending to a third party.
Effective screening	Access to finance is most beneficial to firms that are credit-constrained (Amos and Doungahire 2019), so interventions that seek to expand access to credit should screen potential borrowers to assess whether they are credit-constrained. Lenders should also seek out firms that are already relatively efficient and have growth potential (Arulraj and Annamalai 2020).	It is assumed that the intervention will only provide finance to credit-constrained firms.
Context & sequence	<p>Zhuang et al (2009) note that there are 'disagreements over how financial sector development should be sequenced in developing countries' and note that SME credit programs 'need to be accompanied by other support services such as provision of training and capacity building, assistance in accessing markets and technologies, and addressing other market failures.'</p> <p>Zidana (2015) argues: 'Increased access to financing without addressing the documented challenges of unreliable power supply, complicated business permit procedures, exorbitant tax rates, limited access to land, etc. is likely to negate... the expected benefits... to SMEs.'</p>	The intervention should be designed in such a way as to mitigate barriers to doing business. For example, the intervention could be set up in a way that reallocates some of the risk of lending to SMEs away from the lender, allowing the lender to offer credit at a lower interest rate to SMEs.
Timescale for impact	Puatwoe and Piabuo (2017) find a negative relationship between bank deposits, private investment and economic growth in the short run, but a positive long run relationship.	Long-run impacts are ignored in this study.

the bank's loan origination and risk assessment processes and help train staff in innovative methods of lending and risk mitigation. The increased use of technology to both deliver and monitor loans can also help to address some of the information asymmetries that arise in lending.

The risk sharing arrangement can be structured in a variety of ways, such as a *pari passu* (i.e. 50-50 split) arrangement between the lender and the guarantor. However, the risk need not be equally shared by the lender and the guarantor. It is important that the lender be required to maintain a high enough share of the default risk to avoid the potential for moral hazard to occur. For example, if the guarantor assumes too much of the risk the lender may feel free to invest in high-risk investments and cut costs associated with properly screening potential clients.

There are many other factors to take into consideration when undertaking the detailed design of a CGS. It is beyond the scope of this analysis to undertake such a detailed design exercise. However, there are many publicly available resources that outline the principles and best practices of CGS design. These resources include the World Bank Group's [Principles for Public Credit Guarantee Schemes \(CGSs\) for SMEs](#) and GIZ's guide [SMEs' Credit Guarantee Schemes in Developing and Emerging Economies](#). Additional resources are listed in the References section of this report.

3. Cost-benefit Analysis Methodology

Cost-benefit analysis provides a way to assess which intervention options will result in the greatest impact at the most efficient cost, allowing policy makers and program managers to make informed decisions regarding their program models.

This section summarizes the methodology of the cost-benefit analysis (CBA) for the two selected interventions.

General summary of the models

Investment in agro-processing value chain integration

Based on the opportunities and challenges facing the soybean value chain described above, the first CBA will simulate a value chain integration intervention that aims to increase the 'pull-factor' for soybeans via increased production and use of poultry feed. One way to facilitate this would be to establish linkages between small-scale and commercial poultry producers through farming models such as contract farming arrangements (CFA) or nucleus-outgrower schemes (NOS). A condition of this intervention would be that commercial poultry producers are required to purchase poultry feed from local processors for the input packages provided to outgrowers. With this condition in place, Malawian soybean processors will be able to market greater quantities of soybean meal.

NOS have experienced anecdotal success in Mozambique and Kenya's poultry sectors with positive upstream effects on soybean production via backward linkages (Dos Anjos 2014; Karnani and McKague 2016; Wainaina 2012). However, a study by Shaw et al (2019) warns:

There have been a number of investments that have attempted to utilise small farmers as outgrowers to supplement large-scale production. The idea is to give small farmers a reliable outlet for their produce and to give DOC producers a broader sales base for their chicks. Unfortunately, these types of investments tend to perform poorly because it is inefficient for companies to organise buy-back from small farmers due to logistics, biosecurity issues and side selling risks (of poultry and or the feed inputs provided). Similarly, the productivity at this scale is often lower than larger producer outgrowers (e.g. growing 5,000 or more) which is a standard model in Europe.

A study conducted by the CASA Malawi Country team notes that 'commercial producers see no value in developing contract farming mechanisms for the industry' (CASA 2020). However, the same report notes that Kapani is currently piloting an outgrower scheme. LTS International also reported that commercial poultry producers in Malawi have expressed interest in and, in some cases, piloted such models (LTS International 2017). The 'local chicken' market niche represents a promising opportunity for the establishment of outgrower schemes. The local chicken niche demonstrates high growth potential, meaning that commercial producers might gain a strategic advantage from entering into contract arrangements with smallholders to gain access to a reliable supply of local chicken eggs.

Beesabathuni et al (2018) developed an 'archetype' business model for a poultry egg production outgrower business model based on empirical evidence from real-life businesses, showing that outgrower models can dramatically improve small-scale poultry farmers' incomes. The poultry value chain also offers employment opportunities to workers of various skill levels (Table 3.1).

Table 3.1: Poultry value chain employment opportunities (CASA 2020)

Skill level	Roles
Low	Poultry farm attendants
Medium	Industrial labourers in processing and packaging plants, administrators/managers, drivers, handy-people
High	Extension and veterinary service providers

Systematic reviews have found heterogeneous and upwardly biased impacts of CFAs (Meemken and Bellemare 2019; Ton et al 2017). Poorly-designed CFAs are susceptible to elite capture, exploitation of farmers, contract breaches by both parties, and land tenure insecurity which can deepen rather than mitigate poverty and inequality. Indeed, MAIWD's 2017 Agriculture Sector Performance Report notes:

'Despite the existence of the various farming arrangements in the Malawi's agricultural sector, the history of contract farming in Malawi shows that farmers have, for a long time, not benefited as much from contract farming. Buyers of agricultural commodities have often taken advantage of the lack of a clear regulatory framework on contract farming in Malawi, and exploited farmers and farm labourers (including women, children and other vulnerable groups), while not taking care of the environment in the process.'

Hall et al (2017) argue that any agricultural commercialization approach 'must take into account local specificities of history, geography, agroecology and agrarian relations, and seek routes to more sustainable and inclusive pathways of commercialisation.' With these considerations in mind, there is cautious agreement in the literature that well-designed CFAs and NOS can improve outcomes for various actors along the value chain. Recent case studies indicate positive results of Incentive-Based Contract Farming (IBCF) arrangements in Malawi (MOST 2017; Prosper Markets 2020), and the

Government of Malawi developed a Contract Farming Strategy in 2016 'with the view of realizing the potential benefits associated with a functional contract farming system and to create an enabling environment for all entities participating in contract farming' (MAIWD 2017).

The poultry outgrower scheme would involve:

- The Government of Malawi assisting commercial poultry producers in setting up the outgrower schemes (possibly through tax incentives or interest-free loans);
- Commercial poultry producers helping rural farmers set up their poultry farms including purchasing and setting up equipment, conducting farmer and worker training, and establishing transportation and marketing networks;
- Outgrower farmers producing eggs from local chickens, procuring new day-old chicks (DOCs) and improved inputs (including poultry feed), and employing farm workers;
- Soybean processors increasing their supply of soybean meal to meet the incremental demand for poultry feed from the outgrower farms.

The intervention would bear the following costs, benefits and transfers:

- Cost 1: Incremental egg production costs
- Cost 2: Outgrower farm startup costs
- Cost 3: Incremental operations and maintenance (O&M) costs
- Cost 4: Social cost of carbon
- Benefit 1: Incremental egg sales value
- Benefit 2: Cost savings on baseline egg production
- Benefit 3: Incremental income to labour entering the soybean processing sector
- Transfer 1: Incremental income to labour entering outgrower farms

This intervention would take place over a period of twenty years, with a discount rate of 8% in the base case. The main beneficiaries would be rural poultry farmers and workers. We assume that the poultry egg market is locally competitive so that average production costs are equal to average market prices.

Some of the main assumptions are summarized in the table below.

Table 3.2: Key assumptions in the poultry outgrower scheme intervention model

Assumption	Description
Main currency	United States Dollar (USD)
Other currencies	Malawian Kwacha (MWK)
Timeframe	20 years with one period: Y1-Y20 - intervention implementation
Discount rate	5%, 8%, and 14%
Program cost per egg produced	Beesabathuni et al (2018) estimate the program price for an egg outgrower scheme at \$0.05 per egg produced. The program price will be tested within the range of \$0.03 - \$0.07 per egg produced.
Market price of eggs	\$0.16, \$0.13, and \$0.10

SME access to finance

The second CBA model simulates an intervention that provides SMEs with access to finance via a Credit Guarantee Scheme (CGS). A CGS is a tripartite arrangement in which a third party guarantor commits to paying a financier a guaranteed payment to compensate for losses incurred by the financier under a credit facility. In Malawi, this intervention would involve the following steps:

- The Government of Malawi would work with a bank and a third party guarantor to establish a credit facility to provide accessible financing to SMEs.
- The bank would lend to SMEs and provide basic financial literacy training during the loan onboarding process.
- If or when the bank incurs losses (under the facility) that are equal to the guaranteed amount, the guarantor would pay the guaranteed amount to the bank to compensate for the losses.

