Evaluation of Market Opportunities for Soybean in Tanzania

USDA FAS *Soya ni Pesa* Project

December 2012

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1. LIST OF ACCRONYMS

AGRA	Alliance for a Green Revolution in Africa
AGSI	Agro-Industries and Post-Harvest Management Service
AO	Absolute Options LLC
ASA	Agricultural Seed Agency
ASA	American Soybean Association
BEE	Business Enabling Environment
Bu	Bushel
C&F	Cost and Freight
CIAT	*Centro Internacional Agricultura Tropical*
CRS	Catholic Relief Services
CSB	Corn-soy blend
DRC	Democratic Republic of Congo
Est	Estimated
EAC	East Africa Community
ETG	Export Trading Group
FAO	Food and Agriculture Organization
FAS	Foreign Agricultural Service
GAPEX	General Agricultural Production for Export
Ha	Hectares
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IITA	International Institute for Tropical Agriculture
IPP	Import parity price(s)
Kg(s)	Kilogram(s)
Lb(s)	Pound(s)
Ltd	Limited
MFAC	Ministry of Agriculture Food Security and Cooperatives
MT	Metric Tons
N2 Africa	Nitrogen to Africa
NFRA	National Food Reserve Agency
NMC	National Milling Corporation
NOPA	National Oilseed Processors Association
OFC	Overseas Food Corporation
RUTF	Ready to Use Therapeutic Foods
SACCO	Savings and Credit Cooperative Organization
SAGCOT	Southern Africa Growth Corridor of Tanzania
SGR	Strategic Grain Reserve
SPI	Soy protein isolate
TOR	Term of Reference
TSBF	Tropical Soil Biology and Fertility institute
Tsh	Tanzanian Schillings
TSP	Textured soy protein
US$	United States Dollars
USAID	United States Agency for International Development
UN	United Nations
USA	United States of America
USDA	United States Department of Agriculture
VSL	Village Savings and Loans
WFP	World Food Programme
WISHH	World Initiative for Soy in Human Health

2. EXECUTIVE SUMMARY

In September 2012, Catholic Relief Services (CRS) Tanzania was awarded the *Soya ni Pesa* (Soybean is Money) project. The *Soya ni Pes*a project is a four-year value chain-wide project to increase the competitiveness of soybean production and processing in Tanzania. This project is financed through a donation from the United States Department of Agriculture (USDA), Foreign Agricultural Service (FAS) of US$10.5 million. The stated purpose of the *Soya ni Pesa* project is to increase agricultural productivity and accelerate the commercialization of soybeans from smallholder farmers to supply the emerging demand for poultry feed (see below **Background and Objectives**).

In November 2012, CRS hired Absolute Options LLC (AO) to undertake this evaluation of market opportunities for soybean in Tanzania (see below: **Attachment 1: Terms of Reference**). The purpose of this evaluation is to provide the project team with an evaluation of market conditions and business prospects for soybean within the poultry feed industry. For the purposes of this evaluation, demand for soybeans is divided into six distinct market segments (see below: **Markets**):

1. Small-Scale Soyfoods Producers
2. Large-Scale Soyfoods Producers
3. Small-Scale Animal Feed Processors
4. Large-scale Animal Feed Processors
5. Household Consumption
6. Exports

At the farm level, the project will introduce a package of agronomic interventions to improve productivity and quantity of soybeans in the production areas. This will include the development of specialized input supply systems, pre- and post-planting agronomic practices, as recommended by soybean research centers in Tanzania, and improved post-harvest handling at the farm level. Given the tenuous nature of *current* market linkages for soybeans faced by producers, an initial package of no- to low-cost of supply interventions will be required. Over the course of the following crop seasons, these interventions will increase yields toward ranges cited by soybeans researchers (see below: **Supply Summary**).

