

Assessing market prospects for grain legumes in Malawi

Joseph Dzanja*

Department of Agribusiness Management, Faculty of Development Studies, Lilongwe University of Agriculture and Natural Resources, Lilongwe, Malawi. E-mail: jdzanja@bunda.luanar.mw

Miriam Matita

Department of Extension, Faculty of Development Studies, Lilongwe University of Agriculture and Natural Resources, Lilongwe, Malawi. E-mail: mmatita@bunda.luanar.mw

Henry Kankwamba

Department of Agricultural and Applied Economics, Faculty of Development Studies, Lilongwe University of Agriculture and Natural Resources, Lilongwe, Malawi. E-mail: hkankwamba@gmail.com

Michael Dolislager

Department of Agricultural, Food, & Resource Economics, Michigan State University Morrill Hall of Agriculture, East Lansing, MI. E-mail: dolislager@gmail.com

David Tschirley

Agricultural, Food, and Resource Economics, Michigan State University, Justin S Morrill Hall of Agriculture, East Lansing, MI. E-mail: tschirle@anr.msu.edu

*Corresponding author

Abstract

This paper explores the possibility of markets supporting the uptake of multipurpose legume cropping systems by providing growth in demand in the future for these legumes. The analysis uses expenditure elasticities generated from cross-sectional and secondary data to evaluate alternative scenarios for future growth in product demand. A “market mapping” exercise quantified the structure and flows of pulses within the Malawi’s domestic production and marketing system. Based on scenarios of 1% and 4.5% annual growth in real per capita income, total direct demand for legumes is projected to rise between 3.5% and 6.3% per year. Growth prospects were strongest for soybean, followed by pigeon pea and groundnut, and finally cow peas. However, growth prospects are threatened by aflatoxin contamination in groundnuts, hence the need for continued efforts on all levels to reduce its occurrence. Further, women entrepreneurs are confined to retail markets, and growing their businesses through processing technologies would increase their returns.

Key words: legumes; markets; Malawi agri-food systems

1. Introduction

Malawi is a landlocked country in Southern Africa, with an economy driven predominantly by an agricultural sector that accounts for one third of GDP and nearly 80% of employment (FAO 2015). Tobacco contributes 60% of exports, with sugar and tea contributing a further 20%. Maize is the dominant staple food, and is allocated 80% of cultivated land in the smallholder sector. The estate sector contributes about 90% of total exports (Franke *et al.* 2014). Agricultural productivity in the region is poor, with annual national average grain yields from 2008 to 2012 varying between 0.3 and 2.2 t/ha in Malawi, Mozambique and Zimbabwe (FAOSTAT 2014). Poor crop productivity has partly been addressed by the Farm Input Subsidy Programme (FISP) (Chibwana *et al.* 2012), which has

contributed to raising national maize productivity and slightly reducing rural poverty, but is not without controversy. Households participating in FISP have been found to simplify crop rotations by allocating more land to maize and tobacco at the expense of other crops (Chibwana *et al.* 2012). The over-reliance on maize has led to repeated recommendations for crop diversification using legumes.

Grain legumes, whose improved seeds are provided under FISP, provide more promising entry points to diversify cropping systems and enhance soil fertility management due to their multiple benefits, including a high content of protein and minerals, plus the ability to improve N availability in the soils (Yusuf *et al.* 2009).

Several studies have been carried out on legume crops in Malawi, targeting soybean and groundnut market efficiency. For example, studies on the spatial integration of markets for beans in Malawi (e.g. Mtumbuka *et al.* 2014) concluded that legumes tend to move in the same direction, implying market co-integration. Research on grain legume cropping systems has demonstrated that these systems are capable of substantially improving the agronomic sustainability and long-term productivity of agriculture in Malawi (Mhango *et al.* 2013). However, this requires that these systems and their constituent crops be widely adopted. The purpose of this paper is therefore to assess market growth prospects for these legumes in Malawi over the next 15 years, as one crucial element in assessing the likelihood and challenges of ensuring widespread adoption of these cropping systems.

The paper proceeds as follows: Section 2 reviews the data and the methods used. Section 3 is on the results, characterising the national and regional patterns of production, marketing and consumption of soybean, pigeon pea, cowpea and groundnut, using data from Malawi's 2010/2011 Integrated Household Survey. Section 4 quantifies the structure of the marketing system for grain legumes serving the local consumer market in Lilongwe City, estimating market shares for key supply regions, the key wholesale markets where retail traders obtain these products, and the key retail markets in the city, while Section 5 considers gender balance in the system. Section 6 quantitatively and qualitatively assesses growth prospects for crops with respect to local demand, exports and processing, and what drives their *derived demand*. The reason for the focus on processing is that recent research shows high growth prospects for processed foods in Africa over the coming decades (Tschirley *et al.* 2014). Section 7 concludes the paper.