The intervention would bear the following costs, benefits and transfers:

- Cost 1: Opportunity cost of capital
- Cost 2: CGS administration costs
- Benefit 1: Incremental return on capital
- Benefit 2: SME surplus from reduced cost of borrowing
- Transfer 1: Increased income to labour

- Transfer 2: Credit-worthy loans
- Transfer 3: Default loans
- Transfer 4: Cost of financing
- Transfer 5: Credit repayment
- Transfer 6: Return on investment
- Transfer 7: Compensation for default loans
- Transfer 8: Guarantee fees

This intervention would take place over a period of six years, with a discount rate of 8%. The main beneficiaries would be SMEs and their workers.

Some of the main assumptions are summarized in the table below.

Table 3.3: Key assumptions in the SMEs CGS intervention model

Assumption	Description
Main currency	United States Dollar (USD)
Other currencies	Malawian Kwacha (MWK)
Timeframe	6 years with two periods: Y1-Y5 - lending period Y1-Y6 - repayment period
Discount rate ²⁰	5%, 8%, and 14%
Lending rate	15%, 19%, 24%
Interest elasticity	-0.14, -0.28, and -0.42
Default rate	5%, 17%, and 25%
Administration costs as percentage of guaranteed amount	1%, 2%, and 3%

Benefits, costs, transfers, and stakeholders

Table 3.4: Benefits, Costs, Transfers, and Stakeholders of the poultry outgrower scheme

Impact	Stakeholder				
	Malawian economy	Global economy	Soybean Processing Workers	Outgrower Farmers	Outgrower Workers
B1 - Incremental egg sales value				✓	
B2 - Cost savings on baseline egg production				✓	
B3 - Incremental income to labour entering the soybean processing sector			✓		
C1 - Incremental egg production costs				✓	
C2 - Outgrower farm startup costs				✓	
C3 - Incremental farmer operations and maintenance (O&M) costs				✓	
C4 - Social cost of carbon	✓	✓			
T1 - Incremental income to labour entering the outgrower farms				✓-	✓+

²⁰ This is set equal to the average annual rate of return on capital.

Table 3.5: Benefits, Costs, Transfers, and Stakeholders of the CGS intervention

Impact	Stakeholder					
	SMEs	Defaulters	Lender	Workers	Guarantor	Capital
B1 - Incremental return on capital	✓					
B2 - SME surplus from reduced cost of borrowing	✓					
C1 - Cost of capital						✓
C2 - CGS administration costs					✓	
T1 - Increased income to labour	✓-			✓+		
T2 - Credit-worthy loans	✓+		✓-			
T3 - Default loans		✓+	✓-			
T4 - Cost of financing			✓-			✓+
T5 - Credit repayment	✓-		✓+			
T6 - Return on investment	✓-		✓+			
T7 - Compensation for default loans			✓+	✓-		
T8 - Guarantee fees			✓-	✓+		

Poultry farm outgrower scheme CBA model specification

B1 - Incremental egg sales value

Narrative

Investment in the poultry outgrower scheme will increase the efficiency with which smallholder farmers are able to produce local chicken eggs. It is assumed that the total national supply of eggs will increase at the recent historical compound annual growth rate (CAGR) of egg production in Malawi. We assume that the growth rate for local eggs is the same as the growth rate for all eggs (local + commercial). Outgrowers are assumed to maintain a fixed percentage of the rural poultry egg market; the rural poultry egg market is in turn assumed to maintain a constant percentage of the total egg market. Together, these figures are used to estimate the total volume of eggs supplied by outgrowers each year. We refer to this as the 'baseline' trend in demand for eggs. We assume that the eggs supplied by outgrowers displace local chicken eggs that would otherwise have been produced less efficiently by smallholder farmers. Therefore, the intervention does not directly increase the baseline level of local egg production, but it improves the efficiency with which a portion of this baseline level is produced.

The increased production efficiency results in a price reduction in the local market where the outgrowers and commercial producers sell local chicken eggs. Thus, the intervention indirectly increases demand for local chicken eggs, which induces the outgrowers to increase their supply above the expected baseline level. We conservatively assume that the price drop applies only to those eggs produced by the outgrowers, rather than to all baseline egg production.

Timeframe(s)

Y1 to Y20

Inputs	Dimensions	Estimate	Unit	Source of verification
$P_{\square}^{producer,w/o}$ Egg producer price without intervention		0.09	USD	CASA
$P_{\square}^{producer,w}$ Egg producer price with intervention		0.05	USD	Beesabathuni 2018
$P_{\square}^{market,w/o}$ Egg market price without intervention		0.13	USD	CASA
<i>CAGR</i> Compound annual growth rate of demand for eggs		4.08	%	FAOStat
Q_0 Baseline egg production		496M	#	FAOStat
Q_0^{rural} Baseline rural egg production		273M	#	GoM, Gondwe
$S^{outgrower}$ Percentage of incremental commercial eggs supplied by outgrowers with intervention		25	%	Chosen
η Price elasticity of demand for eggs		-1.213	%	Ecker & Qaim 2008

Calculation

Benefit:
$$B1_t^{outgrower} = Q_t^{outgrower} \times \Delta P \times \eta \times P_{avg,incremental}$$

$$Q_t^{outgrower} = [Q_0 \times (1 + CAGR)^t] - Q_0 \times \frac{Q_0^{rural}}{Q_0} \times S^{outgrower}$$

Where:
$$\Delta P = \frac{P_{\square}^{producer,w} - P_{\square}^{producer,w/o}}{P_{\square}^{market,w/o}}$$

$$P_{avg,incremental} = \left[\frac{(P_{\square}^{producer,w} - P_{\square}^{producer,w/o})}{2} + P_{\square}^{market,w/o} \right]$$

B2 - Cost savings on baseline egg production

Narrative

Investment in the poultry outgrower scheme will increase the efficiency with which smallholder farmers are able to produce local chicken eggs. It is assumed that the total national supply of eggs will increase at the recent historical compound annual growth rate (CAGR) of egg production in Malawi. We assume that the growth rate for local eggs is the same as the growth rate for all eggs (local + commercial). Outgrowers are assumed to maintain a fixed percentage of the rural poultry egg market; the rural poultry egg market is in turn assumed to maintain a constant percentage of the total egg market. Together, these figures are used to estimate the total volume of eggs supplied by outgrowers each year. We refer to this as the 'baseline' trend in demand for eggs. We assume that the eggs supplied by outgrowers displace local chicken eggs that would otherwise have been produced less efficiently by smallholder farmers. Therefore, the intervention does not directly increase the baseline level of local egg production, but it improves the efficiency with which a portion of this baseline level is produced.

The increased production efficiency results in a price reduction in the local market where the outgrowers and commercial producers sell local chicken eggs. This cost saving only applies to the quantity of eggs that would have been supplied by smallholder farmers without the intervention (i.e. the baseline egg production) rather than the total quantity of eggs supplied by the outgrowers (as in Benefit 1).

Timeframe(s)

Y1 to Y20

Inputs	Dimensions	Estimate	Unit	Source of verification
$P_{\square}^{producer,w/o}$	Egg producer price without intervention	0.09	USD	CASA
$P_{\square}^{producer,w}$	Egg producer price with intervention	0.05	USD	Beesabathuni 2018
$CAGR$	Compound annual growth rate of demand for eggs	0.13	%	FAOStat
Q_0	Baseline egg production	4.08	#	FAOStat
Q_0^{rural}	Baseline rural egg production	496M	#	GoM, Gondwe
$S^{outgrower}$	Percentage of incremental commercial eggs supplied by outgrowers with intervention	273M	%	Assumed

Calculation

$$\text{Benefit: } B2_t^{Outgrower} = Q_t^{outgrower} \times (P_{\square}^{producer,w/o} - P_{\square}^{producer,w})$$

$$\text{Where: } Q_t^{outgrower} = [(Q_0 \times (1 + CAGR)^t) - Q_0] \times \frac{Q_0^{rural}}{Q_0} \times S^{outgrower}$$

B3 - Incremental income to labour entering the soybean processing sector

Narrative

One of the mechanisms through which this increased efficiency is achieved is through the use of improved chicken feed. Soybean meal constitutes a substantial fraction of the value of chicken feed. We assume that the outgrowers are required to source their feed from local producers. Since we assume that the eggs supplied by outgrowers displace local chicken eggs that would otherwise have been produced less efficiently by smallholder farmers, the incremental demand for chicken feed is driven by the total quantity of eggs supplied by outgrowers (baseline + incremental supply). The increase in value added by soybean processors in response to the increased demand for chicken feed necessitates an increase in the amount of labour inputs into their production processes, resulting in increased income to labour. The opportunity cost of labour is assumed to be equal to the average remuneration per employee in mixed farming activities.

