The Malawi Priorities Project

Cost-benefit analysis of interventions to encourage agricultural exports in Malawi - Technical Reports

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

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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.

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Limestone Analytics LLC (Limestone) is a consulting firm specializing in the evaluation of international development projects and social programs. The firm is recognized for combining academic rigor, state-of-the-art methods, and wide-ranging international development experience to provide customized evaluation and economic analysis services. It helps its clients incorporate evidence to improve the design, financing, and implementation of their projects. Information about Limestone's current and past projects can be found at limestone-analytics.com.

Contents

Acronyms

ADMARC	Agricultural Development and Marketing Corporation
AAG	Academic Advisory Group
AFIDEP	African Institute for Development Policy
ASWAp	Agriculture Sector Wide Approach
BCR	Benefit-Cost Ratio
CBA	Cost-Benefit Analysis
CCC	Copenhagen Consensus Center
CEAR	Central East African Railways
DALY	Disability Adjusted Life Year
ECI	Economic Complexity Index
EPA	Economic Partnership Agreement
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FISP	Farm Input Subsidy Program
GDP	Gross Domestic Product
HCC	Hepatocellular carcinoma
HDI	Human Development Index
HIV	Human Immunodeficiency Virus
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute for Tropical Agriculture
IFPRI	International Food Policy Research Institute
MAFSA	Mchinji Area Smallholder Farmers Association
MAPAC	Malawi Program for Aflatoxin Control
MBS	Malawi Bureau of Standards
MCDA	Multi-criteria Decision Analysis
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
NAS	National Adaptation Strategy
NASFAM	National Smallholder Farmers' Association of Malawi
NES	National Export Strategy
NAIP	National Agriculture Investment Plan
NPC	National Planning Commission
REER	Real Economic Exchange Rate
SSA	Sub-Saharan Africa
SQUAM	Standardization, Quality Assurance, Accreditation, Metrology Project
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development

1. Introduction and Context

Agriculture is the backbone of Malawi's economy; it accounts for one third of gross domestic product (GDP), almost 80 percent of employment, and 80 percent of the country's total exports (World Bank, 2020). However, Malawi remains highly reliant on tobacco, which accounts for almost 70 percent of the country's total exports (Atlas, 2018), and has been slow to diversify into other crops. The lack of diversity in Malawi's export basket, combined with low agricultural productivity and dependence on subsistence farming, has made the agricultural sector vulnerable to market and climate induced shocks, thereby limiting the country's overall economic growth. As a consequence, improved agricultural production and diversification is one of the main pillars of Malawi's National Agricultural Investment Plan (NAIP).

Some of the key barriers that have limited Malawi's ability to export high value crops include the following:

- Ad hoc export bans on key commodities and/or lack of coherent policy framework;
- Low quality of agricultural products, including aflatoxin contamination;
- Low farm productivity;
- Insufficient processing capacity in-country;
- High storage, processing and transportation costs;
- Poorly coordinated supply chains to address problems of aggregation, quality; and safety and consistency of supply, among others.

These issues affect several different agricultural supply chains, including maize, soya beans, groundnuts, and timber. Other supply chains, such as tobacco, tea, sugar, and coffee are better established and more organized, though they also face unique barriers, such as low productivity and declining export prices. This paper summarizes the research into the key challenges and opportunities for improving agricultural exports in Malawi.

The team conducted research into Malawi's agricultural sector through a review of past and current agricultural projects, consultations with sector experts, and an extensive review of the literature in order to define a subset of intervention options that could address the key gaps. The research team reviewed the barriers and export potential for all of these value chains, but prioritized interventions that addressed maize and groundnuts because they demonstrated the greatest potential for growth and alignment with national priorities.

The team then conducted a cost benefit analysis to quantify the impacts that a subset of interventions could be pursued in Malawi to bolster agricultural exports. The two interventions that were included in the analysis were:

- The removal of the export ban on maize; and
- Improved standards and practices for testing and certifying groundnut quality.

In the 1970s, groundnuts were the third largest export crop for Malawi (Tsusaka et al, 2016), but this *export market was lost due to persistently high levels of aflatoxin contamination. Gohka et al. (2012) identified the issue of aflatoxin contamination for groundnuts as a top priority Malawi needed to address to expand its export growth. In a study on the economic impact of aflatoxin levels in Malawi, 64% of groundnuts samples were found to contain aflatoxin levels above the regulatory limit (3μg/kg) in the period between 2009-2016 (Msiska and Matumba, 2018). The persistent poor quality of groundnuts has caused a serious loss of confidence from importing markets, limiting Malawi's ability to export the crop and expand the value chain.*

The team conducted a cost-benefit analysis to examine the impact of reforming the Malawi Bureau of Standards (MBS) to have improved technological capacity to grade and certify groundnut quality. The primary costs included improved testing facilities, policy reform, and a farmer training program, while the benefits included an increased proportion of groundnut production that could be sold at a premium price, as well as health benefits from decreased consumption of aflatoxin-contaminated groundnuts.

The second intervention that the research team considered was removal of a long-standing ad hoc export ban on maize, which has remained in place despite increases in maize production and favorable and attractive prices in neighbouring countries.

Many scholars have argued that export bans have negative long term effects, including reducing food security and welfare benefits for rural poor, as well as increasing price volatility. Edelman and Baulch (2016) concluded that 60% of the variation of maize prices in Malawi were due to a combination of long term price trends (inflation) and domestic policy, such as the export ban. Such price volatility can lead to decreased commercial production of staple foods. Barrett (2008) reviewed studies on smallholder participation in staple food markets in eastern and southern Africa and found that volatile markets limit farm-level incentives to increase production and to generate surpluses for the market. Similarly in Malawi, Baulch and Botha (2020) found that large farm operations only grow maize for self-consumption because of the disincentives created by volatile prices and policies. Finally, export bans on staple crops such as maize are often implemented in order to increase domestic food security. However, in the long term, export bans tend to disproportionately reduce the welfare benefits of rural poor (Aragie et al., 2018).

The cost-benefit analysis for the policy intervention to remove the export ban on maize compares the change in consumer surplus losses and producer surplus gains through an economic supply and demand model under two conditions: with the new global price applied, and with the local price that is observed without the policy.

Table 1.1: Intervention benefit-cost ratios

Intervention	Benefit-Cost Ratio		
	5% Discount Rate	8% Discount Rate	14% Discount Rate
Quality control intervention	1.4	1.2	1
Export ban removal[1]	1.13	1.13	1.13

The research team conducted the analysis assuming that 9% of total groundnut production would qualify as premium and that 30% of the observed price gap between domestic and international prices was due to quality.

Although the benefit-cost ratio (BCR) for both interventions are low, they remain above 1, meaning that the net benefits still slightly outweigh the net costs of each intervention. However, in the case of export ban removal, the net welfare benefits per year translate into approximately 1% of the country's GDP thereby representing a substantial welfare gain for Malawi.

[1] Note that BCRs do not change as a function of discount rate because average impacts are evenly distributed across all periods

2. Research Context

The National Planning Commission (NPC), with technical assistance from AFIDEP and the Copenhagen Consensus Center (CCC) are conducting the Malawi Priorities project across 2020 and 2021. The project is a research and advocacy exercise to identify the most effective ways to address the nation's challenges using the framework of cost-benefit analysis. The aim 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, prima facie, contains questions of national importance. The paper also aligns with the pillar of agriculture productivity and commercialisation of the Malawi 2063 vision. Both groundnuts and maize are high value crops, and they are produced for commercial purposes. As Malawi is shifting its dependence on tobacco as a major forex earner for the economy, it is imperative to look into challenges that other traditional cash crops are facing and also finding solutions to those challenges. The challenges and solutions identified for the two value chains have significant implications on the production and commercialisation of the crops hence helping to attain main objectives of the vision 2063 of attaining inclusive wealth creation for all in Malawi.

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, particularly 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 prominent, 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.

2.1 Research process

In August 2020, the research team began investigation on the development question, **"Which high value crops are suitable to be grown in Malawi and are demanded by countries with relatively low-cost transport links?"** which was ranked 4.6 out of 5, according to national priority.

The research team conducted a literature review in order to understand the sector and identify key barriers and performance gaps to exporting high value crops in Malawi. As part of the initial research process, the team participated in a series of consultations with a local academic advisor, Professor Charles Jumbe, in order to confirm and revise understanding of the sector and related issues. Once the key performance gaps were outlined, the research team explored interventions that have been implemented in Malawi that address such issues. The menu of barriers and interventions were reviewed by Professor Jumbe, who provided feedback on additional considerations, as well as contacts from the sector who have been involved in market research, feasibility studies, and program design to increase export of high value crops. The sector experts were able to provide valuable insight into what interventions have had the greatest reach, impact, and data availability and helped identify what subset interventions should be included in the feasibility study.

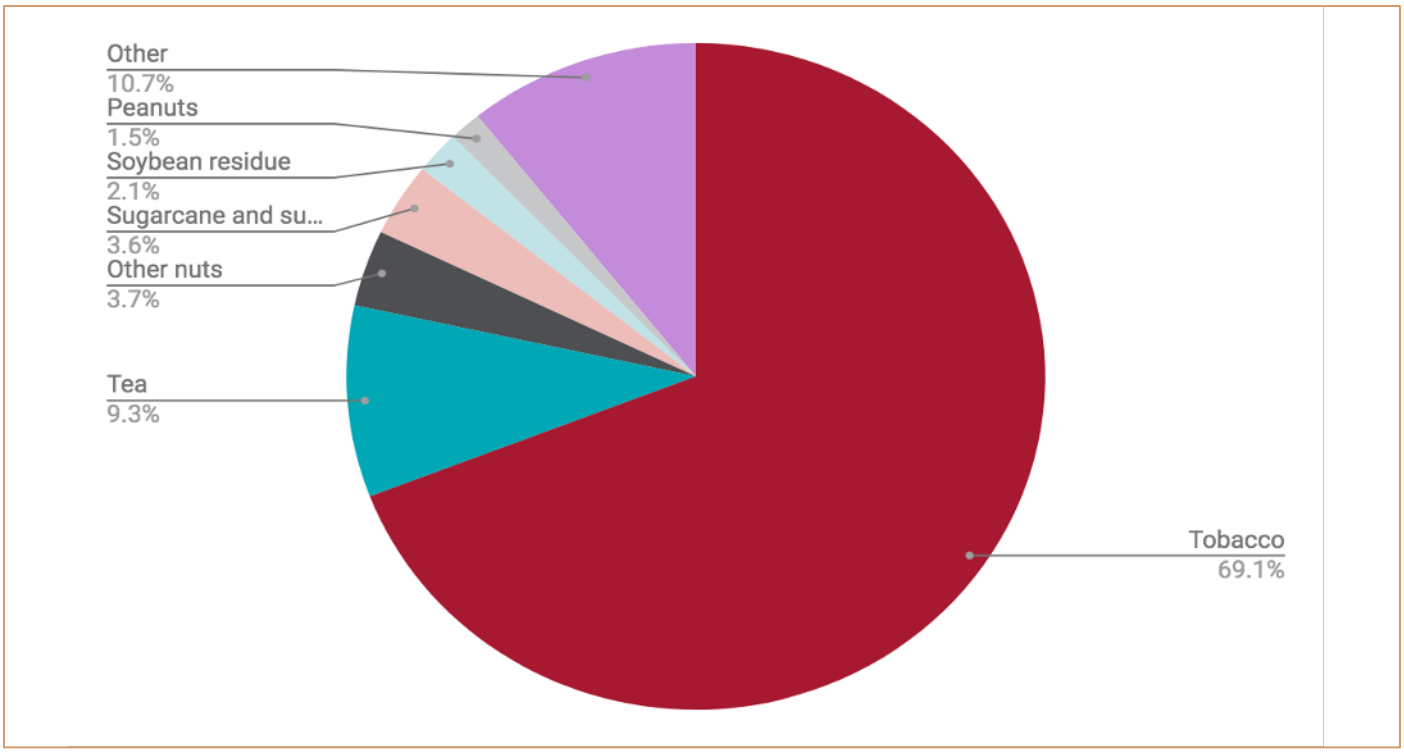
2.2 Agriculture sector background

Export basket

Agriculture is the backbone of Malawi's economy; it accounts for one third of GDP, almost 80 percent of employment, and 80 percent of the country's total exports (World Bank, 2020). Tobacco alone accounts for almost 70 percent of Malawi's total exports (Atlas, 2018). The lack of economic diversity has made the agricultural sector in Malawi vulnerable to market or climate induced shocks. As a consequence, improved agricultural production and diversification is one of the main pillars of Malawi's National Agricultural Investment Plan (NIAP).