2. Data and methods

Key data used in this paper were the 2010/2011 Integrated Household Survey (IHS), "market mapping" data, and company interviews. This section briefly discusses each source of data and the methods applied to it.

2.1 The 2010/11 Integrated Household Survey (IHS)

This is the latest nationally representative household expenditure survey in Malawi. Some 12 288 randomly selected households were interviewed across nearly 800 "enumeration areas" spread throughout the country. Data from the survey allowed the estimation of total production, sales and consumption of these crops. All analysis was done using population weights as developed by Malawi's national statistical agency for this survey.

2.2 Market-mapping data

Data were also collected from some key produce markets for market mapping, to provide a cost-effective, but methodologically defensible, estimate of: (a) the structure of the marketing system serving a defined centre of demand (typically a city). Structure is defined in terms of key marketplaces

in retail, wholesale and assembly, and key production zones supplying the centre of demand; and (b) the share of each market in flows through the system, and of each production zone in total supply.

Research data were collected from a series of market surveys, starting with retail markets. The data collected were used to identify key markets at wholesale and assembly markets. Surveys at those levels were used to identify key production zones. Three steps were followed at the retail market level. First, as many retail markets as possible in the urban centre were identified using an iterative approach crossing municipality data, local researcher knowledge and selected market visits. Second, each market was visited and a rapid count of the number of traders of each of the target crops was conducted. Finally, markets were listed in descending order of total number of traders of target crops, and a rapid, questionnaire-based survey was conducted in enough markets (starting with the largest and working down) to cover at least two-thirds of the number of counted traders across all markets.

The study identified the first, second and third most important supply sources used by each trader over the preceding 12 months for the target crops. These were typically wholesale markets, but could also be production zones. The idea was to find the share of each trader's total supply that came from the most important supply source. The identified wholesale or assembly markets were used as supply sources by retailers and the relative size of each was quantified. The top two or three of the identified markets were then surveyed with a similar questionnaire, which served to identify and estimate the market size of rural areas and markets where traders selling in these markets obtained their product.

The study assumes equal average size of daily transactions per trader across markets within a market level. Using the market mapping technique, an estimation of market shares of retail markets in urban centres was possible. The research team identified and compared procurement by retail traders directly at farm and wholesale markets. The identified wholesale markets, production areas and rural markets supplying wholesale markets were those frequented the most by retailers. The assumption of equal mean daily transactions per trader across markets reduced potential errors and was justified based on very low barriers to entry into retail trade in countries such as Malawi, which would tend to drive convergence of daily returns (and thus daily volumes) across traders. Out of 576 fully completed interviews at the retail level, only 85 (15%) listed three supply sources – all others listed one (52%) or two (33%). Thus, in 85% of cases, this approach yielded definitive answers on the share of total supply coming from each source (100% in the 301 cases listing only one source, and 100% minus indicated share from the top source in all cases listing only two supply sources). In the 15% of cases indicating three supply sources, shares were calculated as follows: top supply source: as indicated by trader; second supply source: 67% of (100% - percentage from top source); and third supply source: 33% of (100% - percentage from top source).

Of the 85 cases (15%) listing three supply sources at retail, 24 (29%) indicated that *all or nearly all* their supply came from the top source, and 42 (50%) indicated that *more than half* came from this source; either response leaves a small share coming from the third supply source. The amount of potential error from the computation method shown above, which involves an admittedly arbitrary assumption of a 2:1 ratio of size of secondary versus tertiary supply source, thus introduces very little error into the calculation of relative market sizes.

At the wholesale/assembly level, 29 of 155 completed questionnaires (19%) indicated three supply sources. Of these 29, 17 indicated that the top source provided all or nearly all of their supply, and nine indicated the top source provided more than half. Again, potential errors from our simplifying assumption above were thus very low at the wholesale/assembly level.

2.3 Qualitative data from interviews with grain legume traders and processors

Nine companies were interviewed in Lilongwe and Blantyre cities. The focus was on trade in grain legumes – the share of each going into processing, direct local sale or exports; growth over the past three to five years; and the level and source of anticipated growth over the next three to five years. Key policy issues affecting their business were also discussed. Table 1 provides information on each interview.