Timeframe(s)

Y1 - Y20

Inputs	Dimensions	Estimate	Unit	Source of verification
λ^{oil}	Ratio of labour income to value added in fats and oils processing sector	0.24	#	IFPRI, FRED
W_t^{oil}	Remuneration per employee in fats and oils manufacturing	1,645	USD	NSO Malawi
W_t^{farm}	Remuneration per employee in mixed farming	183	USD	NSO Malawi
P_{\square}^{oil}	Soybean oil market price	999	USD	ITC Trademap
$P_{\square}^{oilcake}$	Soybean oilcake market price	407	USD	ITC Trademap
r	Ratio of oil : oilcake produced in soybean processing	0.23	#	Goldsmith 2020
$CAGR$	Compound annual growth rate of demand for eggs	4.08	%	FAOStat
Q_0	Baseline egg production	496M	#	FAOStat

Q_0^{rural}	Baseline rural egg production		273M	#	GoM, Gondwe
$S^{outgrower}$	Percentage of incremental commercial eggs supplied by outgrowers with intervention		25	%	Chosen
n	Number of eggs laid per chicken per year		180	#	FAO
f	Amount of poultry feed needed per chicken per year		0.083	MT	ICRISAT
S^{meal}	Soybean oilcake percent contribution to poultry feed		15.9	%	ICRISAT

Calculation

Benefit:
$$B3_t^{processor.labour} = \Delta vadd_t^{soybean} \times l^{oil} \times \frac{1}{W_t^{oil}} \times (W_t^{oil} - W_t^{farm})$$

Where:
$$\Delta vadd_t^{soybean} = p_{\square}^{oil} \times \Delta Q_t^{oil} + p_{\square}^{oilcake} \times \Delta Q_t^{oilcake}$$

$$\Delta Q_t^{oil} = r \times \Delta Q_t^{oilcake}; \Delta Q_t^{oilcake} = \frac{Q_t^{outgrower}}{n} \times f \times S^{meal}$$

$$Q_t^{outgrower} = [Q_0 \times (1 + CAGR)^t] - Q_0 \times \frac{Q_0^{rural}}{Q_0} \times S^{outgrower}$$

C1 - Incremental egg production costs

Narrative

Investment in the poultry outgrower scheme will increase the efficiency with which smallholder farmers are able to produce local chicken eggs. It is assumed that the total national supply of eggs will increase at the recent historical compound annual growth rate (CAGR) of egg production in Malawi. We assume that the growth rate for local eggs is the same as the growth rate for all eggs (local + commercial). Outgrowers are assumed to maintain a fixed percentage of the rural poultry egg market; the rural poultry egg market is in turn assumed to maintain a constant percentage of the total egg market. Together, these figures are used to estimate the total volume of eggs supplied by outgrowers each year. We refer to this as the ‘baseline’ trend in demand for eggs. We assume that the eggs supplied by outgrowers displace local chicken eggs that would otherwise have been produced less efficiently by smallholder farmers. Therefore, the intervention does not directly increase the baseline level of local egg production, but it improves the efficiency with which a portion of this baseline level is produced.

The increased production efficiency results in a price reduction in the local market where the outgrowers and commercial producers sell local chicken eggs. Thus, the intervention indirectly increases demand for local chicken eggs, which induces the outgrowers to increase their supply above the expected baseline level. The costs incurred by the outgrowers to produce this incremental supply of eggs are incremental costs to Malawi’s economy.

Timeframe(s)

Y1 - Y20

Inputs		Dimensions	Estimate	Unit	Source of verification
$p_{\square}^{producer,w/o}$	Egg producer price without intervention		0.09	USD	CASA
$p_{\square}^{producer,w}$	Egg producer price with intervention		0.05	USD	Beesabathuni 2018
$p_{\square}^{market,w/o}$	Egg market price without intervention		0.13	USD	CASA
$CAGR$	Compound annual growth rate of demand for eggs		4.08	%	FAOStat
Q_0	Baseline egg production		496M	#	FAOStat
Q_0^{rural}	Baseline rural egg production		273M	#	GoM, Gondwe

$S^{outgrower}$	Percentage of incremental commercial eggs supplied by outgrowers with intervention		25	%	Assumed
η	Price elasticity of demand for eggs		-1.213	%	Ecker & Qaim 2008
Calculation					
Benefit:		$C1_t^{outgrower} = Q_t^{outgrower} \times \Delta P \times \eta \times P^{market,w}$			
		$Q_t^{outgrower} = [(Q_0 \times (1 + CAGR)^t) - Q] \times \frac{Q_0^{rural}}{Q_0} \times S^{outgrower}$			
Where		$\Delta P = \frac{P_{\square}^{producer,w} - P_{\square}^{producer,w/o}}{P_{\square}^{market,w/o}}$			
		$P^{market,w} = [(P_{\square}^{market,w/o} - P_{\square}^{producer,w/o}) + P_{\square}^{producer,w}]$			

C2 - Farm capital investments

Narrative					
Money required to start a poultry farm: includes infrastructure (building and cages) and starter pack, as well as any costs associated with training farmers and farm workers.					
Timeframe(s)					
Y1 - Y20					
Inputs		Dimensions	Estimate	Unit	Source of verification
$C_t^{startup}$	Start-up capital required per outgrower farm	Time	30,000	USD	Beesabathuni et al 2018
O_t	Number of outgrower farms participating in the intervention	Time	See model	#	Chosen
Calculation					
Cost:		$C2_t^{outgrower} = C_t^{startup} \times O_t$			

C3 - Recurring capital costs

Narrative					
Recurring capital required during each laying cycle to re-populate hen population.					
Timeframe(s)					
Y1 - Y20					
Inputs		Dimensions	Estimate	Unit	Source of verification
$C_t^{recurring}$	Recurring capital required per outgrower farm	Time	9,000	USD	Beesabathuni et al 2018
O_t	Number of outgrower farms participating in the intervention	Time	See model	#	Chosen
Calculation					
Cost:		$C3_t^{outgrower} = C_t^{recurring} \times O_t$			

C4 - Social cost of carbon

Narrative

Investment in the poultry outgrower scheme will increase the efficiency with which smallholder farmers are able to produce local chicken eggs. It is assumed that the total national supply of eggs will increase at the recent historical compound annual growth rate (CAGR) of egg production in Malawi. We assume that the growth rate for local eggs is the same as the growth rate for all eggs (local + commercial). Outgrowers are assumed to maintain a fixed percentage of the rural poultry egg market; the rural poultry egg market is in turn assumed to maintain a constant percentage of the total egg market. Together, these figures are used to estimate the total volume of eggs supplied by outgrowers each year. We refer to this as the 'baseline' trend in demand for eggs. We assume that the eggs supplied by outgrowers displace local chicken eggs that would otherwise have been produced less efficiently by smallholder farmers. Therefore, the intervention does not directly increase the baseline level of local egg production, but it improves the efficiency with which a portion of this baseline level is produced.

The increased production efficiency results in a price reduction in the local market where the outgrowers and commercial producers sell local chicken eggs. Thus, the intervention indirectly increases demand for local chicken eggs, which induces the outgrowers to increase their supply above the expected baseline level. This increased egg supply generates increased greenhouse gas emissions, which can be accounted for using the social cost of carbon.

Timeframe(s)

Y1 - Y20

Inputs	Dimensions	Estimate	Unit	Source of verification	
$P_{\square}^{producer,w/o}$	Egg producer price without intervention	Time	0.09	USD	CASA
$P_{\square}^{producer,w}$	Egg producer price with intervention	Time	0.05	USD	Beesabathuni 2018
$P_{\square}^{market,w/o}$	Egg market price without intervention		0.13	USD	CASA
$CAGR$	Compound annual growth rate of demand for eggs		4.08	%	FAOStat
Q_0	Baseline egg production		496M	#	FAOStat
Q_0^{rural}	Baseline rural egg production		273M	#	GoM, Gondwe
$S^{outgrower}$	Percentage of incremental commercial eggs supplied by outgrowers with intervention		25	%	Assumed
η	Price elasticity of demand for eggs		-1.213	%	Ecker & Qaim 2008
m	Mass of an egg		0.043	kg	FAO
e	Carbon dioxide emissions per kg of egg produced		3.7	kg	FAO
SCC	Global social cost of carbon per kg of CO ₂ eq emissions		See model	USD	Tol 2018

Calculation

$$\text{Cost: } C1_t^{outgrower} = Q_t^{outgrower} \times m \times e \times SCC$$

$$Q_t^{outgrower} = [[Q_0 \times (1 + CAGR)^t] - Q] \times \frac{Q_0^{rural}}{Q_0} \times S^{outgrower}$$

Where:

$$\Delta P = \frac{P_{\square}^{producer,w} - P_{\square}^{producer,w/o}}{P_{\square}^{market,w/o}}$$

T1 - Incremental income to labour entering the outgrower farms

Narrative

A portion of the value added by outgrowers through incremental egg production is allocated to labour inputs into their production processes, resulting in increased income to labour. The opportunity cost of labour is assumed to be equal to the average remuneration per employee in mixed farming activities.