Malawi ranks as the 118th most complex country in the Economic Complexity Index (ECI) ranking by the Atlas of Economic Activity (2018). The index ranks countries based on the diversification and complexity of their export basket. Malawi has only diversified into four new products, all in the agricultural sector, since 2003 (Atlas, 2018). In 2018, Malawi exported $998M and imported $1.51B, resulting in a negative trade balance of -$514M (Atlas, 2018).

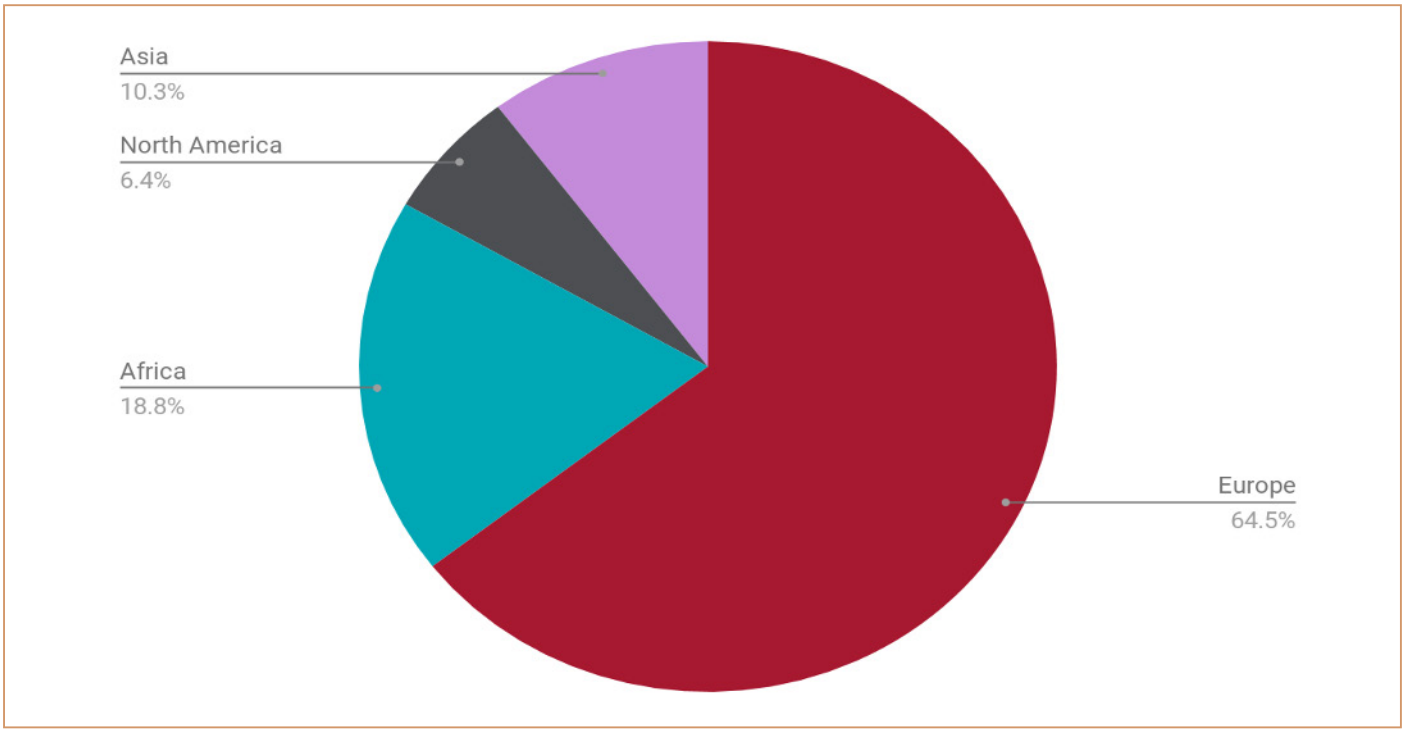
Figure 2.1: Share of Malawi's Export Basket by Commodity, Atlas 2018



Prior to the pandemic, Malawi's economy was on a positive trajectory for the third consecutive year in 2019, primarily driven by improved agricultural production in maize and other crops, despite the adverse effect of Cyclone Idai. Maize production had increased from 3.39 to 3.69 million metric tons from 2018 - 2019 (World Bank, 2020). Tobacco sales, however, were weaker, declining from 202.0 million kilograms in 2018 to 165.6 million kilograms in 2019, with average prices reducing from US$ 1.67/kilogram in 2018 to US$1.43/kilogram in 2019 (World Bank, 2020).

The main trading partners for exports are Belgium (20.7%), Germany (13.16%), and Russia (7.25%). Imports primarily come from South Africa (28%), China (14.4%) and India (11.6%).

Figure 2.2: Malawi's Primary Export Destinations, Atlas 2018



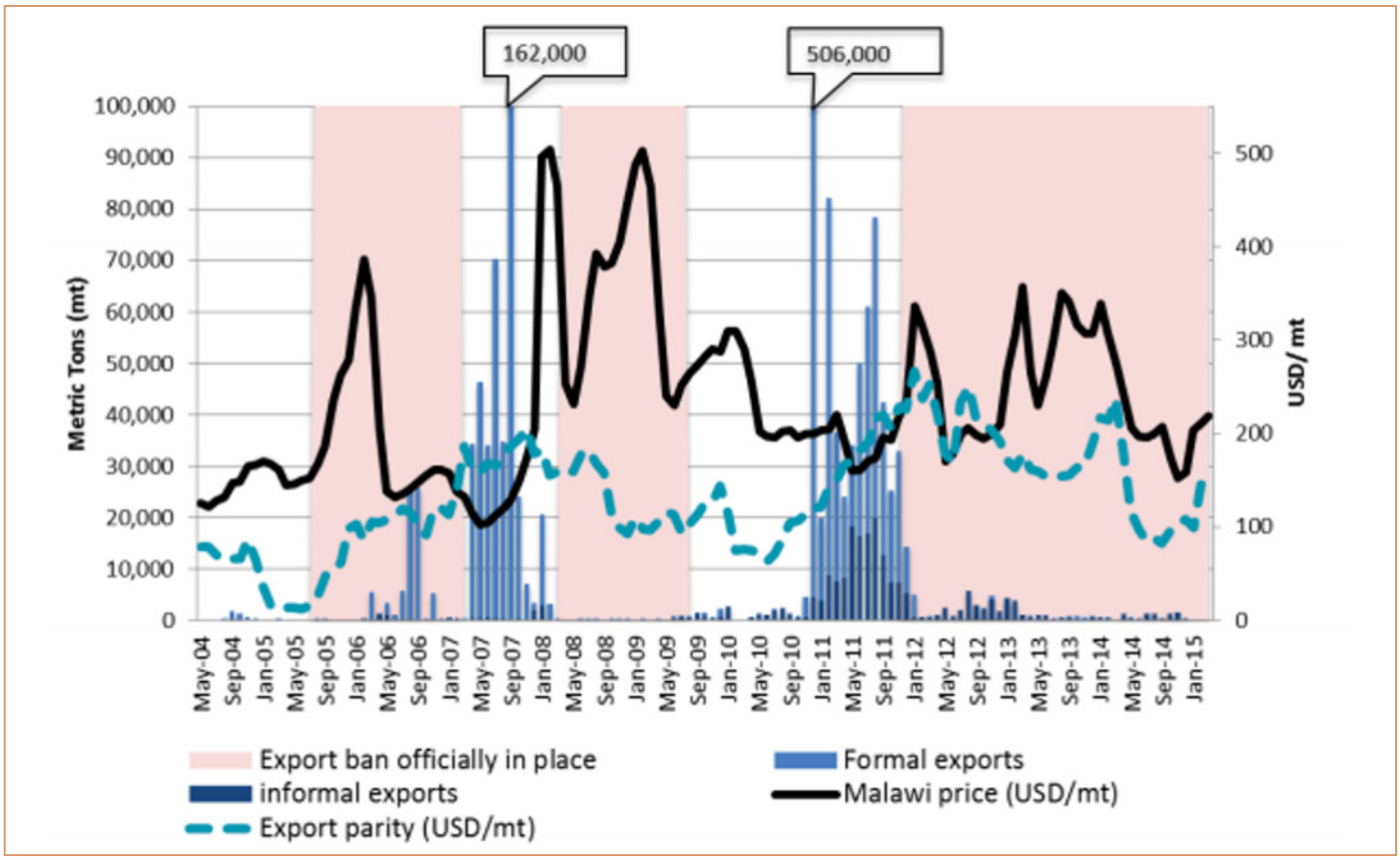
Maize and soya beans

Maize is a very important food crop in Malawi. The crop occupies over 70% of the total cultivated land (Wilson, 2014). It is primarily grown by smallholder farmers for household consumption and is the staple crop in local diets.

Malawi has instituted regular, ad hoc export bans on maize in an effort to promote national food security since 2005 (Edelman and Baulch, 2016). Banning the export of maize is typically done to increase domestic food supply and protect citizens from international food price hikes. However, the restrictions have not been successful in reducing the local price of maize compared to regional markets.

In fact, Malawi has experienced the greatest maize price volatility in the region, after Zimbabwe (Minot, 2014), which has been linked to domestic policy, rather than international market shocks, and corresponds to seasonal trends in maize stock fluctuations (Sassi, 2015). The inconsistent policy and price fluctuations have in turn generated significant market uncertainty for farmers and deterred commercial farms from growing surpluses (Baulch and Botha, 2020). The figure below demonstrates these price fluctuations across three export bans from 2005 to 2014.

Figure 2.3: Maize export bans and maize price fluctuations 2005-2015 (Edelman and Baulch, 2016)



Outright export bans for soya beans have been less frequent, however a number of policies restrict exports with similar effect; since 2015 there has been an export levy on soya and a requirement that all soya exports be processed through a single trade company (Edelman and Baulch, 2016). These policies aim to benefit local vegetable oil processors and the poultry industry by encouraging lower input prices.

Groundnuts

Like maize, groundnuts currently contribute very little to exports, but are staples in local diets both domestically and regionally. Groundnuts used to be a major export in the 1980s but have declined substantially in recent decades because of issues in quality. The primary concern is persistently high levels of aflatoxin in groundnut products. Aflatoxin contamination occurs as a result of poor planting, drying, and storage methods, resulting from small holder farmers' lack of capacity, knowledge, and proper incentives to increase product quality (Gourichon et al, 2017).

The groundnut value chain has been identified as a key sector for investment because of high global demand, ease of scalability, and potential value addition through oil processing (Gourichon et al, 2017). In 2012, Gohka et al. conducted a baseline study to understand the greatest barriers to export opportunities. They identified improved aflatoxin mitigation and management and control for groundnuts as one of the top four issues that the country needed to address to encourage export growth (Diaz Rios et al, 2013).