Table 1: Interview with grain legume trading and processing companies

Company name (person interviewed and location)	Legumes bought	Processed legume-based products	Notes
Export Trading Group (ETG): Marketing Manager (Blantyre), Procurement Team Member (Lilongwe)	Pigeon pea (Pp), soybean (Sb), groundnut (Gn), cowpea, common beans	Pp: dal, animal feed Sb: likuni phala, soya pieces	Major African multinational. Increasing capacity for expected growth in markets for soya pieces, peanut butter, soya cooking oil and animal feed.
RAB Processors: Managing Director (Blantyre)	Soybean, pigeon pea, groundnut, cowpea, common beans	Sb: likuni phala, animal feed Pp: dal Gn: peanut butter, roasted nuts	Large local company involved in all aspects of legume industry. Producing soya pieces for local market and graded/ blanched groundnuts for export market.
Universal Industries: Group Food Technologist (Blantyre)	Soybean, groundnut	Sb: instant porridge, soya pieces, cooking oil, biscuits Gn: biscuits, peanut butter	Highly diversified food-processing company. Instant soybean-based porridge is in demand in rural areas for nutritional supplementation.
Sunseed Limited: Managing Director (Lilongwe)	Soybean, groundnut	Sb: cooking oil, animal feed Gn: cooking oil, animal feed	A local cooking oil company that views oil as a by-product of animal feed, because animal feed has greater profit potential.
Transglobe: Warehouse/Logistics Manager (Blantyre)	Pigeon pea, soybean, cowpea, groundnut, common beans	Pp: dal Sb: likuni phala, animal feed	The agricultural trade and exporting arm of locally based Tayub Corporation. Will be adding production lines for soya pieces to other processing activities.
Demeter Agriculture Limited/Farmer's World: Administration Manager (Lilongwe)	Groundnut, soybean, pigeon pea, cowpea, common beans	None	Local company owning multiple Malawian companies, including Demeter Agriculture Limited. Business focus is on selling inputs and trading unprocessed production.
Agricultural Commodity Exchange (ACE): Trade Specialist (Lilongwe)	Soybean, pigeon pea	None	Local, donor-subsidised non-profit that facilitates the trade of maize and legumes. They do not engage in processing.
ADMARC Limited: Marketing Manager (Blantyre)	Groundnut, soybean, cowpea, common beans	Gn: grading Pp: dal	Malawian parastatal. Primary processing activities are cotton ginning and rice milling. Considered industry leader in groundnut grading. Anticipates growth in production of dal, and intends to enter growing markets of peanut butter and animal feed.
Afri-Nut: Operations Manager (Lilongwe)	Groundnut	Gn: grading, ready-use paste, cooking oil, animal feed	Local company involved in trading, grading, storing and early stage processing of groundnuts to be sold to other processors for final processing.

Note: Pp: pigeon pea; Gn: Groundnuts; Sb: soybean

2.4 Analytical framework

The general modelling approach used to project future demand for grain legumes was adopted from Tschirley *et al.* (2013) and Tschirley *et al.* (2014). For this paper, comparable methods were applied to the Malawi 2010/2011 IHS data for the derivation of demand elasticities and budget shares and the projection of demand under two scenarios from 2010 to 2025. *Demand elasticities* are statistical parameters that capture percentage change in consumer demand for a given item in response to a one percent change in consumer incomes. To generate them, statistical techniques are used that exploit variation in incomes and demand across households in the dataset.

3. Results

All results are based on data from IHS 2010/2011.¹ Three points stand out in Table 2. First, groundnut and pigeon pea dominate production, but groundnut alone dominates local consumption. This pattern reflects a strong export market for pigeon pea, while groundnut is primarily consumed locally. Second, soybean is the most intensively marketed crop: relative to each crop's total production, nearly twice as much soybean is marketed as any other crop. This is not surprising, given that soybean was not traditionally produced in Malawi and that its recent rapid expansion was driven almost entirely by demand for animal feed, complemented more recently by an emerging market for human consumption (see below). Third, cowpea production and sales are tiny compared to other crops, with production only one-sixth that of soybeans and sales less than one-tenth.

Three points can be highlighted in Table 3. First, production and sales of soybean, pigeon pea and groundnut are highly regionally concentrated. For soybean, 83% of production and 93% of sales come from the central region; 97% of pigeon pea production and 98% of sales are from the southern region; and 77% of groundnut production and 86% of sales are from the central region. Pigeon pea, in fact, is a crop entirely of the southern region, accounting for 97% to 98% of production, sales and consumption out of own production, and 89% of consumption out of purchases.