Timeframe(s)

Y1 - Y20

Inputs		Dimensions	Estimate	Unit	Source of verification
l^{meat}	Ratio of labour income to value added in meat processing sector		0.21	#	IFPRI, FRED
$W_t^{poultry}$	Remuneration per employee in poultry raising	Time	548	USD	NSO Malawi
W_t^{farm}	Remuneration per employee in mixed farming	Time	183	USD	NSO Malawi
$P_{\square}^{producer,w}$	Egg producer price with intervention		0.05	USD	CASA
$CAGR$	Compound annual growth rate of demand for eggs		4.08	%	FAOStat
Q_0	Baseline egg production		496M	#	FAOStat
Q_0^{rural}	Baseline rural egg production		273M	#	GoM, Gondwe
$S^{outgrower}$	Percentage of incremental commercial eggs supplied by outgrowers with intervention		25	%	Assumed

Calculation

Transfer:
$$T1_t^{outgrower.labour} = \Delta vadd_t^{outgrower} \times l^{meat} \times \frac{1}{W_t^{poultry}} \times (W_t^{poultry} - W_t^{farm})$$

Where
$$\Delta vadd_t^{outgrowers} = Q_t^{outgrower} \times P_{\square}^{producer}$$

$$Q_t^{outgrower} = [(Q_0 \times (1 + CAGR)^t) - Q_0] \times \frac{Q_0^{rural}}{Q_0} \times S^{outgrower}$$

CGS scheme CBA model specification

B1 - Incremental return on capital

Narrative					
Increasing access to credit will allow financially-constrained SMEs to invest in expanding their production base. The firms' incremental return on capital represents the net benefits to Malawi of SMEs' investments. The rate of default on the loans as well as the rate of depreciation of capital assets are not explicitly included in the formula, as these are already accounted for in the rate of return on capital.					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
$ROCE$	Return on capital employed		15.22	%	IFPRI, FRED
Calculation					
Transfer:		$B1_t^{SMEs} = \Delta S_t^{capital} \times ROCE$			
<p>Since the cumulative probability of repayment at maturity is expressed as:</p> $p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders \& Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$</p> $\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$ <p>Where</p> <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$</p> <p>$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.</p> $\Delta S_t^{capital} = \Delta Q_t + \Delta Q_{t-1}$					

B2 - SME surplus from reduced cost of borrowing

Narrative					
<p>The credit guarantee scheme will allow lenders to reduce the risk premiums charged on loans to SMEs, reducing the cost of finance for SMEs. This reduction in the cost of borrowing is a benefit to SMEs who would otherwise have been rationed out of the credit market. In Year 1 and Year 6, only the first and fifth loan cohort pay interest respectively. In all other years, two loan cohorts each pay interest on the outstanding loans.</p>					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
$ROCE$	Return on capital employed		15.22	%	IFPRI, FRED
Calculation					
$B2_t^{SMEs} = \frac{\Delta Q_t \times (1 - d^{expected}) \times (R^{commercial,w/o} - R^{commercial,w})}{2} \times (1 + ROCE) \text{ if } t = 1$					
Transfer:	$B2_t^{SMEs} = \frac{\Delta Q_t \times (1 - d^{expected}) \times (R^{commercial,w/o} - R^{commercial,w})}{2} \times (1 + ROCE) \times 2 \text{ if } 1 < t < 6$				
	$B2_t^{SMEs} = \frac{\Delta Q_{t-1} \times (1 - d^{expected}) \times (R^{commercial,w/o} - R^{commercial,w})}{2} \times (1 + ROCE) \text{ if } t = 6$				
<p>Since the cumulative probability of repayment at maturity is expressed as:</p> $p^{repayment} = 1 - d^{expected} = \frac{(1 + R^{risk\ free})^T}{(1 + R^{commercial,w})^T} \text{ (Saunders & Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1 + R^{risk\ free})^T}{(1 - d^{expected})^T} \right]^{\frac{1}{T}} - 1$</p> <p>Where $\Delta R = R^{commercial,w} - R^{commercial,w/o}$; $R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$</p> <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$</p> <p>$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.</p>					

C1 - Cost of capital

Narrative

This is the opportunity cost of funds that are channeled into the SMEs. The opportunity cost is calculated based on the average rate of return on capital in the economy.

Timeframe(s)

Repayment period (Y1 - Y6)

Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
$ROCE$	Opportunity cost of capital		15.22	%	IFPRI, FRED

Calculation

Transfer:
$$C1_t^{capital} = \Delta S_t^{capital} \times C^{capital}$$

Since the cumulative probability of repayment at loan maturity is expressed as:

$$p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w/o})^T} \text{ (Saunders & Cornett 2013)}$$

$$\text{Therefore: } R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$$

$$\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$$

Where

$$\text{Since the interest elasticity of demand for credit is expressed as: } \eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$$

$$\text{Therefore: } \Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}} \text{ if } t < 6$$

$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.

$$\Delta S_t^{capital} = \Delta Q_t + \Delta Q_{t-1}$$

C2 - CGS administration costs

Narrative					
The cost of operating the CGS. These costs are covered through 'guarantee fees' which typically range from 0.5 - 3.65% of the guaranteed amount (ADB 2021). We assume that guarantee fees are exactly equal to the administration costs.					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
C^{admin}	Administration costs as percentage of guaranteed amount		2%	%	ADB 2021
Calculation					
Transfer:			$C2_t^{Guarantor} = \Delta Q_t \times C^{admin}; if t = 1$		
			$C2_t^{Guarantor} = 2 \times \Delta Q_t \times C^{admin}; if 1 < t < 6$		
			$C2_t^{Guarantor} = \Delta Q_{t-1} \times C^{admin}; if t = 6$		
			Since the cumulative probability of repayment at loan maturity is expressed as:		
			$p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T}$ (Saunders & Cornett 2013)		
			Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$		
Where:			$\Delta R = R^{commercial,w} - R^{commercial,w/o}$; $R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$		
			Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$		
			Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$		
			$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.		

T1 - Increased income to labour

Narrative

Increasing access to credit will allow financially-constrained SMEs to invest in expanding their production base, including hiring additional labour, resulting in increased income to labour. The opportunity cost of labour is assumed to be equal to the average remuneration per employee in mixed farming activities. Assuming a fixed ratio between the sector's capital stock and labour income, the cumulative total credit allocated (i.e. incremental capital stock) can be used to calculate the incremental income paid to labour each year. The rate of default on the loans as well as the rate of depreciation of capital assets are not explicitly included in the formula, as these are already accounted for in the rate of return on capital.

Timeframe(s)

Repayment period (Y1 - Y6)

Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
$l^{[i]}$	Ratio of labour income to capital stock	Subsector	See model	#	IFPRI, FRED
W_t^w	Remuneration per employee with intervention	Time, Subsector	See model	USD	NSO Malawi
$W_t^{w/o}$	Remuneration per employee without intervention	Time	183	USD	NSO Malawi

Calculation

Transfer:
$$T1_t^{labour} = \Delta S_t^{capital} \times l^{[i]} \times \frac{1}{W_t^w} \times (W_t^w - W_t^{w/o})$$

Since the cumulative probability of repayment at loan maturity is expressed as:

$$p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders \& Cornett 2013)}$$

$$\text{Therefore: } R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$$

$$\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$$

Where:

$$\text{Since the interest elasticity of demand for credit is expressed as: } \eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$$

$$\text{Therefore: } \Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}} \text{ if } t < 6$$

$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.

$$\Delta S_t^{capital} = \Delta Q_t + \Delta Q_{t-1}$$

T2 - Credit-worthy loans

Narrative					
Credit lent to credit-worthy SMEs.					
Timeframe(s)					
Lending period (Y1 - Y5)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
Calculation					
Transfer:	$T2_t^{Lender.SME} = \Delta Q_t \times (1 - d^{expected})$				
	<p>Since the cumulative probability of repayment at loan maturity is expressed as:</p> $p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders \& Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{1 - d^{expected}} \right]^{\frac{1}{T}} - 1$</p> <p>Where</p> $\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$ <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$</p>				

T3 - Default loans

Narrative					
Credit lent to SMEs that default on the loans.					
Timeframe(s)					
Lending period (Y1 - Y5)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
Calculation					
Transfer:	$T3_t^{Lender.SME} = \Delta Q_t \times d^{expected}$				
	<p>Since the cumulative probability of repayment at loan maturity is expressed</p> $p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders \& Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{1-d^{expected}} \right]^{\frac{1}{T}} - 1$</p> <p>Where</p> $\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$ <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$</p>				

T4 - Cost of financing

Narrative

The cost of financing the loans incurred by the lender.