Malawi has strict regulations around permitted aflatoxin levels in maize and groundnuts. The maximum tolerable level in commercial products is set at 3 µg/kg which is even more stringent than the harmonized limit used in the EU (4 µg/kg) (Msiska and Matumba, 2018). However, there is confusion regarding what regulating agency is responsible for monitoring this for commercial products. Unlike tea and cotton, there is no dedicated authority or policy aimed at upholding quality standards that could revive confidence from world markets.

Due to the loss of formal export markets, groundnuts are primarily sold informally across borders (Nyondo et al, 2018). The fraction of groundnuts that are still traded formally through structured markets are primarily exported to regional markets, including the neighbouring countries of Tanzania, Kenya, Zambia, South Africa, and Zimbabwe. These countries combined account for 95% of Malawi's production of groundnuts (Malawi Investment and Trade Centre, 2020). However, the share of Tanzania's groundnut imports has been declining over the last three years and is also subject to a 10% levy. South Africa is also a key location from which exports can travel to international markets.

Table 2.1: Countries Importing Groundnuts from Malawi

Importers	Exported value in 2009	Exported value in 2010	Exported value in 2011	Exported value in 2012	Exported value in 2013
Zambia	1%	0%	3%	13%	32%
Tanzania	32%	49%	43%	30%	28%
Kenya	6%	28%	24%	25%	27%
Zimbabwe	4%	10%	5%	10%	8%
South Africa	57%	11%	23%	11%	4%
Vietnam	0%	0%	0%	11%	2%

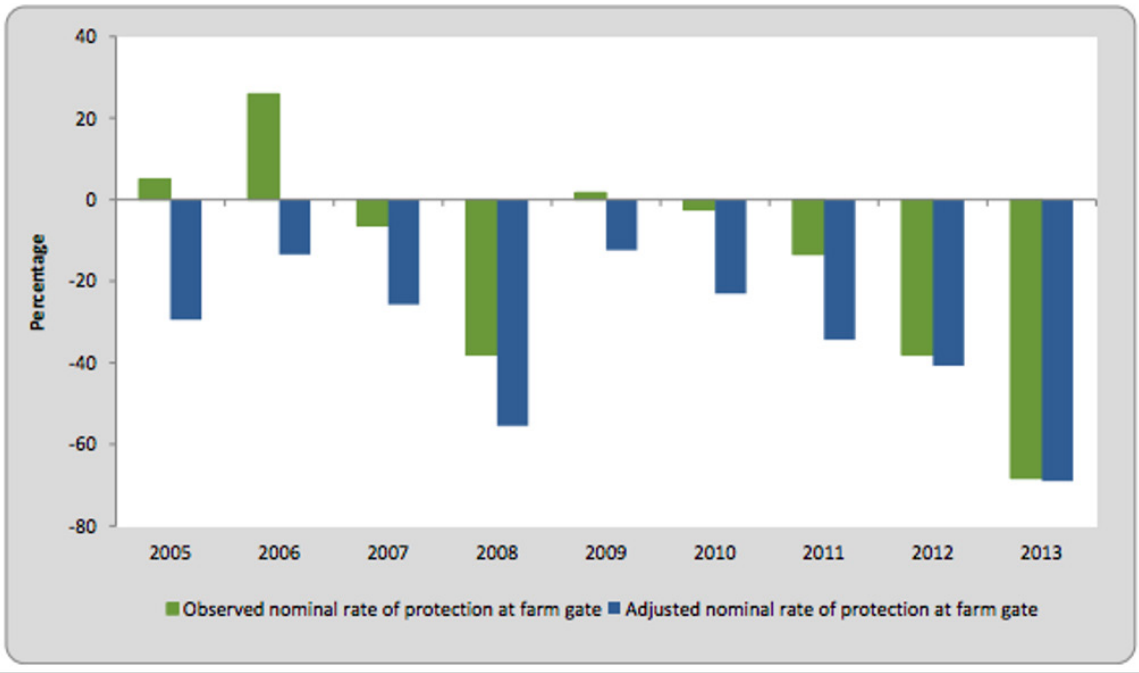
Source: https://mitc.mw/trade/index.php/market-indicators.html

In addition to quality, low productivity, as well as drying, storage, processing and transportation costs also create bottlenecks. Furthermore, the future of groundnut trade is highly determined by the successful development of coordinated supply chains to address problems of aggregation, quality and safety and consistency of supply, along with logistic and market issues (Diaz Rios et al, 2013).

In recent years, Malawi has placed more emphasis on groundnut production. It is now supported by Agricultural Sector Wide Approach (ASWAp), the National Export Strategy (NES), and the Farm Input Subsidy Programme (FISP) (FAO, 2014). NASFAM has been the main exporter until a new fairtrade company developed the product Afrinut and became an important exporter (FAO, 2014).

However, most groundnuts are produced by smallholder farmers for household consumption and sales on local or informal markets. About 60% of groundnuts are consumed directly by households (FAO, 2014). About 15% is sold for export, mostly to regional markets, and the rest is sold on local markets (FAO, 2014). Currently there is no price incentive for farmers to increase the quality of their groundnuts for sale on export markets and persistent inefficiencies in the value chain, as demonstrated in Figure 2.4.

Figure 2.4: Observed and adjusted nominal rate of protection at farm gate for shelled groundnuts in Malawi (%) 2005-2013 from FAO, 2014



Some testing facilities exist in Malawi, such as the Aflatoxin Testing Laboratory at the Chitedze Research Station, and others such as the Malawi Bureau of Standards standardization, quality assurance, accreditation and metrology (SQAM) services are under development. However, the presence of the Chitedze laboratory, which has been in place since 1948, has not effectively reduced aflatoxin levels to date.

Sugar

Another lucrative value chain in Malawi is sugar. Sugar currently only makes up about 4% of Malawi's export basket. The export value of sugar progresses at a slower rate than other commodities because production is restricted by the need to readily access water and processing plants. Therefore, sugar cane is typically grown on estate crops, typically structured through outgrower schemes, or contract farming.. However, it has high export potential and a robust and supportive policy framework.

A sugar cane products strategy was developed for the National Export Strategy (2013-2018). It stated that Malawi's goal was to have sugar cane products account for 15 percent of exports by 2027 (NES, 2012).

Sugar accounts for 20 percent of the total national exports to the European Union (EU) through an Economic Partnership Agreement (EPA) (GoM and UNDP, 2012). The EU Sugar Protocol guarantees high prices for specific quantities of sugar to African, Carribean, Pacific countries sugarcane producing countries and preferential export quotas to Least Developed Countries such as Malawi. In turn, Malawi's National Adaptation Strategy (NAS) identified support for sugar cane growers and increased factory capacity as crucial steps to supporting the industry over the next ten years.

It is worth noting that sugar production also faces similar problems as other value chains. FAO (2015) states that farmers face price disincentives because there are so few buyers in Malawi (there are only two processing mills), who tend to charge large milling fees. This is exacerbated by weak tenure rights and higher asset specificity of sugarcane compared to other crops (FAO, 2015). Furthermore, domestic prices are not correlated with export prices.

Tea

Tea makes up a significant part of the export basket. It is consistently one of the top three exports in the country. Consequently, it is not a priority under the NAS or NES, though it is worth noting that Malawi is one of the largest African tea producers and tea production remains relatively stable (Gourichon et al, 2017). Sugarcane is primarily grown by estates with an expanding out-grower sector. According to FAO (2015) Malawi produced approximately 300000 tonnes of sugar, 73000 tonnes of molasses and 19 million litres of alcohols, including ethanol, in 2010. About 70 percent of sugar is sold on the domestic market and 30 percent internationally, of which half was exported to Europe under preferential trade agreements (FAO,2015). However, production has not increased over time because tea is a perennial crop that takes several years to mature before it can be harvested. Therefore, changing land use to produce tea requires a high start-up cost for smallholders and land constraints limit estates.

Tobacco

Tobacco, also known locally as "green gold," is the primary export in Malawi and an important cash crop for both smallholder farmers and large estates (FAO, 2003). In 2003, tobacco comprised 13% of Malawi's GDP, 23% of its total tax base, and one in five households relied substantially upon income from tobacco production or employment (Jaffee, 2003).

Malawi has a long history of producing tobacco, but considerably increased annual output throughout the 1990s. Output finally reached nearly 160 000 tonnes in the year 2000, making Malawi one of the top ten tobacco producers in the world (FAO, 2003). The majority of the crop, burley, is produced by small scale farmers, while flue is cured by commercial farmers.

Tobacco benefits from a robust policy framework, a wide network of auction houses, contract farming arrangements that support smallholder farmers, and established transportation infrastructure. However, in recent years production has decreased due to decreasing world demand, decreasing yield, and issues of quality. There is also increasing competition from Mozambique, who can offer multinational companies various incentives including large tracts of unexploited land for tobacco production (ICRISAT, 2011). Tobacco sales in 2020 decline from previous years, from 202.0 million kilograms in 2018 to 165.6 million kilograms in 2019, with average prices reducing from US$ 1.67/kilogram in 2018 to US$1.43/kilogram in 2019 (World Bank, 2020).

Furthermore, tobacco production has been identified as a major factor in natural resource depletion (ICRISAT, 2011). The government of Malawi has recently prioritized diversifying crops away from reliance on tobacco through new policy frameworks and institutions such as NASFAM have worked to assist farmers in coping with uncertain tobacco prices by promoting grain legumes.

Government policy

The government of Malawi recognizes the need to focus efforts on the agricultural sector to improve general economic growth in the country. In 2011, the government developed the Agriculture Sector-Wide Approach, ASWAp (2011-2015). The plan advocated strategic investment in programmes and initiatives that fall under three distinct pillars: food security and risk management; commercial agriculture, agro-processing, and market development; and sustainable agricultural land and water management. This was recently followed by National Agriculture Policy (NAP), which aims to transform the agriculture sector in Malawi by moving subsistence farmers into commercial farming. The NAP is supported by the National Agriculture Investment Plan (NAIP), which serves as an implementation framework for the fiscal years 2017/2018 - 2022/2023. NAIP has four programs and sixteen intervention areas, summarized below.

Table 2.2: NAIP four programs for the fiscal years 2017/2018 - 2022/2023

Program	Objective	Funding (USD)
Policies, institutions, coordination	To improve policy and regulatory environment , stakeholder coordination and accountability	372 M
Resilient livelihoods and agricultural systems	To strengthen resilience of livelihoods and natural resource base for agriculture.	925 M
Production and productivity	To increase production and productivity of a more diversified agricultural sector	994 M
Markets, value addition, trade, finance	To enhance market access, value addition, trade, and access to finance	927 M

Table 2.2: NAIP four programs for the fiscal years 2017/2018 - 2022/2023

Intervention	Outcomes	Funding (USD M)
Policy, Program and Stakeholder Coordination	Effective mechanisms for multi-sectoral and multistakeholder coordination to support Program implementation and M&E introduced	182
Farmer Organisations	Strengthened performance and outreach of farmer organisations	16
Public agricultural services delivery	Strengthened MoAIWD's capacity to provide Relevant, market-oriented agricultural extension services	93
Food and Nutrition Security	Available diversified and nutritious foods consumed	209
Food safety and quality	Food safety and quality standards established and mainstreamed	11
Empowerment and tenure security	Empowered Women and youth and enhanced land tenure security	33
Disaster risk management	Strengthened Capacity to manage disasters and reduce their impact	413
Pest and disease management	Major pests and diseases controlled and major outbreaks managed effectively	232
Agricultural innovation systems	Demand-driven, pluralistic innovation systems for relevant technologies generated and disseminated	432
Access to inputs	Broader range of quality inputs at reasonable costs timely accessed by farmers	361
Natural resource management and Climate	Change Sustainably managed natural resources and enhanced climate resilience of production systems	65
Irrigation development	Sustainably increased use of irrigation (increased use of sustainable irrigation)	396
Mechanisation	Improved access to and use of mechanisation services	55
Agricultural markets and trade	Enhanced efficiency and inclusiveness of agricultural markets and trade	522
Investments in agribusiness	Increased agro-processing, value addition and investments into the domestic markets	168
Access to financial services	Improved access to finance by target groups	31

3. Literature review and intervention selection

The literature review for this research question involved identifying key barriers to exporting high value crops, quantifying the relevant performance gaps, and then prioritizing interventions that address those gaps.