Table 2: Production, Marketing, and Direct Consumption of Grain Legumes in Malawi

	Production (MT)	Sales (MT)	% Sold	Sales ('000 USD)	Price (USD/MT at farm)	Direct consumption ('000 USD)
Soybean	28 094	19 371	69%	8 194	423	20 288
Pigeon pea	77 487	20 773	27%	8 716	420	68 806
Cowpea	4 929	1 738	35%	812	467	28 920
Groundnut	102 574	28 204	27%	22 878	811	171 158
Other legumes	32 612	9 530	29%	6 679	701	213 548
Soybean	11%	24%		17%		4%
Pigeon pea	32%	26%		18%		14%
Cowpea	2%	2%		2%		6%
Groundnut	42%	35%		48%		34%
Other legumes	13%	12%		14%		42%

Notes: sales are valued at prices received by farmers at farm gate or in rural markets; consumption is valued at consumer purchase prices

Second, markets lead to the consumption of soybean and groundnut that is more spatially dispersed than their production, but markets do not do this for pigeon pea. In other words, soybeans and groundnuts are consumed well beyond their production areas, while pigeon pea tends to be consumed only where it is produced. This pattern is evident, as the shares of different regions in total national

¹ Note: the production figures are lower than those provided in FAO, which are based primarily on official data.

consumption from purchases are much less variable than those same shares when based only on consumption from production; and both these shares are less variable across regions than are production shares. For example, the central region produces 77% of all groundnuts, but accounts for only 43% of all consumption from purchases. For soybean, these figures are 83% and 57% respectively. Furthermore, correlations in the final two columns show consumption from purchases is much less correlated with production than is consumption from own production (for all but cowpea). The impact of markets on this redistribution is greatest for groundnuts.

The third and last point is that cowpea production in the central region appears to be more commercialised than in other areas – this region accounts for only 24% of national production but 51% of national sales value.

Table 3: Regional dimensions of grain legume production, sales and consumption in Malawi

	Production share	Sales value share	Consumption share from:		Correlations, production share with:	
			Own production	Purchases	Consumption from own production	Consumption from purchases
Soybean						
Northern	13%	6%	18%	14%		
Central	83%	93%	78%	57%	1.00	0.90
Southern	4%	1%	4%	29%		
Pigeon pea						
Northern	0%	0%	0%	2%		
Central	3%	2%	2%	9%	1.00	1.00
Southern	97%	98%	98%	89%		
Cowpea						
Northern	23%	5%	12%	6%		
Central	24%	51%	47%	43%	0.52	0.78
Southern	53%	45%	41%	51%		
Groundnut						
Northern	6%	3%	13%	15%		
Central	77%	84%	65%	43%	1.00	0.64
Southern	17%	13%	22%	42%		

Note: Correlation is between production share and consumption share from purchases.

4. Structure and flows in local consumer market

The production and consumption discussed in the previous section are connected through a dense network of marketplaces, many of them “informal”. The stylised flow of product starts with rudimentary rural assembly points, often with no infrastructure of any kind, where farmers sell their products; the product then flows through wholesale markets and on to retail markets in cities and towns throughout the country. In practice, some share of the flow can “skip” stages and, for example, be purchased directly by a retail trader for sale to consumers in the retail market. Because supermarket penetration is incipient at best in Malawi, the clear majority of Malawian consumers obtain most of their food from such markets at retail – open-air marketplaces that may or may not be sanctioned by local government structures. Thus, the structure of these informal markets and flows through them provide an understanding of how most farmers sell their product and how most consumers obtain it. This section reports the results of a market-mapping exercise that captured this structure and flow.

Figure 1 shows the structure of the local consumer market supplying Lilongwe City with grain legumes derived from retail and wholesale market-mapping data. The percentages in the figure refer to all legumes included in the study – soybean, cowpea, pigeon pea and groundnut. Several results stand out. First, the Dedza and Lilongwe districts of the central region dominate supplies for the city, providing 52% and 37% respectively of the city’s total supply. This pattern is consistent with two known facts: the dominance of the central region in the production of groundnuts and soybean, and

the minimal consumption of pigeon pea outside of the southern region, where almost all its production takes place.