Timeframe(s)

Lending period (Y1 - Y5)

Inputs		Dimensions	Estimate	Unit	Source of verification
$C^{financing}$	Financing costs		12	%	Reserve Bank of Malawi
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen

Calculation

Transfer:
$$T4_t^{Lender} = \Delta Q_t \times C^{financing}$$

Since the cumulative probability of repayment at loan maturity is expressed as:

$$p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders \& Cornett 2013)}$$

$$\text{Therefore: } R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$$

Where

$$\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$$

$$\text{Since the interest elasticity of demand for credit is expressed as: } \eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$$

$$\text{Therefore: } \Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$$

T5 - Credit repayment

Narrative					
Principal repaid by SMEs to the lender. We assume half of the principal of the first loan cohort is paid in Year 1, and half of the principal of the fifth loan cohort is paid in Year 6. In all other years, two loan cohorts each pay half of the total principal on the outstanding loans.					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
Calculation					
Transfer:	$T5_t^{SME.Lender} = \frac{\Delta Q_t}{2} \times (1 - d^{expected}) \text{ if } t = 1$ $T5_t^{SME.Lender} = \Delta Q_t \times (1 - d^{expected}) \text{ if } 1 < t < 6$ $T5_t^{SME.Lender} = \frac{\Delta Q_{t-1}}{2} \times (1 - d^{expected}) \text{ if } t = 6$				
Where	<p>Since the cumulative probability of repayment at loan maturity is expressed as:</p> $p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w/o})^T} \text{ (Saunders & Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})} \right]^{\frac{1}{T}} - 1$</p> $\Delta R = R^{commercial,w} - R^{commercial,w/o} ; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$ <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$</p> <p>$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.</p>				

T6 - Return on investment

Narrative					
Each year, the lender collects interest on the outstanding debt issued to SMEs through the intervention. In Year 1 and Year 6, only the first and fifth loan cohort pay interest respectively. In all other years, two loan cohorts each pay interest on the outstanding loans.					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
Calculation					
			$T6_t^{SME.Lender} = \Delta Q_t \times (1 - d^{expected}) \times R^{commercial,w}$ if $t = 1$		
Transfer:			$T6_t^{SME.Lender} = 2 \times \Delta Q_t \times (1 - d^{expected}) \times R^{commercial,w}$ if $1 < t < 6$		
			$T6_t^{SME.Lender} = \Delta Q_{t-1} \times (1 - d^{expected}) \times R^{commercial,w}$ if $t = 6$		
		Since the cumulative probability of repayment at loan maturity is expressed as:			
		$p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T}$ (Saunders & Cornett 2013)			
		Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$			
Where		$\Delta R = R^{commercial,w} - R^{commercial,w/o}$; $R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$			
		Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$			
		Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$			
		$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.			

T7 - Compensation for default loans

Narrative					
Each year, a certain number of SMEs will default on the credit issued to them under the intervention. The guarantor will compensate the lender for a predetermined share of the losses. We assume half of the defaults in each loan cohort occur in the first year of the loan, and the other half of the defaults occur in the second year of the loan. Therefore, in Year 1 and Year 6 the value of defaults is half the value of defaults in the other years.					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
G	Share of losses covered by guarantee		60	%	Chosen
Calculation					
Transfer:	$T7_{t}^{Guarantor.Lender} = \Delta Q_t \times d^{expected} \times G/2 \text{ if } t = 1$ $T7_{t}^{Guarantor.Lender} = \Delta Q_t \times d^{expected} \times G \text{ if } 1 < t < 6$ $T7_{t}^{Guarantor.Lender} = \Delta Q_{t-1} \times d^{expected} \times G/2 \text{ if } t = 6$				
Where	<p>Since the cumulative probability of repayment at loan maturity is expressed as:</p> $p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders & Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$</p> $\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$ <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$</p> <p>$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.</p>				

T8 - Guarantee fees

Narrative					
The costs of operating the CGS are covered through 'guarantee fees' which typically range from 0.5 - 3.65% of the guaranteed amount (ADB 2021).					
Timeframe(s)					
Repayment period (Y1 - Y6)					
Inputs		Dimensions	Estimate	Unit	Source of verification
Q_t	Total domestic credit to private sector by banks in Malawi	Time	1.2B	USD	World Bank
η	Loan price elasticity		-0.28	#	Karlan 2005
$R^{risk\ free}$	Risk-free lending rate		8.74	%	World Bank
$R^{commercial,w/o}$	Commercial lending rate without the intervention		25.14	%	World Bank
$d^{expected}$	Expected cumulative default probability at loan maturity with intervention		17.1	%	Calice 2016
T	Loan maturity		2	years	Chosen
$C^{guarantee}$	Guarantee fee as percentage of guaranteed amount		2%	%	ADB 2021
Calculation					
Transfer:	$T8_t^{Lendr.Guarantor} = \Delta Q_t \times C^{guarantee} \text{ if } t = 1$ $T8_t^{Lendr.Guarantor} = 2 \times \Delta Q_t \times C^{guarantee} \text{ if } 1 < t < 6$ $T8_t^{Lendr.Guarantor} = \Delta Q_{t-1} \times C^{guarantee} \text{ if } t = 6$				
Where	<p>Since the cumulative probability of repayment at loan maturity is expressed as:</p> $p^{repayment} = 1 - d^{expected} = \frac{(1+R^{risk\ free})^T}{(1+R^{commercial,w})^T} \text{ (Saunders & Cornett 2013)}$ <p>Therefore: $R^{commercial,w} = \left[\frac{(1+R^{risk\ free})^T}{(1-d^{expected})^T} \right]^{\frac{1}{T}} - 1$</p> $\Delta R = R^{commercial,w} - R^{commercial,w/o}; R_{avg} = \frac{R^{commercial,w} + R^{commercial,w/o}}{2}$ <p>Since the interest elasticity of demand for credit is expressed as: $\eta = \frac{\frac{\Delta Q_t}{Q_t}}{\frac{\Delta R}{R_{avg}}}$</p> <p>Therefore: $\Delta Q_t = Q_t \times \eta \times \frac{\Delta R}{R_{avg}}$ if $t < 6$</p> <p>$\Delta Q_t = 0$ if $t = 6$ since credit is only disbursed through the CGS up until and including Year 5.</p>				

4. Conclusion and discussion

The results of the CBA models for the two selected interventions indicate that investing in agro-processing value chain integration and expanding SMEs' access to finance via a CGS can provide modest benefits to the Malawian economy.

Malawi faces a wide range of barriers to achieving structural transformation of its economy and increasing the level of employment among the country's large youth population. These barriers include infrastructure gaps, low access to finance, weak governance and regulations, inefficient markets, and low agricultural productivity among others. This analysis has focused on strengthening market linkages in agro-processing value chains and facilitating SMEs' access to formal finance.

Malawi's agro-processing value chains are characterized by weak linkages and inefficient marketing channels, largely driven by infrastructure gaps and information asymmetries between stakeholders. There is often a mismatch between supply and demand for agricultural products, and it can be challenging for agro-processors to achieve profitable margins. The animal feed to poultry sector value chain is one such example of a value chain that could benefit from greater integration.

The first intervention modelled in this study is a poultry farm outgrower scheme that aims to strengthen connections between small scale poultry farmers, commercial poultry firms, and soybean processors (via animal feed millers). The primary benefits of this intervention are the increased value added by poultry outgrowers and commercial poultry firms, as well as the increased income to labour entering the soybean processing sector. Costs include start-up capital costs, recurring capital costs and program costs.

Figure 4.1 below displays the cost and benefits flows associated with the intervention over time. Figure 4.2 shows the net present value (NPV) of the intervention from the perspective of each stakeholder. As these figures show, the intervention provides modest net benefits to Malawi's economy, with a **benefit cost ratio (BCR) of 1.37**. The intervention yields a positive NPV for each stakeholder. **The intervention would directly create 1,398 new jobs** by the end of the period of analysis, as shown in Figure 4.3. These numbers do not represent net job creation across the economy, but rather the estimated number of jobs that would be demanded as a result of each intervention. This is because we do not consider the number of jobs that would be created in the counterfactual scenario (i.e. if the intervention funds had been put to other productive use in Malawi's economy).