Additional gains in soybean production will require *investments* by producers into soybean production systems, including an increase in area planted to soybean, either through opening of new previously unused land or through conversion of existing cultivated land, as well as a net increase in seed for soybean through additional seed production. Investments into production may also comprise small-scale mechanization of production, or improvements in on-farm

processing, handling, and storage. These investments must come from farmers themselves, and are therefore dependent on the development of proven market linkages. As such, demonstrating proven market linkages is crucial for the success of the project (see below: **Supply Summary**).

Interviews with soybean users in Tanzania about the relative scale of demand revealed that large-scale animal feed processors comprise the largest market segment. This segment currently utilizes an estimated 150,000 MT of protein components, consisting of both imported soybean meal and locally produced fishmeal (*dagaa*). Small-scale animal feed processors and large-scale soyfoods processors follow this segment in scale. Given their scale, *Soya ni Pesa* will need to prioritize market linkages with these market segments in order to achieve its aim of doubling the available supply of domestic soybean. However, small-scale animal feed processing, and both large and small-scale soyfoods producers are also important segments. As cases of soybean development in other countries show, these segments comprise easily accessible demand for smallholders (see below: **Demand Summary**).

Despite the numerous cost and economy of scale advantages of large-scale mechanized soybean production, cost estimates suggest that soybean is a profitable crop for smallholders in Tanzania. Given current production and marketing costs, Tanzanian producers can deliver soybeans competitively against both import parity price (IPP) for imported soy products, and against domestic *dagaa*. However, producers will need to aggregate sufficient quantity of product with a standardized quality (see below: **Production**).

Tanzania has a challenging Business enabling environment, which frequently impedes the timing and types of investments planned by larger-scale enterprises. For these reasons, this evaluation of market opportunities takes a “sector approach”, which highlights the barriers to entry for the market segments noted above that comprises demand. In order to bridge the gap between small-scale producers, and critical large-scale market segments, researchers have developed a “three-tier” approach that is adopted here, and builds demand in phases. This approach includes (i) building a strategic alliance of value chain stakeholders, (ii) extensive awareness creation, and (iii) extensive capacity building and training (see below: **Recommendations**).

The successful development of the soybean value chain in Tanzania implies linking production from smallholder farmers with demand by industrial users. In line with the “three tier” approach, this evaluation recommends three distinct phases of activities, corresponding to the crop seasons, and engaging producers and processors in all market segments (see below: **Operational Plan**):

Prevailing wholesale (farm gate) prices at the time of this evaluation are between Tsh 600 and Tsh 800 per kg, or US$400 to US$534 per MT during the planting season (January), and Tsh 400 and Tsh 600 per kg or US$267 to US$400 per MT during the harvest season (May to June). Prices in Dar es Salaam include a transport premium of approximately US$100. In contrast, import parity prices for soybeans from world markets are approximately US$600 per MT C&F Dar es Salaam (see below: **Markets**).

This evaluation demonstrated that soybeans are a potentially profitable crop for smallholders. Based on an estimated cost of production of US$123 per MT, producer profitability for soybeans ranges between US$277 per MT and US$411 during planting season in January. Profitability ranges between US$144 and US$277 per MT during harvest season in May to June. Given a current import parity price (IPP) of approximately US$600 per MT for soybeans in Dar es Salaam, and the transport cost of approximately US$100 per MT, producers can negotiate a price indicator of approximately US$500 per MT for soybeans delivered to Dar es Salaam less up to US$133 for harvest season deliveries, and up to US$100 for planting season deliveries (see below: **Farmer Business Models**).