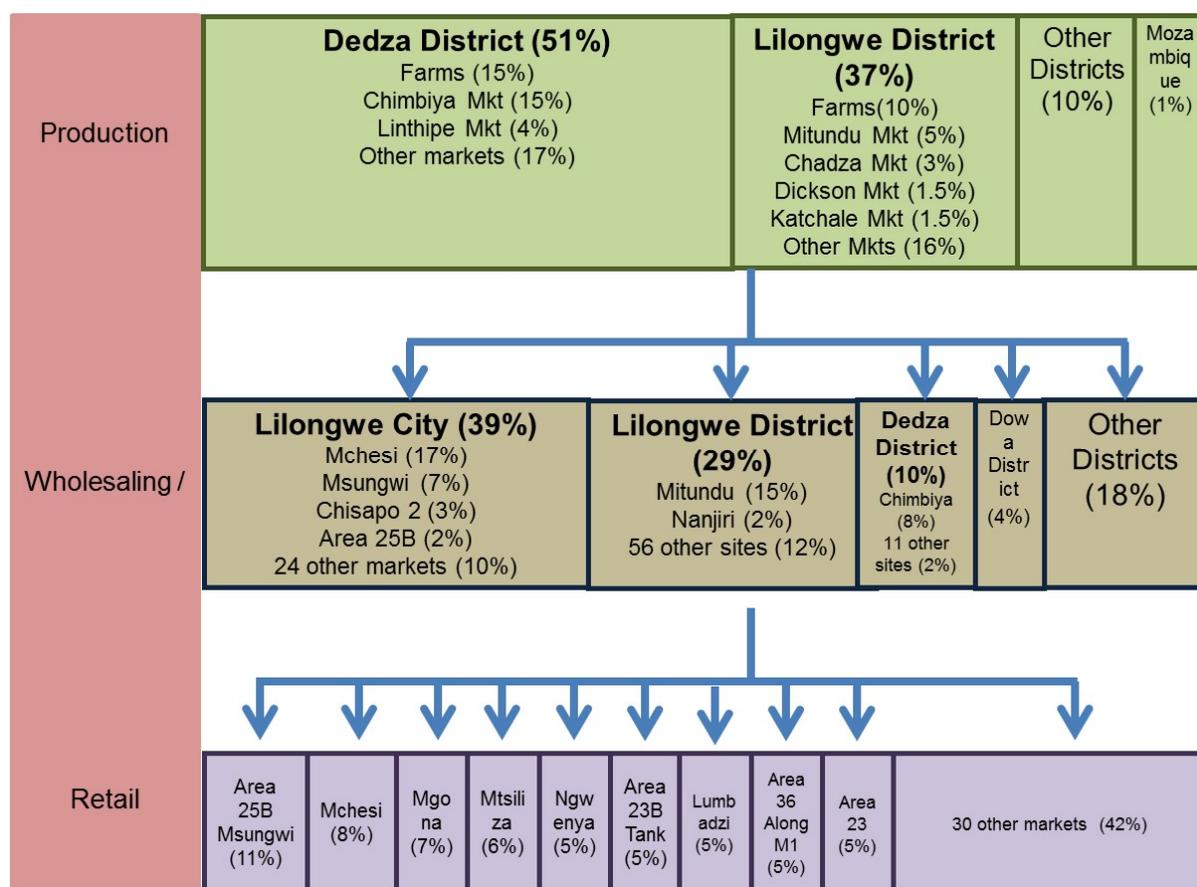


Figure 1: Structure and flows in the local consumer market serving Lilongwe City with grain legumes

Second, in the rural areas, farmers dominantly sell in rural assembly markets, which account for about 75% of all purchases from farmers. Only about one-quarter (26%) of purchases from farmers are made by traders directly at the farms. Malawi appears to have a dense system of rural assembly markets, something not always seen in its less densely populated neighbouring countries.

Third, Lilongwe has no dominant wholesale market. In fact, it has a highly dispersed system of small assembly markets feeding into retail markets. The system is best not even referred to as wholesaling, due to its dispersed structure and the likelihood that nearly all traders operate on a very small scale. This dispersed structure is shown by two facts: (1) no single market accounts for more than 17% of total supply to retail markets (Mchesi is the top market for supplying retailers), and (2) a total of over 100 separate locations were identified by retail traders as places where they regularly purchased product. This is an extremely high number, reflecting a great dispersion of trade compared to other countries in the region, such as Mozambique and Zambia. As an additional indicator of this highly dispersed structure, retail traders purchased over 60% of their supplies in markets outside of Lilongwe City, rather than in one of the “wholesale” markets. This pattern is also unusual when compared to neighbouring countries, where urban retail traders primarily purchase either from their own market or from a dominant wholesale market located elsewhere within the city or in its near outskirts.

A final key result from the figure is that retailing itself is highly dispersed, with nearly 40 identified markets and the largest, Area 25B Msungwi, holding only an 11% market share.

The patterns of trade by product differ very little: Mitundu and Mchesi are first and second respectively in supplying groundnuts and soya bean to retailers, and Mchesi is first in pigeon pea and cowpea. The only slight difference is found in pigeon pea, where two markets in the southern region – Lizulu in Ntcheu District and Kubanda in Balaka District – rank third and fifth, with 7% and 6% respectively, of the supply to retailers. This of course is not surprising, given the strong dominance of the southern region in pigeon pea production.