Figure 4.1: Summary of results for poultry outgrower scheme CBA

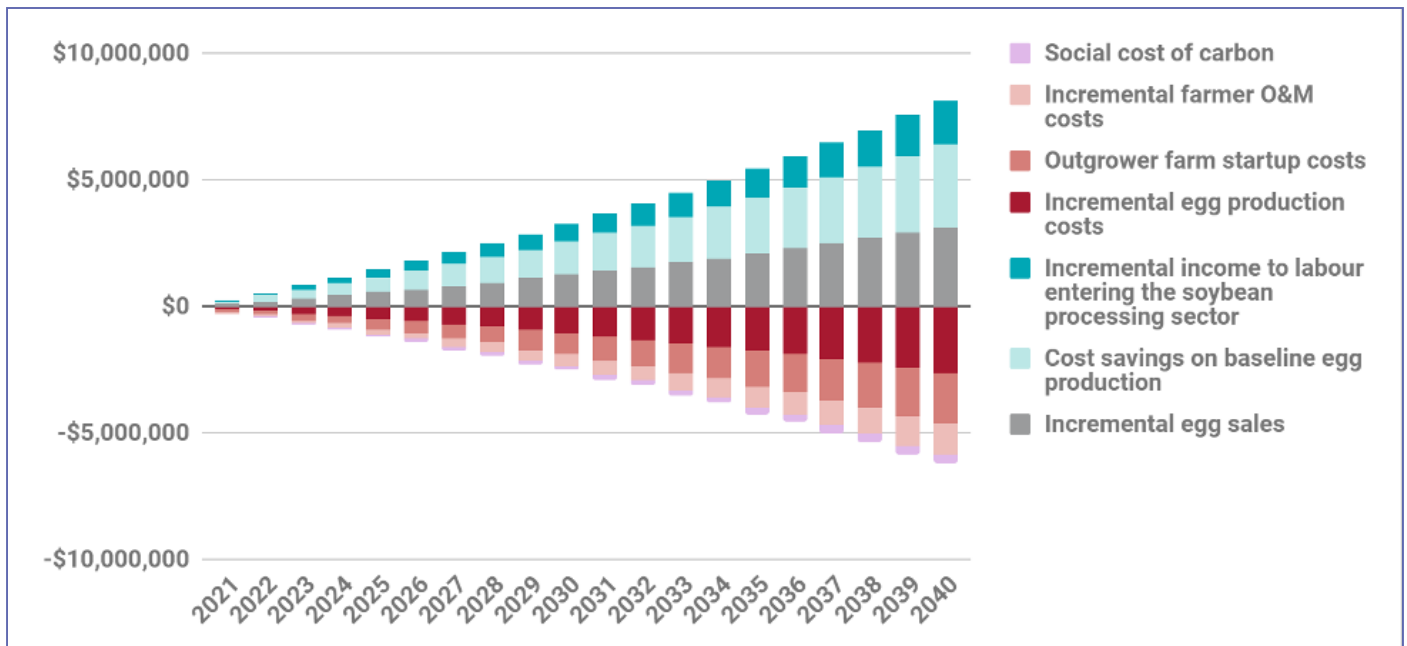


Figure 4.2: Net present value (NPV) of the poultry outgrower scheme for each stakeholder

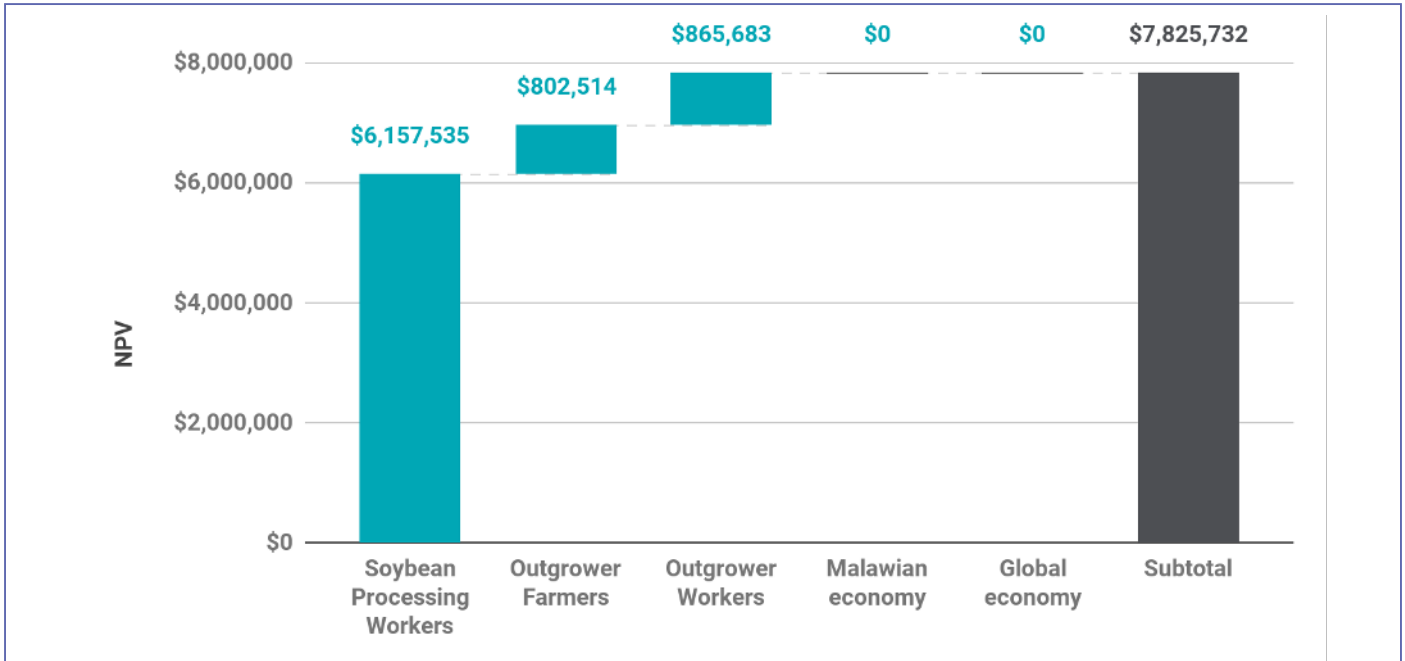
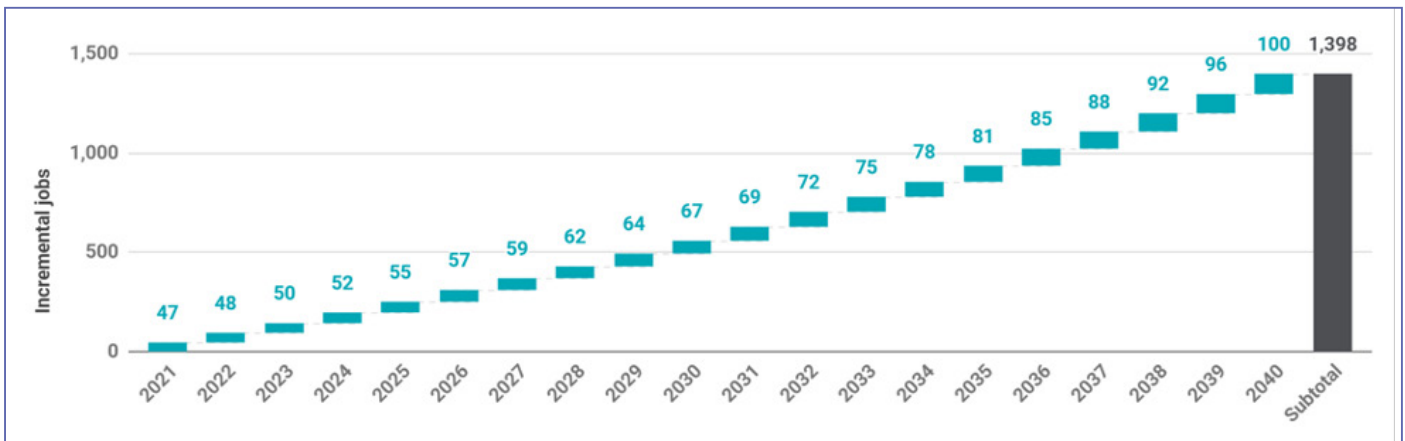


Figure 4.3: Jobs created by the poultry outgrower scheme over time



Many SMEs in Malawi face barriers to accessing formal finance. These credit-constrained SMEs may be unable to invest in production-enhancing inputs, including hired labour. Even if an SME can access credit, the owner may lack the financial literacy required to manage the loan. On the other side of the transaction, financiers are often unable or unwilling to lend to SMEs due to the relatively high risk of default compared to larger firms.