Finally, areas for additional research include (see below: **Additional Research**)

- Small-Scale Soy Production and Handling Mechanization
- Policy analysis for promotion of soybean
- Feasibility of Micro-Enterprise Development for Rhizobium Seed-Coating
- Availability and Cost-Benefit of Vertical Storage
- Feasibility of Time Arbitrage Mechanisms

3. BACKGROUND AND OBJECTIVES

In September 2012, Catholic Relief Services (CRS) Tanzania was awarded the *Soya ni Pesa* (Soybean is Money) project. This project is financed through a donation from the United States Department of Agriculture (USDA), Foreign Agricultural Service (FAS) of US$ 10.5 million, consisting of US$2 million in cash and US$8.5 million through monetization. The stated purpose of the *Soya ni Pesa* project is to accelerate the commercialization of soybeans from smallholder farmers to supply the emerging demand for poultry feed.[1] In support of this goal, the specific objectives (SOs) and intermediate results (IRs) of the project are:

- SO 1: Increased agricultural productivity
  - Increased use of improved agricultural techniques and technologies
  - Increased availability of improved inputs
  - Improved infrastructure to support on-farm production
  - Increased use of financial services
  - Increased knowledge by farmers of improved agricultural techniques and technologies
  - Improved farm management (operations, financial)
  - Improved knowledge regarding farm management
  - Increased access to improved market information
- SO 2: Expanded trade of agricultural products (domestic, regional and international)
  - Improved quality of post-production agricultural products (soybeans, eggs)
  - Increased use of improved post-production processing and handling practices
  - Improved post-harvest infrastructure
  - Increased access to market to sell agricultural products
  - Improved marketing of agricultural products
  - Improved linkages between buyers and sellers

In November 2012, CRS hired Absolute Options LLC (AO) to undertake an evaluation of market opportunities for soybean in Tanzania. The purpose of this evaluation is to provide the project team with an update on market conditions and business prospects for soybean within the poultry feed industry. Results from the evaluation will provide a critical first step in making better decisions on where to focus investments within particular geographic areas and farmer segments.[2]

[1] "Agreement Between The Government of the United States of America and Catholic Relief Services-United States Conference of Catholic Bishops for the Provision of Agricultural Commodities Through the Food for Progress Act" USDA FAS, December 2012

[2] See Attachment One: Terms of Reference

In line with the Terms of Reference (TOR) described above, this evaluation provides the following:

- Context: Overview of the Soybean Value Chain in Tanzania
- Expected domestic growth in the feed sector, with specific analysis of new investments being made in the poultry sector and the potential for smallholders to supply locally grown soybeans to target companies
- The comparative / competitive advantage for Tanzanian smallholder farmers to compete with existing domestic feed inputs and imported feed inputs
- Key interventions required to change or upgrade supply chain to transform the crop to a commercial value proposition for the feed industry
- Outlines for initial business plans with target companies
- The potential of the commodity or sub-products to supply both domestic and regional markets

As per the (TOR), this evaluation also provides recommendations on the following:

- Key areas of intervention and additional research that needs to be done to further develop links between smallholder producers of soybean to supply the feed industry
- Suggested strategic allies and their potential roles for the *Soya ni Pesa* project
- Prioritized recommendations on key areas of intervention / investment at the technical, organizational, financial and policy levels for the *Soya ni Pesa* Project
- Recommended operational plan for enabling farmers to meet targets for the project
- Suggested business models for farmers

4. CONTEXT: The Soybean Value Chain in Tanzania

This section provides a description of the soybean value chain in Tanzania, including growth in market segments, in order to identify key areas for investment to support to both production and demand.

4.1 Regional Context and Overview

Soybeans are produced and consumed in most countries in Africa, but large-scale production is centered in relatively few countries. Major African producers include Nigeria (approximately 600,000 MT annually), South Africa (approximately 515,000 MT annually), Uganda (approximately 180,000 MT annually), and Zimbabwe (approximately 110,000 MT annually). Malawi and Zambia are also expanding producers, with approximately 25,000 MT and 30,000 MT of annual production respectively. However, the evolution of soybean production does not necessarily follow the evolution of soybean consumption. Major soybean consuming countries include South Africa, Nigeria, Zimbabwe, and Kenya. Consumption comprises a variety of soybean users. For the purpose of this evaluation of market opportunities, these users are divided into six market segments:

1. Small-Scale Soyfoods Producers
2. Large-Scale Soyfoods Producers[3]
3. Small-Scale Animal Feed Processors
4. Large-scale Animal Feed Processors
5. House Consumption
6. Exports

Regional studies of the evolution of soybean production and consumption in Africa reveal several "tendencies" for growth of production and consumption.[4] These include:

[3] Large-Scale Soyfoods Producers include companies that produce food aid products. These products include corn-soy blend (CSB), soymeal, and extruded soy in ready to use therapeutic food (RUTF) used for treatment of severely malnourished children. These products are largely produced on contract for large-scale food aid implementers such as the World Food Programme (WFP).