Thus, the key result of the market-mapping exercise is this highly dispersed structure of trade. Such a system also implies very low transaction volumes for traders, which implies the need for them to charge high percentage margins to earn a living wage. One important aspect of promoting demand for dry pulses in the country will be reducing unit costs in marketing, and this can happen only as the scale of operation of traders increases.

5. Gender balance

Wholesale trade is dominated by males, who comprise 82% of all traders at this level. At retail, female traders make up about half of all traders: the market-counting exercise conducted across all identified markets prior to the market-mapping survey showed 477 out of 974 traders (49%) were female, while the market-mapping exercise itself resulted in a 51% female share at the retail level. The dominance of males at the wholesale level and the greater role of females at the retail level is a common pattern throughout east and southern Africa, likely reflecting more limited access to capital for females that prevents most of them from entering the wholesale trade, but making retailing an attractive livelihood option. Furthermore, retail outlets are generally closer to homes than wholesalers, a phenomenon that suits women who may have many domestic chores.

6. Growth prospects

Based both on company interviews and on simple modelling of future demand scenarios, it is concluded that, if income growth remains positive, market growth prospects are strong for grain legumes in Malawi. Growth prospects for soybean are considered strongest, followed by either pigeon pea or groundnut, depending on the factors discussed below. Cowpea's longer term growth prospects are limited unless new food-processing strategies are developed to make intensive use of this crop.

This positive assessment is based on two factors: the country's rapid population growth, which is projected to remain near 3% per year, and, paradoxically, its very low average incomes. These low incomes lead consumers to devote a large share of additional income to food expenditure. Any positive per capita income growth will thus lead to impressive growth in total market demand within the country. Regarding this latter factor, most of the interviewed companies saw robust growth in an urban middle class in Malawi, and considered this a major reason for optimism regarding market prospects.

Below we first discuss formal projections of growth prospects for the domestic market, followed by a discussion of prospects for growth in processing and exports.

6.1 Projecting growth in local demand

Quantitatively assessing growth prospects requires the estimation of consumer expenditure elasticities and the budget shares of the crops in question and the foods for which they serve as input. Table 4 provides the consumption of each legume, and livestock products, in rural and urban areas. Livestock products are included because they use soybean (and sometimes pigeon pea) in their production, and thus drive additional *derived demand* for those crops – demand that stems from final

consumer demand for livestock products (and those products' demand for legumes as a production input), not for legumes themselves. Five patterns stand out.

- First, demand elasticities are lower in urban than in rural areas for both direct consumption of legumes and for meat.
- Second, budget shares are lower in urban than in rural areas for direct legume consumption, but are higher in urban areas for meat. Both patterns reflect the much higher average incomes seen in urban areas – about \$3.10 USD per person per day compared to only \$1.15 USD in rural areas. Higher incomes always push demand elasticities for food down (based on Engel's Law) and nearly always drive budget shares of meat higher.
- Third, demand elasticities for direct consumption are very high for soybean and groundnut in both the rural and urban areas. Indeed, soybeans and groundnuts are clearly luxury goods in rural areas, as shown by elasticities above 1.0. This means the budget share of these products will rise with income, rather than falling as for most food items. Elasticities for these two are near 1.0 in urban areas, meaning their budget share will remain nearly constant as incomes rise. Elasticities this high for basic grains are unusual, and reflect current very low incomes in Malawi; they also mean households still spend a large share of any additional income on food. These elasticities will fall over time as incomes rise, but will likely remain high for many years. Thus, demand for direct consumption of these two crops is likely to grow very rapidly in both areas.
- Fourth, cowpea has the lowest rural demand elasticity and a negative urban elasticity, meaning urban residents buy relatively less of this product as their incomes grow.
- Fifth, demand elasticities for meat, dairy and eggs are exceptionally high, above 2.0 for all but eggs in rural areas, and well above 1.0 in all cases in urban areas. It was expected that demand elasticities for these products would be substantially higher than for legumes themselves, as with only a few exceptions consumers throughout the world increase these products' shares in their diets as incomes rise.

Based on the elasticities and budget shares in Table 4 and two scenarios based on growth in incomes, Table 5 projects possible growth between 2010 and 2025 in the demand for legumes and livestock products.