3.1 Key barriers

The table below presents a summary of the primary barriers that prevent the export of high value crops, along with possible interventions that address each barrier.

Table 3.1: Summary of barriers and potential intervention options reviewed

Value Chain	Key Barrier	Possible interventions
Groundnuts	Aflatoxin contamination	• Harvest and post-harvest training of farmers to combat aflatoxin • Improved field planting methods • Regulatory requirements • Improve access to aflatoxin diagnostic tools • Price incentives for higher quality grades
	Poor access to markets	• Improved access to formal markets - providing market price info, • Address export controls
Sugar	Lack of milling capacity	• Promoting private investment in sugar processing plants • Increase number of mills to allow for more processing
	Quotas and guaranteed price arrangements being phased out	• Increase plantation area to compensate for price reduction • Improve the transport infrastructure to reduce transportation cost
Maize Soya Nuts	Export ban	• Remove export ban on maize • Improve policy framework
	Aflatoxin contamination	• Improved farming practices
General	Production constraints	• Improve quality of inputs (fertilizer, pesticides, seeds) • Pre- and post-harvest training • Improved access to finance, financial literacy • Improved land tenure rights

There are a number of other high value crops that the research team considered in the initial review, but decided to exclude from further study. These included:

- Timber: timber was not identified as a priority by academic advisors. It was previously a high value crop concentrated in the Northern region of Malawi that expanded during the leadership of Dr. Banda. However, when the government changed in the early 1990s, private actors took over the timber industry. Since this time, a number of non-Malawian enterprises have dominated local production, drove bidding prices down, and made large profits overseas without systematic effort to replant. Furthermore, conservation rates are (10-15 per cent), partially due to the size specifications in East African export markets, which negatively affect sustainability (Kafakoma and Mataya, 2009).
- Tea: tea is currently produced in large quantities, primarily for the EU market, but requires high rainfall and acidic soil, limiting the geographical regions where it can be produced. This value chain is already well established in the specific regions that are suitable for growing. Although it can be difficult to encourage farmers who are not growing tea to transition to the crop, since it is perennial and a few years before it matures, the industry is developed and many processing companies already have contract farming arrangements that assist farmers with inputs and harvesting.
- Cassava: cassava used to be a food crop, but is no longer demanded by local or regional markets because of the dominance of maize. Cassava is only grown for home consumption - usually as a supplement for food deficits in the south during lean seasons. There have been some projects to produce ethanol from cassava, but the market for this value chain remains weak. Cassava's export potential is further limited by poor processing facilities (ethanol, starch and high quality

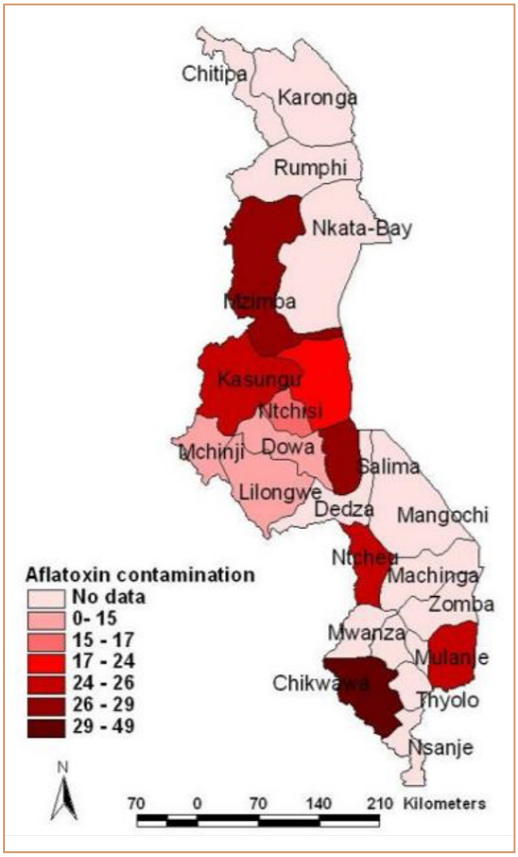
cassava flour) and the crop's high perishability nature.

- Cotton: the demand for cotton from Malawi is also weak due to the closure of multiple textile companies in the country. This reduced cotton as a viable commodity for export. ADMARC used to operate as a marketing organization, but is not as efficient now, leading to a severe lack of investment support for cotton. There is currently no market for cotton and inputs, such as seeds, are hard to find.

3.2 Gap Analysis and Intervention Options

For each barrier, the research team examined the specific performance gaps and intervention options could address such gaps.

Figure 3.1: Aflatoxin contamination by region (Monyo et al, 2010)



Aflatoxin contamination

Gohka et al. (2012) identified the issue of aflatoxin contamination for groundnuts as a top priority Malawi needed to address to expand export growth. In a study on the economic impact of aflatoxin levels in Malawi, 64% of groundnuts samples were found to contain aflatoxin levels above the regulatory limit (3µg/kg) in the period between 2009- 2016 (Msiska and Matumba, 2018).

Contamination can reduce the value of groundnuts at different levels of trade by lowering prices, incurring greater inspection costs, disposal, or rejection of lots or treatment of lots at additional cost prior to sale, compensation in case of claims, and cost of sampling and analysis along the value chain (FAO, 2018). For example, in Gambia, the cumulative economic loss on domestic and international trade of groundnuts between 2000 and 2014 was about $23 million, which amounts to a yearly loss of about $1.52 million (FAO, 2018). A recent report projected the deterrent impact of aflatoxin contamination on groundnut exports in Malawi at nearly US$11 million in 2017 (Gohka et al., 2012).

Msiska and Matumba (2018) quantify the lost value of groundnut export from Malawi to European markets, which have higher quality standards, compared to regional markets with lower standards. They find that, according to 2012-2014 international export prices for groundnuts, Malawi's loss is estimated at 27% per unit (MK272/kg) for ESA versus MK372.5/kg for the EU. Further, they argue that if Malawi had maintained the EU market, groundnut production would have increased by about 49% (to about 532,000 metric tonne) over the period of 2012-2014, which would translate into annual total national export earnings of MK29.725 billion (USD 86.0 million) against the actual USD 55.0 million. This implies a loss of US$31.0 million due to poor market access over the study period.

Another way of quantifying the gap created by quality issues is to compare the domestic price of groundnuts with that of the international market.

Table 3.2: Domestic and global prices for groundnuts, by year

Year	Retail Price (Kwacha/Kg)	Retail Price (USD/Kg)	Wholesale Price (Kwacha/Kg)	Global Market Prices (USD/ton)	Global Market Prices (USD/kg)
2015	500-700	**0.67 - 0.93**	565- 700		
2016	600-620	**0.80 - 0.83**	550-720	1600	**1.76**
2017	800-850	**1.07 - 1.13**	740-750	1650	**1.82**
2018	470 - 800	**0.63 - 1.07**	330	1700	**1.87**

Source: https://mitc.mw/trade/index.php/market-prices.html

Aflatoxin contamination in groundnuts also has negative health impacts, posing additional cancer risk arising from synergistic hepato-carcinogenic effects of aflatoxin B1 and HIV (Msiska and Matumba, 2018). In their study on the economic impacts of aflatoxin, Msiska and Matumba (2018) estimated the health impact of current contaminated groundnut consumption as 433.8 Disability Adjusted Life Years (DALYs) per 100,000 population, primarily due to aflatoxin-induced hepatocellular carcinoma (HCC). The monetization of the risk for 2281 aflatoxin-induced liver cancer cases results in a loss of up to US$ 373 million annually.

The issue of aflatoxin contamination is well researched. Many interventions have been implemented in Sub-Saharan African, including in Malawi and neighbouring countries, with mixed success. There is evidence that aflatoxin levels in Malawi can be reduced through improved farming practices (Jordan et al., 2018; Bandyopadhyay, R. et al., 2019; Zuza E et al., 2017; UNIDO,

2012), which increases the volume of products suitable for formal markets. However, farmers currently have poor access to such markets. When farmers lack access to markets, there is no incentive to improve the quality of products because they are unable to profit from the higher export value (Limbikani M et al. 2015, Edelman and Baulch, 2016). Therefore, there is some debate about whether improving quality or improving market access is first priority when addressing aflatoxin contamination issues.

One study (Pound, 2013) examines the introduction of a free trade agreement between EU markets and the Mchinji Area Smallholder Farmers' Association (MASFA). The partnership program was very popular among farmers in its inception, however declined significantly in popularity because the fairtrade prices being paid to farmers ended up being less than the price that traders would pay for ungraded nuts. Therefore, there was no incentive for farmers to invest in improving the quality of their groundnuts to sell to a fair trade market, since there was no premium for higher quality products.

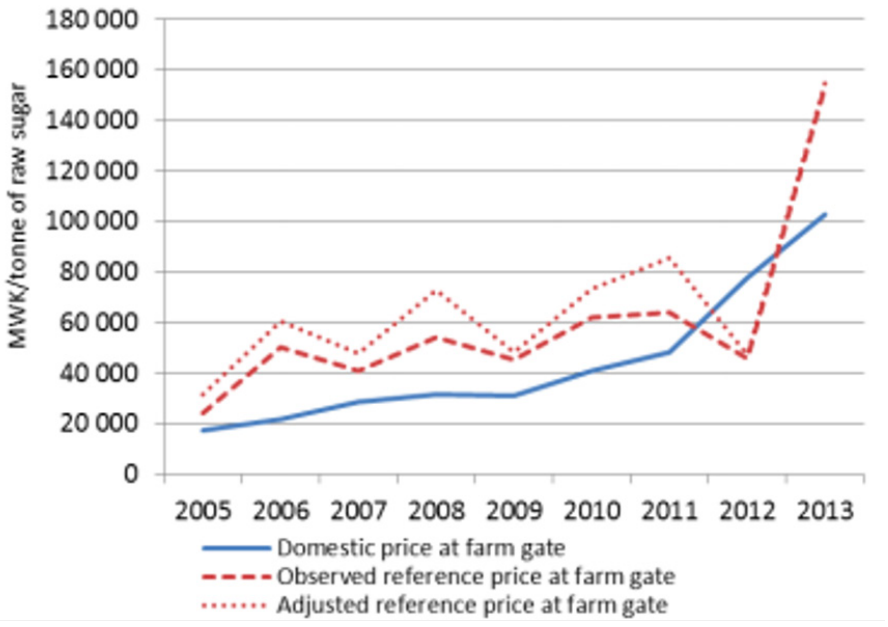
Sugar processing

In Malawi, sugar has been identified as one of priority export commodities in the 2013-2018 Malawi National Export Strategy (NAS). There are currently two sugar mills in Malawi; Illovo Sugar Malawi, which has two factories in Dwangwa (central Malawi) and Nchalo (southern Malawi), and Salima Sugar, which is a relatively new operation based in Salima.

Prior to Salima Sugar in 2016, Illovo Sugar Malawi was the country's only sugar producer and miller. The company produced about 300,000 tonnes of sugar in 2012/13 and operates five distribution centres for sugar sales throughout Malawi. Over half of the company's total sugar production is sold within Malawi with the remainder being sold to regional markets in Africa or exported to the EU under the Everything But Arms Arrangement.