[4] For background assessments of the cases of Kenya, Nigeria, and Zimbabwe, see Chianu, Joseph et al "Promoting a Versatile but yet Minor Crop: Soybean in the Farming Systems of Kenya" Journal of Sustainable Development in Africa, Volume 10, No.4, 2009. For the cases and Malawi and Zambia, see Zulu, W. "Use of Soybean in Poultry Feed: Perspective from Zambia, Malawi and Botswana" First National Soybean Stakeholders Workshop, November 10, 2005

1. Promotion of soyfoods and simple processing by the public sector leads to the development of household consumption through integration into diets and creates demand for soybeans by smallholders (Uganda, Nigeria, Burundi, DRC, Rwanda).
2. Development of trade and large-scale farming to supply large-scale soyfoods and animals feeds industries, and subsequent "spread" to smallholder production (Zimbabwe)
3. Investment by the private and public sector in small-scale animal feed, leads to increasing smallholder surpluses of soybeans, and ultimately the development of exports (Uganda, Nigeria)
4. Aggressive marketing and mix of small and later large-scale production of soyfoods (including food aid commodities) and animal feed develops supply from smallholder and large-scale producers (Zambia, Malawi)
5. Significant government investment into agronomic research, local uses, and development of processing industries leads to widespread adoption of soybeans and facilitates the development of soyfoods and animal feeds industries (Nigeria)
6. Large-scale industrial use by large-scale soyfoods and animal feed producers leading to significant imports, but limited smallholder or large-scale production (Kenya)

These tendencies demonstrate several useful observations for production and consumption development, which can be taken into account when developing strategies for the development of the soybean value chain in Tanzania:

1. Like most crops, smallholder adoption of soybeans is facilitated by integration of consumption into local diets. However, as opposed to other legumes and pulses, soybeans require some level of processing knowledge in order to prepare them. Therefore, dissemination of processing and cooking methods is key to supporting adoption by smallholders. The highly successful cases of Uganda and Nigeria, and to a lesser extent, Burundi and Rwanda, demonstrate this.[5]
2. Smallholder producers are initially most effective at supplying small-scale industries, though the scale of industries may grow over time. The cases of Uganda, Malawi and Zambia, where smallholders initially supplied a "base" of small-scale soyfoods and animal feed industries, and are now expanding to supply larger industries, are examples of this.
3. Large-scale production of soybeans may "spread" to smallholders. This model, which can entail contract farming or out-grower schemes, is often referred to as the "mother

[5] Chianu, Joseph et al "Promoting a Versatile but yet Minor Crop: Soybean in the Farming Systems of Kenya" Journal of Sustainable Development in Africa, Volume 10, No.4, 2009

farm" approach. The case of Zimbabwe, prior to the disruption of farming in the early part of the last decade, seems to demonstrate this observation.