Table 4: Expenditure elasticities and food budget shares for direct consumer demand for grain legumes, and for meat, dairy and eggs in Malawi

Food item	Elasticities		Food budget shares	
	Rural	Urban	Rural	Urban
Legumes				
Soybeans	1.29	0.99	0.31%	0.22%
Pigeon pea	0.67	0.43	1.70%	0.38%
Cowpea	0.58	-0.42	0.75%	0.26%
Groundnuts	1.11	0.98	2.89%	1.57%
Other Legumes	1.00	0.42	3.88%	4.11%
Meat, dairy, eggs				
Beef	2.22	2.12	0.94%	3.24%
Other Meat	2.07	1.54	3.65%	3.25%
Dairy	2.55	1.56	0.65%	2.35%
Poultry	2.25	1.70	3.73%	5.31%
Eggs	1.76	1.36	1.59%	2.61%

Table 5: Projected growth in local demand for direct human consumption of grain legumes in Malawi from 2010 to 2025, under two alternative scenarios

	4.5% per capita growth per annum				1.0% per capita growth per annum			
	Total value ('000 000 USD/yr.)		% change		Total value ('000 000 USD/yr.)		% change	
Food items	2010	2025	Total	Annualised	2010	2025	Total	Annualised
Legumes								
Soybeans	16	48	206%	7.7%	16	27	74%	3.8%
Pigeon pea	72	153	113%	5.2%	72	114	59%	3.1%
Cowpea	33	64	93%	4.5%	33	52	57%	3.0%
Groundnuts	136	382	180%	7.1%	136	232	70%	3.6%
Other legumes	213	527	147%	6.2%	213	362	70%	3.6%
All legumes	470	1 173	150%	6.3%	470	786	67%	3.5%
Meat, dairy, eggs								
Beef	120	522	334%	10.3%	120	240	99%	4.7%
Other meat	231	843	265%	9.0%	231	416	80%	4.0%
Dairy	91	356	293%	9.5%	91	178	96%	4.6%
Poultry	293	1 030	251%	8.7%	293	540	84%	4.1%
Eggs	118	372	214%	7.9%	118	214	81%	4.0%
Total	854	3 123	266%	9.0%	854	1 586	86%	4.2%

Even under the low growth scenario, total growth in direct demand for legumes by consumers increases by at least 3% per year. This result is driven by high demand elasticities associated with poverty and the nearly 3% population growth that Malawi is forecast to maintain over the projection period. The 4.5% growth scenario delivers projected growth rates in demand as high as nearly 8% for direct consumption of soybeans, and 8% to 10% for the various types of meat.

Soybean's robust growth prospects are based on its high direct demand elasticity, its established role as a source of protein and fat in animal feed, and the very high demand elasticities for livestock products. Note that soybean's derived demand (through livestock products) will be driven by two factors: very rapid growth in demand for livestock (if incomes rise) and a likely move over time towards intensified animal production featuring more use of balanced feeds (and less use of pasture). These factors will combine multiplicatively to drive demand growth for soybean. This transition is already being seen in poultry production; the production of other meat in the country is dominated by pasture systems, and the transition to widespread use of balanced feeds will take longer to occur. Rising energy prices could slow the transition but are unlikely to stop it.

Growth in demand for pigeon pea and groundnuts may be subject to more uncertainty. Growth factors for groundnuts are its robust and broad-based local demand and high demand elasticity, together with strong emerging demand in local markets for processed products such as peanut butter and roasted peanuts. On the negative side, exports of groundnut and its processed products are often limited to informal trade due to the prevalence of aflatoxin, which leads to import bans in neighbouring South Africa and other developed economies. If Malawi were to succeed in keeping aflatoxin levels in its groundnuts to internationally accepted levels, it could potentially see substantial export growth.

The main growth factor for pigeon pea is its strong export market, which can absorb far more product than Malawi can produce. However, this market is both competitive and potentially unstable, depending on policy and production trends in India. Secondly, demand growth in other regions of the country, especially the central region due to its population, could fuel strong overall growth in local demand for pigeon peas. As observed, pigeon pea consumption in Malawi is currently limited almost entirely to the south where it is produced. Achieving such growth in the near term, however, would typically require organised action to promote the crop, and is often difficult to achieve even in the presence of such action.

6.2 Exports and processing

Export demand could also contribute to robust growth in demand for Malawian pulses. Company interviews indicated exports of both processed and unprocessed foods are a major component in many companies' businesses. Dhal – processed pigeon pea – is currently the main export, destined primarily for India and the United Arab Emirates. Growth has been very strong in recent years, and the companies involved expect it to continue. Opportunely, government does not consider it a strategic crop and therefore does not intervene with trade bans, tariffs, or any controls on local trade. The major dynamic in the market is that good pigeon pea harvests in India lead local companies to process their pigeon pea for export both to India (which remains deficit) and the United Arab Emirates, while a poor pigeon pea harvest in India makes it more profitable to export unprocessed pigeon pea.