Prior to the establishment of Salima Sugar, there were many issues in the sugar cane value chain resulting from the monopolistic powers of Illovo Sugar Malawi. From 2005 to 2013, the FAO (2015) found that farm gate prices for raw sugar in Malawi were not correlated with export prices, meaning that, minus the milling fee (40 percent of divisible revenue on sugar and molasses sales) cane growers are paid 60 percent of the domestic wholesale or ex-factory price (see Figure 3.2). This situation led to price disincentives for farmers since they received 23 percent less on average than the international equivalent price. In 2012 the market environment improved, since the benchmark price fell sharply while producer prices remained steady.

Figure 3.2: Domestic observed and adjusted price of sugar at farm gate 2005-2013, FAO 2015



Promoting private investment, such as the example of a second sugar mill in Salima, was suggested by the FAO (2015) to help improve price incentives for sugar. They also suggested a revised farm gate price setting mechanism that considered the export price of sugar in addition to the domestic price, in order to increase the price received by farmers, and thus incentivize production, while protecting them from international price shocks.

The introduction of Salima Sugar Company, established under the Public Private Partnership (PPP) as part of the Green Belt Initiative, was welcomed in Malawi as a means to heighten competition on the local sugar market and stabilize sugar prices.

Few interventions that address sugarcane production have been implemented in Malawi. One evaluation from 2009 has examined the results of a project aimed at improving out-grower sugar cane farming, but only found that the project was poorly managed and implemented and failed to achieve its original objective of promoting out-grower farming as there was no enabling policy environment to protect the smallholders from firms that hold dominant market positions. In addition, the insights of this study may no longer be as relevant due to the introduction of the new sugar mill. The second study looked at the role of intermediary coordination in improving market linkages in Tanzania and Malawi. However, neither study addresses nor quantifies the primary gap identified, which is a lack of sugar mill capacity in Malawi.

Export bans

Export bans on maize have remained despite increases in maize production and favorable and attractive prices in neighboring countries. Malawi's economy was on a positive trajectory for the third consecutive year in 2019, prior to the pandemic, primarily driven by improved agricultural production in maize and other crops, despite the adverse effect of Cyclone Idai. Maize production had increased from 3.39 to 3.69 million metric tons from 2018 - 2019 (World Bank, 2020).

Edelman and Baulch (2016) concluded that only 40% of the price fluctuations in maize were due to seasonal factors; 60% of the variation was due to a combination of long-term price trends (inflation) and domestic policy, such as the export ban. This finding is supported by another study, which found that large farm operations only grow maize for self-consumption because of the disincentives created by volatile prices and policies (Baulch and Botha, 2020).

This price volatility can lead to decreased commercial production of staple foods. Barrett (2008) reviewed studies on smallholder participation in staple food markets in eastern and southern Africa and found that volatile markets limit farm-level incentives to increase production and to generate surpluses for the market. In Malawi, only 17% of smallholder farmers sell maize at all, and only 10% are net-sellers of maize (Edelman and Baulch, 2016). Aragie et al. (2018) also found that maize export bans in Malawi only benefit the urban non-poor, while poor farmers' incomes and maize consumption levels decline in the long run.

Edelman and Baulch (2016) also found that the periods of soya bean export bans coincided with higher and more volatile prices compared to regional markets. Although the soya export bans have had little effect on the national economy as a whole, the policies have impacted the soya bean sector by 12% and reduced farmer's revenue by 56% in a year (Edelman and Baulch, 2016). Finally, the bans also deter farmers from diversifying away from tobacco, which is experiencing a decline in demand and sales (World Bank, 2020).

In light of this evidence, lifting the export ban on maize is expected to create more stable market conditions and therefore encourage the growth of agriculture commercialization and food security in the long term.

3.3 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: The intervention is identified by sector experts as important and relevant to 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.

Final selection

In addition to the selection criteria identified above, the team has also considered how the recommended interventions align with the other agricultural research questions addressed through the Malawi Priorities project. This includes the question focused on how Malawi can improve access to markets for smallholder farmers.

In order to identify the final subset of interventions to include in the feasibility analysis, we apply the selection criteria to each of the intervention options that were outlined in the previous section. This is summarized below.

Table 3.3: Summary of selection criteria for final choice of interventions

Intervention	Sector Expert Priority	BCR or Cost-Effectiveness	Sufficient size	Significant gap in current coverage	Availability of data	Overall
Introduce better grades/ standards for groundnuts	High	High	Yes	Yes	High	Yes
Remove export ban on maize	High	High	Yes	Yes	Moderate	Yes
Private investment in sugar milling	Low	High	No	Yes	Low	No

The interventions that were chosen for inclusion in the pre-feasibility study include:

1. Improving grading processes/standards for groundnuts
2. Removing the export ban on maize

4. 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 for the cost benefit analysis of two interventions; the first being improving the quality control standards and practices for groundnuts and the second the removal of the export ban on maize.

4.1 Intervention one: improving quality control for groundnuts

General summary

Improving national systems to verify and certify grading standards for value chains such as groundnuts would result in both economic and health benefits. The main beneficiaries of improved capacity to measure and enforce quality standards are farmers and the government. The primary benefits include:

- Benefit 1: Increased value of farm output resulting from the grading and separation of premium grade.
- Benefit 2: Health benefits from reduced exposure/consumption of aflatoxin-contaminated groundnuts

The primary costs include:

- Cost 1: Improving institutional capacity and test facilities that can verify grade standards

The methodology for calculating the benefits of this intervention would look at the difference between the premium price paid for higher grade products that could be sold in larger, formal markets (ESA and EU), and the regular market price for ungraded product, and estimating the share of a commodity that farmers would be able to sell at the higher market price if proper grading measures were introduced. These price differentials are provided by Msiska and Matumba (2018), as well as the Malawi Investment and Trade Centre.

In addition, the intervention will have health benefits, measured by the disability adjusted life years (DALYs) averted from the reduction in aflatoxin levels incurred through higher grade groundnuts.

Table 4.1: General summary of the quality control model

Assumption	Description
Timeframe	Ten years (Y1-Y10)
Periods	Investment in institutional capacity (Y1- Y2) Farmer training (Y3 - Y5) Facility operations and maintenance (Y3-Y10)
Discount rate	5% - 14%
Proportion of groundnuts that qualify as premium	5% - 15%
Proportion of price gap due to quality of groundnuts	20% - 50%

Benefits, costs, and stakeholders

Impacts	Small holder farmers	Consumers	Government (Malawi Bureau of Standards)
B1 Increased value of groundnuts sold at premium	✓		✓
B2 DALYs averted through decrease in consumption of aflatoxin contaminated groundnuts		✓	
C1 Improving institutional capacity and testing facilities			✓
C2 Farmer training			✓

Model specification

Benefit 1: Increased value of farm output resulting from the grading and separation of premium grade

A major barrier preventing Malawi from exporting high-value crops like groundnuts to regional and international markets is ensuring the quality of the product. Although groundnuts used to be a major export commodity, poor quality has reduced confidence in the product and now 60% of groundnuts are consumed directly by households (FAO, 2014). About 15% is sold for export, mostly to regional markets, and the rest is sold on local markets (FAO, 2014). Groundnut exports are subject to strict standards on the level of aflatoxin contamination permitted. If groundnuts could be accurately graded and certified, the higher quality groundnuts could be sold on formal markets for a premium price.

The benefit to smallholder farmers comes from the higher price they would receive for the portion of graded groundnuts they could sell at a premium at each market (local markets ungraded price, compared to price in international markets such as the EU). We calculate the potential additional profit by subtracting the local retail price per kilo of ungraded groundnuts from the price per kilo for groundnuts sold to international (EU) markets. The percentage of groundnut production that is suitable for trade on the EU market is estimated based on the production levels of the Mchinji Area Smallholder Farmers Association, which sells fair trade quality groundnuts to the EU.

Timeframe(s)

Facility operations and maintenance (Y3-Y10)

Inputs		Dimensions	Value	Unit	Source of verification[2]
MWK	Exchange rate USD to MWK		1:745		World Bank, 2020
P^{graded}	Retail price for high quality graded groundnuts per tonne	-	1874.30	USD	FRED, 2020
$\Delta G^{premium}$	Proportion of groundnuts that meet premium grade quality	-	9	%	Fairtrade Foundation, 2020
δ	Portion of the price gap due to quality	-	30	%	Author's estimate
Q	Quantity of groundnuts produced per year	-	344,583	Tonnes	Derlagen and Phiri (2012)

Calculation

Where:

$$B1_t^{[Farmer]} = \left[\delta \times \left(P^{graded} - P^{ungraded}\right)\right] \times \left[\Delta G^{premium} \times Q\right] \times MWK$$

Benefit 2: DALYs averted through decrease in consumption of aflatoxin contaminated groundnuts

The effects of aflatoxins in humans and animals have been categorized in two general forms: acute and chronic aflatoxicosis. Acute aflatoxicosis results from ingestion of moderate to high levels of aflatoxins and is generally characterized by a rapid onset and toxic responses, including hemorrhage, acute liver damage, edema, alteration in digestion, absorption and/or metabolism of nutrients, and possibly death. Chronic aflatoxicosis is characterized by low dose exposure over a long time-period, resulting in cancers and other generally pervasive and irreversible effects, such as low birth weight, stunting, immunosuppression, and cancer, particularly hepatocellular carcinoma (HCC), among others.

The health benefits of reducing aflatoxin levels in groundnuts are based on the Msiska and Matumba (2018) study on the economic impact of Aflatoxin in Malawi. The authors calculate the current annual disability adjusted life years (DALYs) resulting from aflatoxin induced hepatocellular carcinoma (HCC) incidence, based on aflatoxin contamination rates in groundnuts and maize, and consumption levels per household. Although only total DALYs are reported (for both maize and groundnuts), the consumption levels of maize and groundnuts map very closely with the incidence of HCC. We therefore make the assumption that this ratio can be used to estimate the burden of disease attributed to groundnuts.

Therefore, to calculate the benefits associated with reducing aflatoxin levels, we calculate the expected proportion of the DALYs attributable to contaminated groundnuts by multiplying the HCC incidence rate attributable to groundnuts by the total number of DALYs to get the number of DALYs only attributable to groundnut contamination. Then, we estimate the change in aflatoxin levels expected as a result of improved grading processes, based on the experience of MAFSA, which trades a portion of its output to the EU. We then calculate the reduction in DALYs that would result from the reduced aflatoxin levels.

In the calculation of health benefits, the research team applied the Robinson et al. (2019) methodology for valuing a statistical life. The results were not sensitive to using alternative VSL estimates provided by Viscusi et al. (2017).

[2] Implementation data, performance evaluation, or impact evaluation

Timeframe(s)

Facility operations and maintenance (Y3-Y10)

Inputs		Dimensions	Value	Unit	Source of verification[3]
$I^{groundnuts}$	Incidence of HCC associated with groundnuts consumption per 100K	-	4.40	#	Msiska and Matumba (2018)
I^{maize}	Incidence of HCC associated with maize consumption per 100K	-	70.30	#	Msiska and Matumba (2018)
R	Expected reduction in burden of disease from improved grading	-	9	%	Fairtrade Foundation (2020)
$DALY^{total}$	Total DALYs resulting from contaminated groundnuts and maize per year	-	437.80	DALYs	Msiska and Matumba (2018)
VSL	Value of statistical life	-	22,968.50	USD	Robinson et al. (2019)
d	Health discount rate	-	0	%	MCC standard
LE	Life expectancy at average adult age in Malawi	-	39.5	#	World Bank
P^{malawi}	Population in Malawi	-	18,600,000	#	World Bank

Calculation

Benefit:

$$B_2^{farmer} = \left(DALY^{total} \times \frac{I^{groundnuts}}{(I^{groundnuts} + I^{maize})}\right) \times R \times d\left[\frac{VSL}{LE}\right] \times P^{malawi}$$

Cost 1: Improving institutional capacity and test facilities that can verify grade standards

The primary cost is associated with improving the policy, test facilities, and accreditation process of the Malawi Bureau of standards (MBS), as well as developing the capacity of MBS staff. Currently, the MBS does not provide testing services. The intervention would aim to establish a testing laboratory that can verify the aflatoxin contamination levels in common crops, such as maize and groundnuts, as well as assist the MBS to develop policies in line with the National Quality Policy and develop an accreditation process.