4. However, production and consumption of soybeans do not move in tandem. The emergence of large-scale soyfoods and animal feed market segments may not lead to the development of smallholder soybean production. Large-scale users require significant tonnages of standardized quality beans, and at the same time are those that have greatest access to imports from world markets. The case of Kenya seems to demonstrate this observation. Enhancing market linkages through stakeholder coordination is crucial for the evolution of large-scale industry as a production driver. [6]

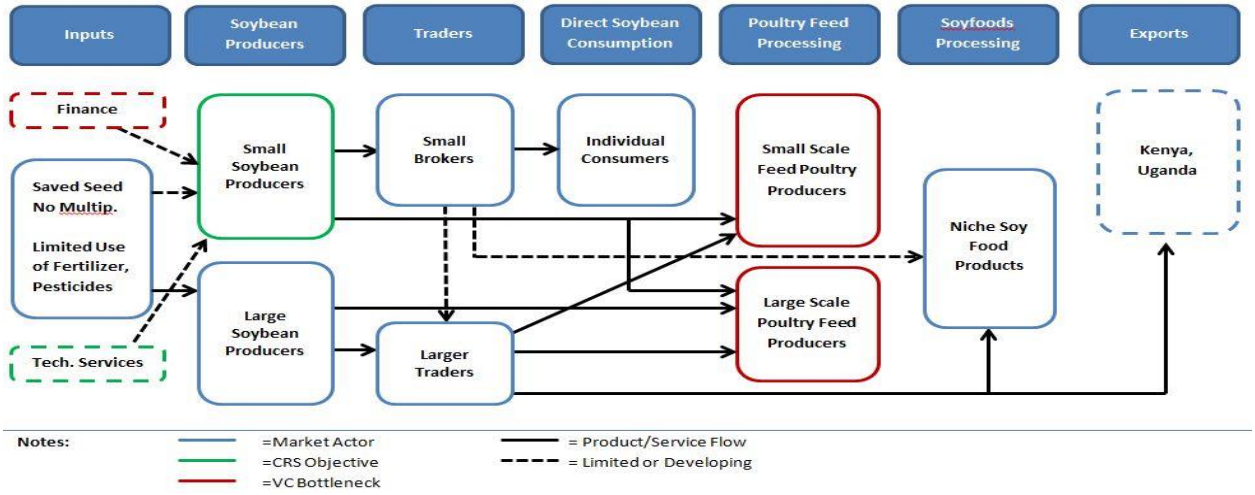
Current soybean markets in Tanzania include all of the market segments of consumption defined above, with the possible exception of exports. However, the sector is extremely undeveloped. Low or sporadic demand for product, and tenuous market linkages with all market segments constrains farmer investments into production systems. Although some soybeans are sold in local markets to a limited number of consumers that use them to fortify local foods, demand for household consumption is extremely limited, as soybeans as not widely integrated into local diets. Both small-scale and large-scale soyfoods processors are present in the country, and these segments are consumers of domestic production. However, their purchases are either very small in scale (in the case of small-scale producers), or sporadic (in the case of large-scale producers), which constrains their function as production drivers.

Significant small and large-scale animal feed processors have emerged, but market linkages with them are even more limited. In the case of small-scale processors, most use locally available, low cost substitute protein components, namely fishmeal (*dagaa*) from lakes Victoria and Nyanza. This product has health risks, and taints the flavor of poultry. It also underperforms soybean meal as a protein component into poultry feed. Large-scale processors in Tanzania frequently access international markets, where standardized quality soybeans and soybean meal are available, which impedes their role as production drivers.

The following sections describe current input systems, production, post-harvest handling, markets, and processing of soybeans in Tanzania, with summaries on opportunities for supply and demand growth.

[6] Ibid.

Figure 1: Soybean Market Map in Tanzania

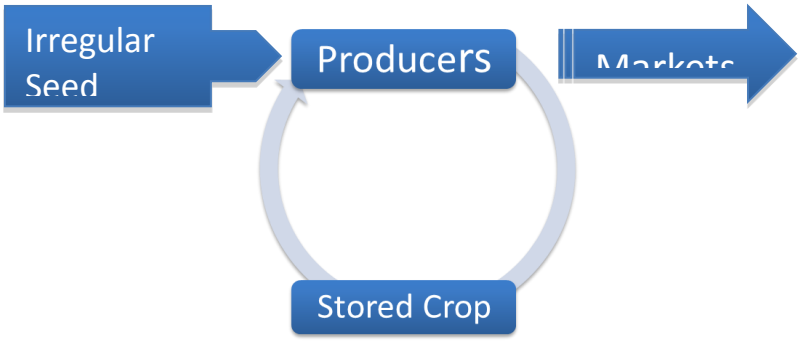


4.2 Input Systems

The input system for soybean in Tanzania is limited.[7] While most farmers in Tanzania are members of producer associations, and have some access to both extension and finance services, they do not currently invest capital inputs such as seed and fertilizer into their soybean systems, due to the tenuous nature of current market linkages. The vast majority of seed used by famers is saved grain from previous harvests.