Soybean is also exported, both in raw and processed form. Whole soybean, soybean meal and even soya pieces move at least to Botswana (which has a large livestock sector but poor conditions for crop production) and South Africa. Unlike pigeon pea, trade policy both in Malawi and its neighbours is a major consideration in this market. At the time of this research, a ban on soybean exports had recently been lifted, although some companies thought it was still in place. Policy in this regard is influenced by the competing interests of different players in the food system. Trading firms and processors for human consumption wish to keep borders open to maximise their flexibility and to take advantage of what is a lucrative export market to Botswana. Other companies, whose interests are primarily in animal feed or soybean oil, would prefer to see export bans on whole soybean, in order to increase availability and lower prices in Malawi.

Groundnut exports are primarily informal, most likely to Mozambique and perhaps to Zambia, due to concerns in formal markets about aflatoxin. Three large companies indicated, however, that they exported about 20% of their groundnut purchases, presumably through formal channels. In addition, at least two companies were entering the value-added export market with blanched and sorted groundnuts for the confectionary market, believing their procedures would allow them to cost-effectively reduce aflatoxin contamination below permitted levels. ADMARC is considered a leader in groundnut grading, while Afri-Nut does early-stage processing of groundnuts for sale to processors. Formal export growth in groundnuts will depend heavily on concerted action among the main players to ensure low aflatoxin contamination.

7. Conclusions and implications

The broad question that guided this research was: where and how can multipurpose legumes be scaled for sustainable intensification of cropping systems and what would the potential impacts be, in the medium term, across the food system in Malawi? The research reported in this paper focused on one key aspect of the scaling question: will markets support broad uptake (scaling) of multipurpose legume cropping systems by providing robust growth in demand over the near-term future for these legumes? Our clear answer is that market demand is very likely to support such uptake; indeed, Malawi faces a major challenge to achieve the total production growth that will be needed to keep up with projected growth in demand.

We focused on three implications of this work for meeting this challenge:

7.1 Continued efforts at farm and post-farm levels to reduce aflatoxin contamination in groundnut

Unless effectively controlled, aflatoxin contamination in groundnuts will exact an increasing toll on human health within the country and will reduce the growth of the sector by closing off formal exports

(Waliyar *et al.* 2013). ICRISAT has for many years focused on this issue, and funding for programmes to promote aflatoxin control has increased in recent years. The Malawi Programme for Aflatoxin Control (MAPAC), launched in late 2013, is one attempt to ensure an integrated, nation-wide approach to the problem. It is beyond the scope of this paper to assess these efforts. Suffice to say that the export market demand for peanut butter and nuts for the confectionary trade could be a key tool for engendering the price differentials that are needed – along with increased knowledge at farm and post-farm levels – to drive down aflatoxin contamination. The implication is that a co-ordinated approach featuring active collaboration between processors/exporters, traders and farmers (especially farmer associations) is needed.

7.2 Assistance packages for small and medium food processors

Research evidence suggests that the growth of the legume sector is tied to processed foods (Tschirley *et al.* 2013; 2014). The well-known demographic bulge in Sub-Saharan Africa (SSA) means jobs need to be created for as many as 15 million people on the continent each year if the youth are to find remunerative employment. With a population growth rate within the upper third of SSA countries, this problem is especially challenging in Malawi. While growth across the entire economy is needed to create these jobs, a large share of the agri-food system in African economies means growth in that system will be especially important for job creation. In Malawi, it is calculated that 91% of all jobs in the country, and 60% of all non-farming jobs, are in the agri-food system.

When these facts are combined with the rapid growth in demand for processed foods in the country, food processing becomes a natural focus for the promotion of job creation. The key question in this regard is what the labour intensity – the number of jobs per unit of output – of the food-processing sector will be. Labour intensity is a function of the scale and capital intensity of production: larger firms tend to be more capital intensive and thus generate fewer jobs per unit of output. It follows, if large numbers of small- and medium-size local food-processing firms can be competitive in the market, the job intensity and total job footprint of the sector can be increased. An important ancillary benefit of such a job-intensive approach is likely to be a more equal distribution of incomes, as small entrepreneurs make solid profits themselves and provide living wages to more people. Further research is needed to better understand the micro-, small-, and medium-scale food-processing sector, and to design packages of assistance that could help more micro-firms grow to at least become small, and small and medium firms to be competitive.

Women already play an important role in Malawi's post-farm agri-food system but are primarily confined to small-scale retail trade that likely generates low daily returns for most of them. Therefore, special attention needs to be paid to promoting the entrepreneurial capacities of women so that they can grow their businesses, add more value to their products, and increase their own earnings in the current setup.

Acknowledgement

This research was funded by Michigan State University's Global Centre for Food System Innovation (GCFSI).

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