The cost can be estimated based on an existing project. The Standardization, Quality Assurance, Accreditation, Metrology Project (SQUAM), funded by the EU, which includes interventions aimed at improving MBS policy framework and capacity for verifying grading standards, provides a reasonable cost estimate.

Added to this is an estimation of the annual cost of operations and maintenance of the lab, the cost of a consultant to review and update the policy framework and regulations for MBS.

Timeframe(s)

Investment in institutional capacity (Y1- Y2)
Facility operations and maintenance (Y3-Y10)

Inputs		Dimensions	Value	Unit	Source of verification[4]
MWK	Exchange rate USD to MWK	-	1:745		World Bank, 2020
CL	Annual cost of establishing the aflatoxin testing laboratory	-	2,500,000	USD	USAID, 2019, SQUAM, 2018
OP	Annual cost of annual operations and maintenance of laboratory	-	100,000	USD	Author's estimate
CP	Cost of consultant to review policies and regulations	-	50,000	USD	Author's estimate
CT	Cost of capacity training for MBS	-	50,000	USD	Author's estimate

Calculation

Cost:

$$C_3 = MWK \times (OP + CL + CM + CT)$$

[3] Implementation data, performance evaluation, or impact evaluation
[4] Implementation data, performance evaluation, or impact evaluation

Cost 2: Farmer training

As part of the grading improvements, it is important to educate farmers on how to use pre and post harvest techniques to reduce aflatoxin contamination and how this will impact their ability to sell to different, more profitable markets. The outreach and training costs for the agricultural extension work that would be undertaken can be estimated by the impact evaluation and associate cost-effectiveness study of a farmers group program in Malawi by Ksoll et al. (2016). Ksoll et al. estimate the total program costs per year, then divide this by the number of program participants to determine the cost per member. Their cost per member is higher than the typical cost for such programs because of the need to use trained staff during implementation, rather than village agents. This makes it an appropriate conservative estimate.

To calculate the cost, the cost per member of farmer group training is multiplied by the number of farmers receiving training and the exchange rate from USD to MWK.

Timeframe(s)					
Farmer training (Y3 - Y5)					
Inputs		**Dimensions**	**Value**	**Unit**	**Source of verification[5]**
MWK	Exchange rate USD to MWK	-	1:745		World Bank, 2020
FG	Cost per member for farmers group trainings	-	75	USD	Ksoll et al., 2016
$N^{farmers}$	Number of farmers reached in training activities per year	-	250,000	#	Author's estimate
Calculation					
Cost:	$C_2 = MWK(FG \times N^{farmers})$				

4.2 Intervention two: removing Malawi's export ban on maize

To measure the costs and benefits of removing Malawi's ban on the export of maize, we compare the expected consumer and producer surplus under two conditions:

1. The export ban is removed, maize is traded at a regional price
2. The export ban stands, maize is traded at the current price observed

We have not calculated additional benefits associated with food security because such benefits overlap with improved economic outcomes already captured in this model. However, it is important to note that many previous studies have examined the impact of export bans and concluded that often, they not only cause increased price volatility in the country for staple grains,[6,7] but that they negatively impact the income, and therefore food security, of rural poor in the long term.[8]

Assumption	Description
Main currency	Malawian Kwacha (MWK)
Other currencies	United States Dollar (USD)
Timeframe	30 years
Assumptions for sensitivity analysis	Demand elasticity Supply elasticity International maize prices Domestic maize prices

[5] Implementation data, performance evaluation, or impact evaluation
[6] Edelman, 2016. Discretionary Maize Policy Interventions in Malawi: An Impact Analysis of Export Bans and Minimum Farm Gate Prices. IFPRI, July 2016.
[7] FAO. 2016. Achieving food security and industrial development in Malawi: Are export restrictions the solution?, by Emerta Aragie, Karl Pauw and Valentina Pernechele. ESA Working Paper No. 16-08. Rome, FAO.
[8] Porteous, O., 2017. Empirical effects of short-term export bans: The case of African maize. Food Policy Vol 71, August 2017, Pages 17-26

Benefits, costs, and stakeholders

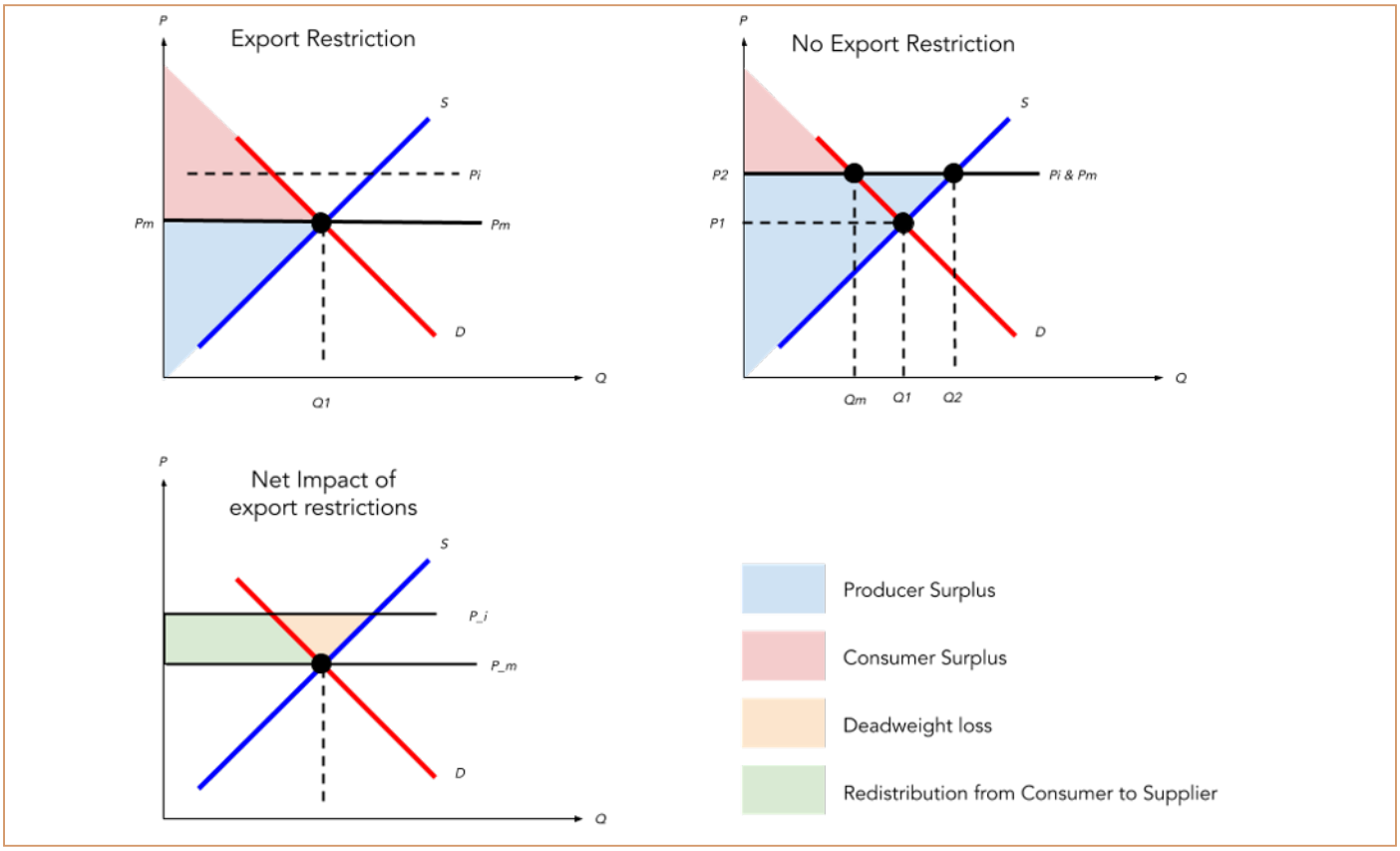
Impacts	Malawi Maize Consumers	Malawi Maize Suppliers
B1 Increased Producer Surplus		✓
C1 Decreased Consumer Surplus	✓	

Model specification

Benefit 1: Increased producer surplus for maize exports

An export ban limits the demand for Malawi's maize to domestic customers, which results in a lower price per unit sold. By removing export restrictions from farmers in Malawi, they will be able to sell their crops for a higher price that is consistent with the regional average.

Figure 4.1: Stakeholder incidence of export restrictions impacts



The price differential is calculated by subtracting the average retail price of maize per kilogram in Malawi from the international maize price per kilogram. The international price per kilogram is estimated using the average Mozambique price values for the past decade.

The volume of maize produced will also increase, as a function of the producer's elasticity of supply. The elasticity of supply is estimated at 2.0 from Aragie et al, 2018. The net benefit for producers will be the full value of the change in price (net of transportation costs) times the initial quantity sold, plus half the change in price times the additional increase in quantity sold (orange deadweight loss area, plus green redistribution area in Figure 4.1).

Timeframe(s)				
20 years				
Inputs		**Value**	**Unit**	**Source of verification**
P^M	Price per KG of maize in Malawi with export ban policies	0.24	USD	GIEWS FPMA Tool
P^I	Price per KG of maize in Maputo	0.40	USD	GIEWS FPMA Tool
$FX^{(MWK/USD)}$	Exchange rate of USD	755	MWK	Google Finance
$Q^{(W/O)}$	Quantity of maize sold in the counterfactual	3,691,866,000	#	Ministry of Agriculture, Irrigation and Water Development
ϵ^S	Elasticity of Supply for maize producers in Malawi	2	#	Aragie et al. 2018
T	Transportation cost per KG to Maputo	0.10	USD	Vilakaz, 2018[9]
Calculation				
Benefit:	$B1_t = [P^I - T - P^M] \times \left(Q^{W/O} + \frac{Q^W - Q^{W/O}}{2}\right) \times FX^{MWK/USD}$			
Where:	$Q^W = Q^{W/O} \times \left(1 + \frac{(P^I - T - P^M)}{P^M} \times \epsilon^s\right)$			

Cost 1: Decreased consumer surplus

An export ban limits the demand for Malawi's maize to domestic customers, which results in a lower price per unit for domestic consumers. By removing export restrictions from farmers in Malawi, farmers will choose to export their crops to other countries until prices in Malawi align with international prices. As a result, consumers in Malawi will consume less maize, and pay a higher price for the maize they do consume.

The expected change in price is calculated by subtracting the average retail price of maize per kilogram in Malawi from the maize price per kilogram in Maputo (net of transportation costs. The international price per kilogram is estimated using the average Mozambique price values for the past decade.

The volume of maize consumed will also decrease, as a function of the consumer's elasticity of demand. The elasticity of demand is estimated at -0.8 in Aragie et al, 2018. The net cost for consumers will be the full value of the change in price times the new quantity consumed, plus half the change in price times the decrease in quantity of maize consumed.