To help address these issues, the second intervention modelled using CBA is a credit guarantee scheme to provide SMEs with greater access to formal finance. The primary benefit of this intervention is the increased return on capital (ROC) earned by SMEs who gain access to credit through the intervention. The cost of the intervention is the program administration costs incurred by the lender.

Figure 4.4 below displays the cost and benefits flows associated with the intervention over time. Figure 4.5 shows the net present value (NPV) of the intervention from the perspective of each stakeholder. As these figures show, the intervention provides marginal net benefits to Malawi’s economy in the short-term, with a **benefit cost ratio (BCR) of 1.05**. The intervention yields a positive NPV for each stakeholder. Importantly, **the intervention would create 2,944 jobs** by the end of the period of analysis, as shown in Figure 4.6. Again, these numbers do not represent net job creation across the economy, but rather the estimated number of jobs that would be demanded as a result of each intervention. This is because we do not consider the number of jobs that would be created in the counterfactual scenario (i.e. if the intervention funds had been put to other productive use in Malawi’s economy).

Figure 4.4: Jobs created by the poultry outgrower scheme over time

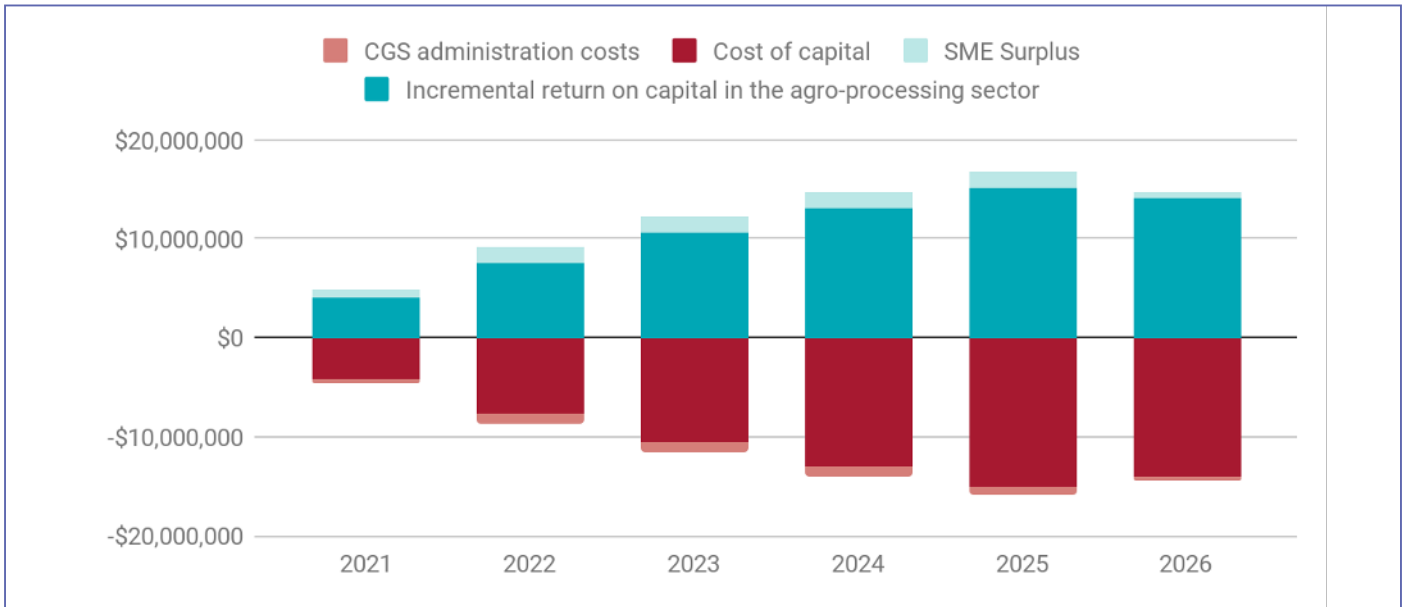


Figure 4.5: Jobs created by the poultry outgrower scheme over time

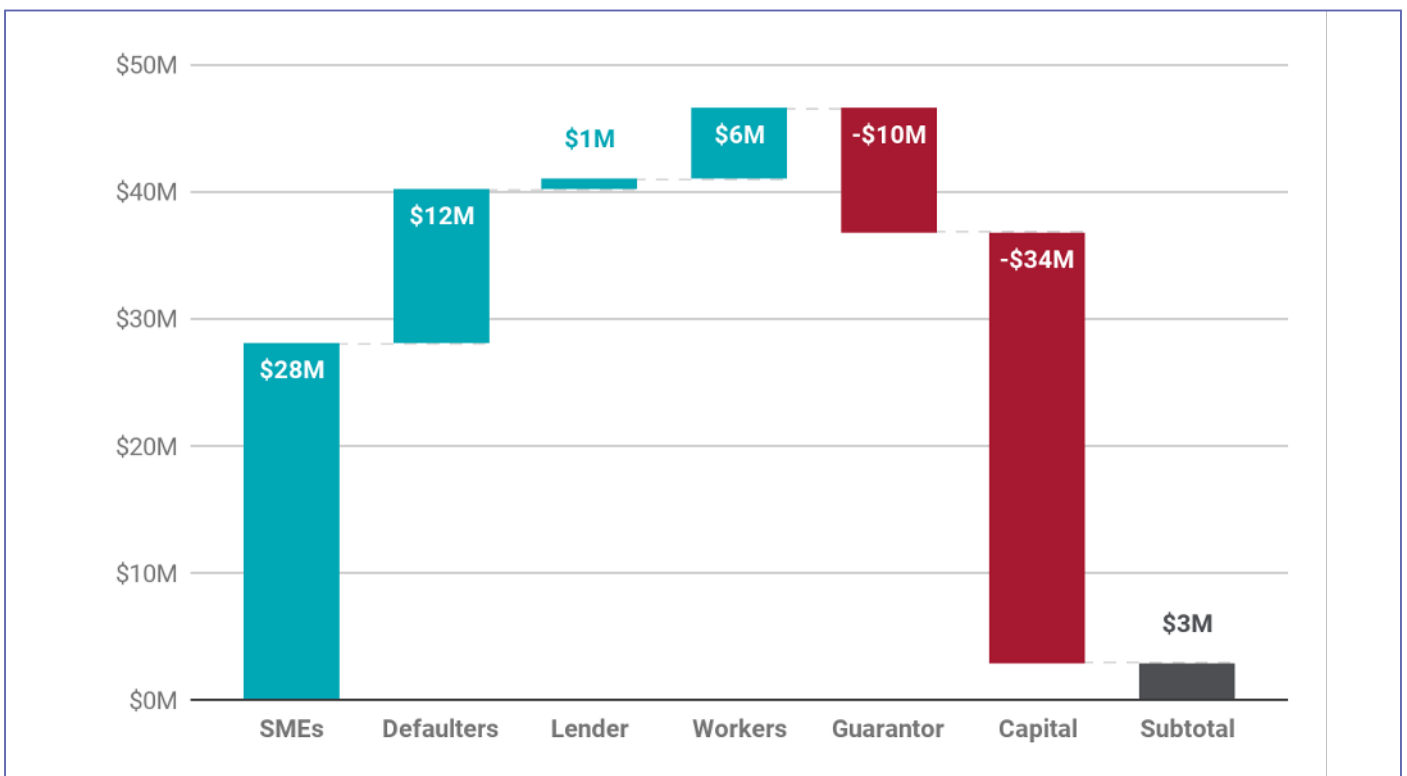
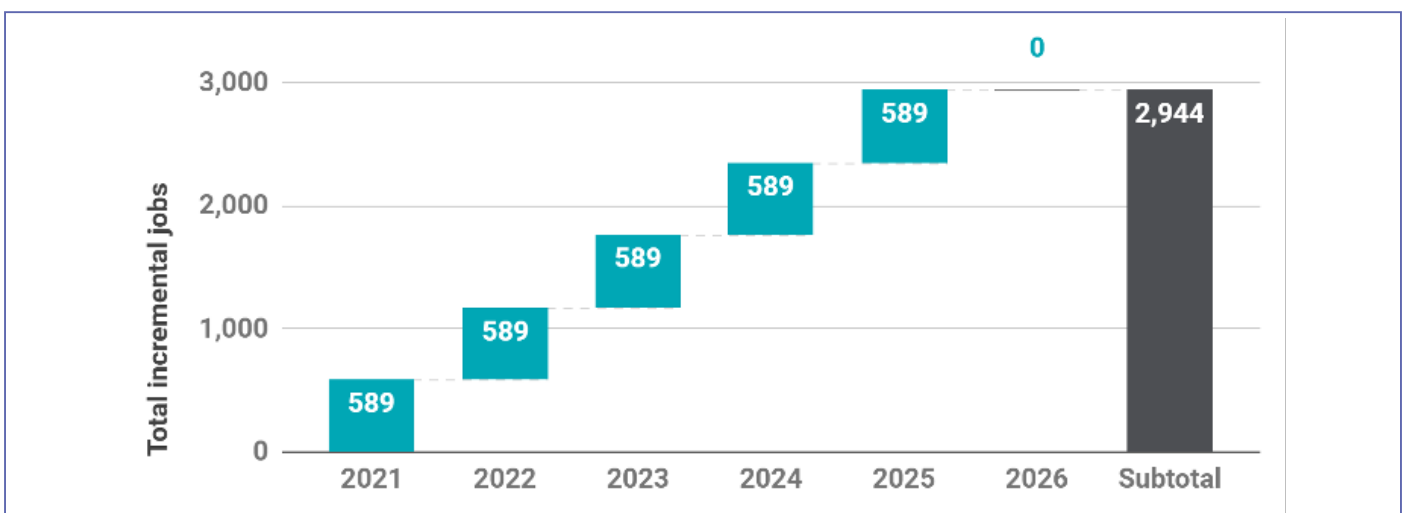


Figure 4.5: Jobs created by the poultry outgrower scheme over time



The baseline results assume that the credit is allocated proportionally to the sizes of each of Malawi's industries. However, some industries might generate more labour income per incremental unit of capital than other sub sectors. The CGS may be designed to target SMEs in sectors with relatively high job creation potential. However, it is likely not feasible to target a single industry with the full amount of the credit guarantee, as it is unlikely that a single industry could absorb such a large influx of capital in a short period of time.

Sensitivity analysis

In order to identify which assumptions are the most critical to the success of each intervention, the team has conducted some basic sensitivity analyses. The following tables report the BCR when alternative input values are assumed for key parameters.

The first parameter we explore is the discount rate. As a default, both models use an 8% discount rate. We find that the BCR is not sensitive to changes in the discount rate.

Table 4.1: Sensitivity analysis for discount rate

Discount Rate			
Parameter value	5%	8%	14%
Poultry outgrower scheme	1.36	1.37	1.36
SME CGS	1.05	1.05	1.05

Beesabathuni et al (2018) estimate the program cost of a commercial poultry egg outgrower scheme at \$0.03 per egg produced per year, assuming each hen lays 290 eggs per year. The FAO (2003) notes that egg production is more likely to be in the range of 180 eggs per year in dry hot climates such as Malawi, which implies a program cost of \$0.05 per egg produced per year under the intervention. Table 4.2 shows that, if the program cost were to rise to \$0.07 per egg produced, the intervention would yield only marginal benefits for Malawi with a BCR of 1.04. On the other hand, a lower program cost of \$0.03 per egg produced would increase the benefits to Malawi with a BCR of 1.61.

Table 4.2: Sensitivity analysis for poultry outgrower scheme program cost

Program cost per egg produced			
Parameter value	\$0.03	\$0.05	\$0.07
BCR	1.61	1.37	1.04

Table 4.3: Sensitivity analysis for poultry outgrower scheme program cost

Market price of eggs			
Parameter value	\$0.10	\$0.13	\$0.16
BCR	1.38	1.37	1.36

The baseline results for the SME CGS intervention assumes a commercial lending rate of 19.43% with the intervention. Table 4.4 shows how the BCR would be affected if the lending rate was instead 15% or 24%. Lowering the lending rate would increase the BCR to 1.14, whereas raising the lending rate would decrease the BCR to 0.96.

Table 4.4: Sensitivity analysis for commercial lending rate

Commercial lending rate			
Parameter value	15%	19.43%	24%
BCR	1.14	1.05	0.96

There is scant evidence in the literature on the interest elasticity of demand for credit amongst SMEs in low-income countries. As such, there is considerable uncertainty associated with the value of the interest elasticity of demand for credit amongst SMEs. However, Table 4.5 shows that the BCR is not sensitive to variations in this parameter.

Table 4.6 shows how the BCR of the SME CGS would be affected by a change in the default rate of borrowing SMEs.²¹ If the CGS is able to reduce the default rate to 5%, the BCR of the intervention would increase to 1.34. However, if the default rate was 25%, the BCR would fall to 0.93.

²¹ The expected default rate used for the baseline analysis is based on findings reported in Calice 2016 for CGS implemented in Africa. However, the default rate reported for Africa (17.10%) is much higher than the global average (2.5%) and higher than the 5% upper limit recommended in the same report. The default rate of 17.1% is based on a relatively small number of borrowers (n=77). All this is to say that it would not be unreasonable for a well-designed and managed CGS to achieve a default rate considerably lower than 17.1%. In this sense, our estimates might be considered conservative.

Table 4.5: Sensitivity analysis for interest elasticity of demand for credit

Interest elasticity of demand for credit			
Parameter value	15%	19.43%	24%
BCR	1.14	1.05	0.96

Table 4.6: Sensitivity analysis for default rate

Default rate			
Parameter value	5%	17%	25%
BCR	1.25	1.05	1.00

Lastly, Table 4.7 shows how the sensitivity of the BCR to changes in the administration costs as a percentage of the guaranteed amount. If the administration costs were only 1% of the guaranteed amount, the BCR would be 1.09, but if the costs were 3% the BCR would fall to 1.02.

Table 4.7: Sensitivity analysis for default rate

Administration costs			
Parameter value	1%	2%	3%
BCR	1.09	1.05	1.02

Policy implications

Based on our desk review and CBA modelling, we offer the following considerations.

The root cause of the youth underemployment and unemployment challenge in Malawi is a lack of jobs which itself is caused by limited structural transformation of the economy. While many youth employment programs cite a lack of skills as a constraining issue, skills development alone will not address the challenge of youth employment in Malawi. For this reason, the team explored interventions that would drive job creation.

Demand-driven education and skills development programs are still needed. Due to the mismatch of demand and supply in the labour market in Malawi, it is likely that economic growth will need to be accompanied by investment in education and infrastructure to connect youth to employers. These programs should be designed and funded based on the skills demanded by the job market.

Industrialization is defined more broadly than simply the growth of manufacturing services but rather as a process of economic transformation that results in employment creation. To that end, a number of tradable services industries share many characteristics as manufacturing, particularly the capacity to create better jobs. They benefit from productivity growth, scale and agglomeration economies.

Any intervention that might be designed based on this study should undertake a thorough assessment of considerations related to land tenure. Land tenure is an exceedingly complex and often contentious matter which should be a central consideration of any intervention that is designed to advance industrialization and youth employment in Malawi. Poorly designed interventions can cause more harm than good by excluding marginalized citizens from accessing benefits or, worse yet, further marginalizing people by dispossessing them of their livelihoods.

Mass employment requires a portfolio of targeted interventions: While the interventions modelled in this study are expected to yield net benefits for Malawi's economy, they fall well short of the 1 million jobs that the Government of Malawi hopes to create during its term. When selecting these interventions, we did not anticipate that they would come anywhere close to generating 1 million new jobs. This level of job creation will require a larger portfolio of interventions, of which the two we have modelled can serve as examples.

The benefits of agro-processing value chain integration can be expanded through exports: The results of the poultry egg outgrower scheme modelled in this study are based on projected domestic demand for poultry eggs. The Government of Malawi could work with entities such as the Malawi Investment and Trade Commission to identify opportunities to expand exports of poultry eggs to regional neighbours to expand and diversify the benefits of value chain integration.

Limitations

There are a number of limitations to this analysis. First, although the goal of industrialization is to achieve structural change, this analysis is based on production functions of Malawi's current economic structure, as well as the current state of technology. As such, we don't allow for any efficiency gains outside of those directly generated by the interventions. Moreover, the estimated impacts on labour income and employment are short-term, first-order impacts; longer-term impacts and spillover effects resulting from linkages between

sectors (i.e. multipliers) are ignored in this study. Therefore, we expect that the intervention would also indirectly create a number of jobs which are not accounted for in the numbers reported here.

The results of the poultry outgrower scheme are explicitly linked to demand for poultry eggs, but the credit guarantee scheme assumes that domestic demand and exports would absorb incremental production facilitated by the increase in capital stock.

This study should not be interpreted as a detailed intervention design or plan. For example, it was beyond the scope of our analysis to determine the number of SMEs who should receive credit, and in what quantities. There may also be other, non-trivial costs associated with implementing these interventions (such as site selection for the poultry outgrower operations) which were beyond the scope of this analysis.

Table 4.8: Similar projects

Project	Funder
Agricultural Commercialization Project	World Bank
Contract Farming and Export Agriculture Facility (ConFarm)	Export Development Fund
Malawi Oilseeds Sector Transformation (MOST) programme	DFID (now FCDO)

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Industrialization and Youth Employment in Malawi: A Cost-Benefit Analysis