Timeframe(s)				
20 Years				
Inputs		**Dimensions**	**Unit**	**Source of verification**
P^M	Price per KG of maize in Malawi	0.24	MWK	GIEWS FPMA Tool
P^I	Price per KG of maize internationally	0.40	USD	GIEWS FPMA Tool
$FX^{(MWK/USD)}$	Exchange rate of USD	755	MWK	Google Finance
$Q^{(W/O)}$	Quantity of maize sold in the counterfactual	3,691,866,000	#	Ministry of Agriculture, Irrigation and Water Development
ϵ^S	Elasticity of demand for maize consumers in Malawi	-0.8	#	Aragie et al. 2018
T	Transportation cost per KG to Maputo	0.10	USD	Vilakaz, 2018[10]
Transportation cost per KG to Maputo				
Benefit:	$C2_t^{Consumers} = [P^I - T - P^M] \times \left(Q^{W/O} + \frac{Q^W - Q^{W/O}}{2}\right) \times FX^{MWK/USD}$			
Where:	**Quantity of maize demanded by consumers without the export ban** $Q^W = Q^{W/O} \times \left(1 + \frac{(P^I - T - P^M)}{P^M} \times \epsilon^D\right)$			

[9] 2000 KM at 0.05USD/ton/km
[10] 2000 KM at 0.05USD/ton/km

Timeframe (flag)

The policy is assumed to last the lifetime of the CBA, which is currently set to 30 years. The policy is assumed to take effect in the first period.

Inputs		Dimensions	Unit
Y_0	Start year	2020	Year
$1Imp^B_{\square}$	Intervention 1 implementation beginning year	2020	Year
$1Imp^L_{\square}$	Intervention 1 implementation length	20	Years
Calculation			
Periods:	*t is a time index corresponding to the number of complete years elapsed since the start year* $Y_t = Y_0 + t$		
Flags:	$F1Imp_t = if(Y_t >= 1Imp^B_{\square}, if(Y_t < (1Imp^B_{\square} + 1Imp^L_{\square}),1,0),0)$		

5. Conclusion and discussion

The results of the CBAs indicate that there are some positive benefits that would result from both the groundnut quality control intervention as well as the export ban removal, although both are sensitive to key assumptions.

Although the majority of Malawi's economy depends on agriculture, there are limited crops that are currently suitable for export to neighboring countries due to quality control issues, poor transportation linkages, uncoordinated farmers with relatively low productivity levels and access to markets, and policy disincentives.

This analysis has focused on two of the primary barriers preventing the export of regionally demanded crops:

- The long-standing export ban on maize; and
- Poor quality control standards and regulations for groundnuts.

The proposed interventions therefore include removal of the export ban and improved regulatory and technical capabilities to grade and certify groundnuts.

The quality control intervention encompassed improving national systems to verify and certify grading standards for value chains such as groundnuts, which is expected to result in both economic and health benefits. The main beneficiaries of improved capacity to measure and enforce quality standards are farmers and the government. The primary benefits include:

- Increased value of farm output resulting from the grading and separation of premium grade.
- Health benefits from reduced exposure/consumption of aflatoxin-contaminated groundnuts

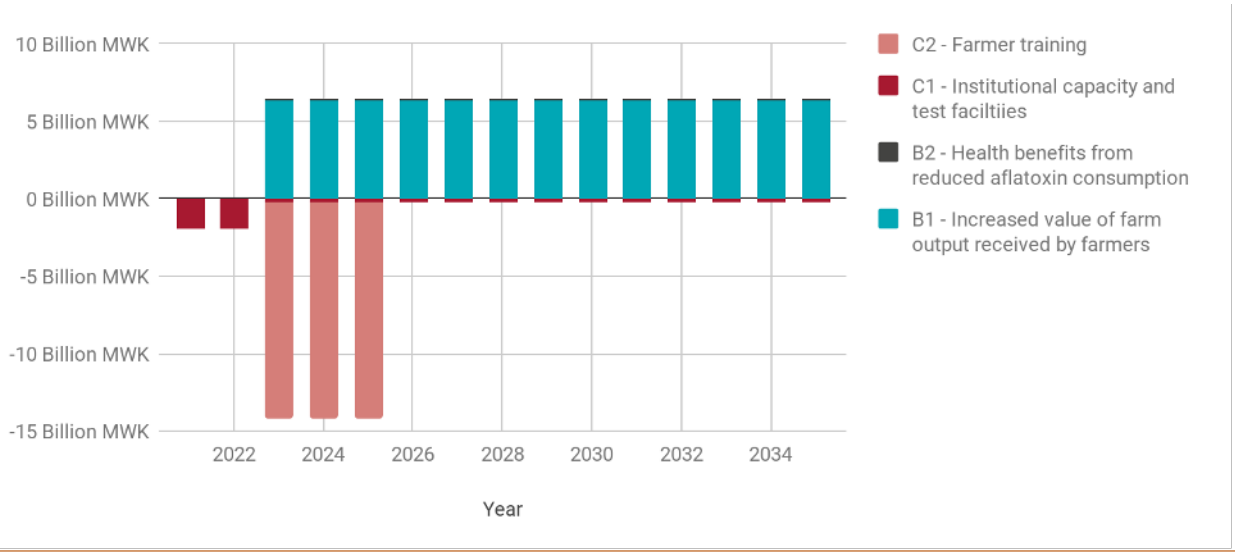
The methodology for calculating the benefits of this intervention measured the difference between the premium price paid for higher grade products that could be sold in larger, formal markets (ESA and EU), and the regular market price for ungraded product, and estimating the share of a commodity that farmers would be able to sell at the higher market price if proper grading measures were introduced. In addition, the intervention will have health benefits, measured by the disability adjusted life years (DALYs) averted by reduced consumption of aflatoxin-contaminated groundnuts that meet higher grade standards.

The CBA of removing the export ban on maize compares the consumer surplus and producer surplus with a higher regional price, and with the status quo local price that is observed with the export ban in place.

Table 5.1: Intervention benefit-cost ratios

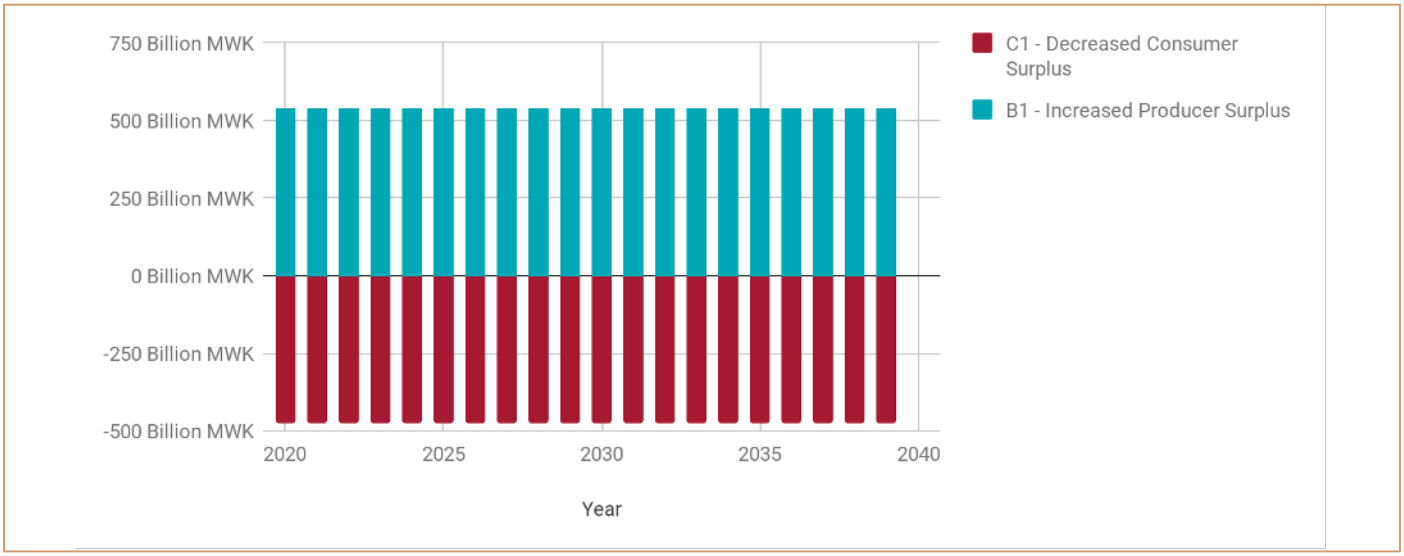
Intervention	Benefit-Cost Ratio		
	5% Discount Rate	8% Discount Rate	14% Discount Rate
Quality control intervention	1.4	1.2	1
Export ban removal[11]	1.13	1.13	1.13

Figure 5.1: Summary of results for quality control CBA



[11] Note that BCRs do not change as a function of discount rate because average impacts are evenly distributed across all periods

Figure 5.2: Summary of results for export ban CBA



All of the interventions proposed have expected benefit-cost ratios above one, even when the highest discount rate is used (14 percent). When the discount rate of five percent is used, benefit-cost ratios are 1.4 for quality control and 1.13 for the export ban removal. This suggests that each of the two interventions could yield positive results on their own while being somewhat cost-effective. Although the BCRs are not high, the interventions merit further consideration.

It is important to note that the analysis conducted here is based on conservative assumptions about the scale of the sector. In both CBAs, it is assumed that the level of production will remain the same. However, it is reasonable to assume that the stability of policies and the opportunity to sell groundnuts at premium prices can increase investor confidence for expanding the production of maize and groundnuts. It can also be argued that more farmers would aim to improve their post-harvest handling techniques once they realise the potential for increased revenue from reducing the levels of aflatoxin.

In addition, it is important to note that historically, groundnuts were an important export for Malawi. In this analysis, we only examine the benefits for smallholder farmers, but not for government, or projected impacts that could increase with the growth of the groundnut value chain. We also do not consider the potential value-addition that increased quality groundnut production could have for the country to agro-processing opportunities.

In relation to the export ban analysis, we intentionally use a simplified model because of the overlap between producers and consumers. Although removing the export ban would result in a significant increase in maize prices, about 60% of consumers are also producers (Aragie et al., 2018), so this group would likely have positive net welfare outcomes. However, this additional cost is expected to have negative welfare effects on those who consume but do not produce maize - i.e. the rural landless and urban poor. Policies would need to be put into place to ensure this group of individuals is not significantly affected. The allocation of the net impact among the rural poor, rural landless and urban dwellers would require additional assumptions related to maize consumption, employment, etc. and so was beyond the scope of this analysis. Such policies fall under income redistribution frameworks of the government that are set a broader level than a single crop.

5.1 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.

Proportion of premium groundnuts

For the first intervention, the proportion of groundnuts that qualify as premium is the main driver of both benefits examined in the analysis. In the model, we assume that 9% of total groundnut production would qualify as premium, based on the experience of the Mchinji Area Smallholder Farmers Association, which currently sells premium groundnuts through a fair trade agreement to the EU. However, we would expect that the proportion of groundnuts that qualify as premium would increase over time as more farmers are trained in proper pre- and post-harvest methods and realize increased profits for premium grade products. We consider alternatives in the table below.

Table 5.2: Sensitivity analysis for proportion of groundnuts that qualify as premium

Scenario	Proportion of premium groundnuts	BCR @ 8% - Intervention 1
Current	9%	1.2
Alternative 1	5%	0.68
Alternative 2	12%	1.6
Alternative 3	15%	2.0

Proportion of price gap due to quality

The main benefit of the groundnut quality intervention is derived from measuring the difference between domestic and international prices for groundnuts and estimating what percentage of this difference is due to quality. In the model, our base assumption is that 30% of the gap is due to quality. However, alternative values are considered below.

Table 5.3: Sensitivity analysis for proportion of price gap due to quality

Scenario	Proportion of premium groundnuts	BCR @ 8% - Intervention 1
Current	30%	1.2
Alternative 1	20%	0.83
Alternative 2	40%	1.6
Alternative 3	50%	2.03

Demand elasticity

The price elasticity of demand for maize is a key input that drives the results of Intervention 2. In our model, we assume a demand elasticity of -0.8, which means the consumer will reduce consumption by roughly 80% of the percentage change in price. We consider alternative values in the table below.

Table 5.4: Sensitivity of BCR to change in price elasticity of demand

Scenario	Elasticity of demand (ϵ^D)	BCR @ 8% - Intervention 2
Current	-0.8	1.13
Alternative 1	-2.0	1.00
Alternative 2	-1.6	1.04
Alternative 3	-1.2	1.08
Alternative 4	-0.4	1.18
Alternative 5	0.0	1.23

Note that as the elasticity of demand becomes greater in magnitude (becomes a lower negative number), the BCR of the intervention decreases. This is because the consumer surplus loss is increasing. If elasticity of demand is greater in magnitude than the elasticity of supply, the BCR indicates a net loss for the intervention. This is unlikely to be the case for a staple grain such as maize however.

Supply elasticity

The price elasticity of supply for maize is another key input that drives the results of Intervention 2. We assume a supply elasticity of 2.0, which means the producer will increase production of maize by 2 times of the percentage change in price. We consider alternative values in the table below.

Table 5.5: Sensitivity of BCR to change in price elasticity of supply

Scenario	Elasticity of demand (ϵ^s)	BCR @ 8% - Intervention 2
Current	2	1.13
Alternative 1	0	0.91
Alternative 2	0.50	0.97
Alternative 3	1.00	1.02
Alternative 4	1.50	1.08
Alternative 5	2.50	1.18
Alternative 6	3.00	1.24

As the elasticity of supply increases, the BCR increases, which is the result of more maize being sold at higher prices, which offsets more of the loss in consumer surplus. If the supply elasticity is less in magnitude than the demand elasticity, the intervention will generate negative results (BCR<1). This is relatively unlikely however, given food consumption is typically inelastic, and that agricultural supply elasticity is typically elastic, at least in the long run.

International maize prices

International maize prices are subject to fluctuations which can impact the results of our proposed intervention. In our base estimates, we assume an average price of 0.4 USD/KG, which was the mean price in Mozambique over the past 10 years. However, within this period prices fluctuated, with a standard deviation equal to 0.8. The following table considers different average international price values going forward.

Table 5.6: Sensitivity of BCR to change in average future international price

Scenario	Regional maize price (USD/KG)	BCR @ 8% - Intervention 1
Current	0.40	1.13
Alternative 1	0.30	1*
Alternative 2	0.50	1.32
Alternative 3	0.60	1.45

**At this price exporting will not occur due to transportation costs*

Obviously, the international price has a significant impact on the BCR of this intervention given that both consumer surplus losses and producer surplus gains will increase with the deviation in prices.

Domestic maize prices

Similarly to international maize prices, domestic prices in Malawi have, and will continue to fluctuate. The average price in Malawi over the past 10 years was 0.24 USD/KG, with a standard deviation of 0.07. The following table considers different average national price values going forward, as would be relevant if the export ban is not removed.

Table 5.7: Sensitivity of BCR to change in average future domestic price

Scenario	Regional maize price (USD/KG)	BCR @ 8% - Intervention 1
Current	0.24	1.13
Alternative 1	0.10	1.66
Alternative 2	0.20	1.24
Alternative 3	0.30	1*

**At this price exporting will not occur due to transportation costs*

Similar to international prices, the more deviation between local and international prices (in this case associated with lower prices domestically) the greater the BCR. This is again because the producer surplus and consumer surplus are more affected by greater changes in prices.

In conclusion, both interventions considered in this analysis have a conservative BCRs above 1. This suggests that removal of the export ban and investment into improved grading processes could both yield important benefits, particularly for smallholder farmers, but that critical assumptions would have to be carefully considered when designing the intervention.

There are a wide variety of barriers preventing Malawi from exporting more high value crops. It was not within the scope of this analysis to consider all options. Future research would benefit from considering the efficacy of pre- and post-harvest practices to improve the quality of crop outs, as well as new developments to reduce aflatoxin, such as Alfasafe products as more evidence is generated.

References

Anitha, S. et al., 2019. Knowledge, Attitude and Practice of Malawian Farmers on Pre- and Post-Harvest Crop Management to Mitigate Aflatoxin Contamination in Groundnut, Maize and Sorghum—Implication for Behavioral Change

Aragie, E et al., 2018. Achieving food security and industrial development in Malawi: Are export restrictions the solution? World Development: Aug; 108: 1–15.

Atlas of Economic Complexity, 2018. The Atlas of Economic Complexity by @HarvardGrwthLab. atlas.cid.harvard.edu/countries/152.

Bandyopadhyay, R. et al. 2019. "Ground-Truthing" Efficacy of Biological Control for Aflatoxin Mitigation in Farmers' Fields in Nigeria: From Field Trials to Commercial Usage, a 10-Year Study

Barrett, C. 2008. "Smallholder market participation: Concepts and evidence from eastern and southern Africa." Food Policy 33: 299–317.

Baulch, B and Botha, R. 2020. Can a maize price band work in Malawi? MaSSP Policy Note 38. Washington, DC: International Food Policy Research Institute (IFPRI).

Diaz Rios, L. et al, 2013, Malawi Programme for Aflatoxin Control (MAPAC): Advancing Collaboration for Effective Aflatoxin Control in Malawi.

Edelman, B, 2016. Discretionary Maize Policy Interventions in Malawi: An Impact Analysis of Export Bans and Minimum Farm Gate Prices. IFPRI, July 2016

Edelman, B, and Baulch, B. 2016. Are Malawi's Maize and Soya Trade Restrictions Doing More Harm Than Good? Washington, DC: International Food Policy Research Institute (IFPRI).

FAO Commodity Studies, 2003. 'Issues in the Global Tobacco Economy – Selected Case Studies', Food and Agriculture Organization, Rome, United Nations

FAO, 2014. Analysis of price incentives for groundnuts in Malawi. Technical notes series, MAFAP, by Gourichon, H., Mkomba, F., Rome.

FAO, 2015. Country Fact Sheet on Food and Agricultural Policy Trends.

FAO, 2015. Analysis of Price Incentives for Sugar in Malawi 2005-2013

FAO, 2018. Food loss analysis: causes and solutions - Case study on the groundnut value chain in the Republic of Malawi. Rome. 50 pp. Licence: CC BY-NC -SA 3.0 IGO.

Gohka et al., 2012. Using Multi Criteria Decision Analysis to Identify and Prioritize Key Sanitary and Phytosanitary Capacity Building Options and Needs for Malawi. USAID, Malawi.

Gourichon, H., Cameron, A. & Pernechele, V., 2017. Assessing the policy environment for cash crops in Malawi: what could hinder the achievement of the National Export Strategy objectives?FAO Agricultural Development Economics Working Paper 17-02. Rome, FAO.

ICRISAT, 2011. Legume Diversification in Smallholder Tobacco Systems of Malawi: Climate Risk Management and Market Opportunities: End of Project Report.

Jaffe, S., 2003. Malawi's Tobacco Sector: Standing on One Strong Leg is Better Than on None. Africa Region Working Paper Series No. 55

Jordan, D., et al., 2018. Preventing mycotoxin contamination in groundnut cultivation. Achieving sustainable cultivation of grain legumes. Volume 2 (pp.181-211)

Kafakoma and Mataya, 2009. Timber value chain analysis for the Viphya Plantations. Malawi Forest Governance Learning Group.

Ksoll et al., 2016. Impact of Village Savings and Loan Associations: Evidence from a cluster randomized trial. Journal of Development Economics, Vol 120: 70-85

Limbikani M., et al., 2015. Concentrating aflatoxins on the domestic market through groundnut export: A focus on Malawian groundnut value and supply chain. Food Control: 51:236–239

"Market Indicators." Malawi Investment and Trade Center: Trade Information Portal, Governmentof Malawi, 2021, mitc.mw/trade/index.php/market-indicators.html.

Minot, N., 2014. Food price volatility in sub-Saharan Africa: Has it really increased? Food Policy, Volume 45, April 2014, Pages 45-56

Monyo E. et al., 2010. Assessing Occurrence and Distribution of Aflatoxins in Malawi: Final Project Report. ICRISAT and NASFAM.

Msiska F. and Matumba L., 2018. Economic Impact Assessment and Management of Aflatoxin in Malawi. Final report for Ministry of Agriculture, Irrigation and Water Development, Ministry of Trade and Industry, Ministry of Health and African Union- PACA Secretariat

National Export Strategy (NEP), 2013-2018. Ministry of Industry and Trade, 2012.

National Agricultural Investment Plan (NAIP): Prioritised and Coordinated Agricultural Transformation Plan for Malawi FY2017/18-2022/23, Ministry of Agriculture, Irrigation and Water Development, 2018.

Nyondo, C., et al., 2018. Systematic Analysis of Groundnut Production, Processing and Marketing in Malawi, Feed the Future Innovation Lab for Food Security Policy Research Brief 64. East Lansing: Michigan State University

Porteous, O., 2017. Empirical effects of short-term export bans: The case of African maize. Food Policy Vol 71, August 2017, Pages 17-26

Pound B. and Phiri A., 2010. Longitudinal Impact Assessment Study of Groundnut Producers

Robinson, L., Hammitt, J., Jamison, D., and Walker, D., 2019. Conducting Benefit-Cost Analysis in Low- and Middle-Income Countries," Journal of Benefit-Cost Analysis, 10(S1): 1-14

Robinson, et al., 2019. Valuing Mortality Risk Reductions in Global Benefit-Cost Analysis. Journal of Benefit-Cost Analysis. 10. 1-36. 10.1017/bca.2018.26.

Sassi, M., 2015. The welfare cost of maize price volatility in Malawi. Bio-based and Applied Economics. 4. 10.13128/BAE-14996.in Malawi: Main Report. Fairtrade Foundation.

SQUAM Project Newsletter, 2017. http://mbsmw.org/wp-content/uploads/2017/10/SQAM-Newsletter-March-Issue-2017.pdf

Tsusaka, et al., 2016. Evolution and impacts of groundnut research and development in Malawi: An ex-post analysis. African Journal of Agricultural Research. 11. 139-158. 10.5897/AJAR2015.10167.

UNIDO, 2012. Independent Evaluation of the UNIDO Project: Capacity Building for Aflatoxin Management and Control in Groundnuts in Malawi.

UNIDO, 2015. Malawi Factsheet. https://www.unido.org/sites/default/files/2015-06/Factsheet_Malawi_21.05_0.pdf

The causes of high intra-regional road freight rates for food and commodities in Southern Africa

Vilakazi, TS, 2018. The causes of high intra-regional road freight rates for food and commodities in Southern Africa, Development Southern Africa

Wilson, P, 2014. Malawian Agriculture: The Commercialization Challenge. Departmental Working Paper 2014-3

World Bank, 2018. Malawi - Systematic Country Diagnostic: Breaking the Cycle of Low Growth and Slow Poverty Reduction. Report No. 132785.

World Bank, 2020. The World Bank in Malawi: Overview. www.worldbank.org/en/country/malawi/overview.

World Bank, 2020b. Malawi Economic Monitor: From Crisis Response to Strong Recovery. July 2020.

Walker, S., and Davies, B., 2020. Farmer perceptions of aflatoxins: implications for intervention in Kenya. In Aflatoxins: Finding solutions for improved food safety, eds. Unnevehr, Laurian J. and Grace, Delia. 2020 Vision Focus 20(7). Washington, D.C.: International Food Policy Research Institute (IFPRI)

Zuza E et al., 2017. Effect of Harvesting Time and Drying Methods on Aflatoxin Contamination in Groundnut in Mozambique. Mycotoxins - Impact and Management Strategies. Ed. Njobeh, P.B and Stepman, F.

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Cost-benefit analysis of interventions to encourage agricultural exports in Malawi