No specialized seed storage or packaging is used to store saved grain, which may result in lower germination rates. In addition to saved grain, NGOs, contract farming or out-grower schemes, and seed research stations, occasionally introduce limited quantities of distributed seed into the seed supply. However, this distributed seed probably represents less than five percent of overall supply in any year in which it occurs.

Figure 2: Soybean Input System in Tanzania



[7] A full assessment of the soybean seed system in Tanzania by Seed Consultant Michael Turner was underway at the time of writing. CRS expects this assessment to be released concurrently with this evaluation.

The varieties of soybean grown in Tanzania include *Bossier*, *Bossier IL*, *Duicker*, *Sable*, *EAI 3715*, *Still*, *Delma*, *SAB/7*, and *PERY 41*.[8] The most widely available seed varieties currently are:

1. *Uyole 1* produced at the Uyole research station near Mbeya. The recommended sowing rate for this seed is 30 kg per Ha, and it has an estimated potential yield of one-two MT per Ha. The estimated protein content of beans produced with this seed is 38-40 percent.
2. *Bossier* produced at Ilonga research station, is suitable for lowlands.[9]

There is currently no commercially available soybean seed in Tanzania aside from that produced by the Agricultural Seed Agency (ASA). As opposed to seed, inputs such as fertilizer and pesticides are generally available from local agro-dealers. Agro-dealer shops are relatively widespread throughout the towns, and even larger villages, in the production areas. However, they do not currently stock inputs specialized for soybeans, including seeds, due to perceived lack of demand.

4.3 Production

Figure 3: Soybean Production Areas in Tanzania

Soybean can be produced in all regions of Tanzania capable of producing maize and beans, and having sufficient rainfall. However, officially sponsored efforts to develop this sector have historically focused on the southern provinces of Ruvuma, Mbeya, Rukwa, Iringa and Morogoro. These efforts have included extension services, distribution of seeds and inputs, and promotion of production of soyfoods such as soybean flour and milk by various para-statal entities such as the Overseas Food Co-operation (OFC), the General Agricultural Production for Export (GAPEX) and later, the National Milling Corporation (NMC).[10]

[8] Chianu, Jonas et al "Soybean Situation and Outlook Analysis: The Case of Tanzania" TSBF CIAT
[9] Interview with Andrew Kunda, Production Manager, ASA Morogoro November 29, 2012

Following a general liberalization of marketing policies between 2003-6, soybean production has declined, but remained consistent in most of the provinces where it was previously promoted. Currently, soybeans are produced throughout the southern provinces of Mbeya, Iringa, Ruvuma, and Morogoro, and to a lesser extent, the northern province of Arusha.[11]

According to the 2008 Government of Tanzania agricultural census,[12] Tanzanian farmers produce an annual average of 5,000 MT of soybeans. The *Soya ni Pesa* project cites this figure in its aim *to double soybean production within four years to upgrade the Tanzanian poultry feed sector*. Figures cited in most studies of the soybean sector in Tanzania likewise approximate this annual average production tonnage.[13] This figure is used as a baseline in this evaluation as well.

These studies indicate the area of soybean production from 4,000 and 8,000 Ha, with a yield range of 500 to 850 kg per Ha. These estimates are consistent with regional studies of low input on-farm soybean productivity.[14] In contrast, yields from research stations in Tanzania indicate ranges from one to two MT per Ha. By comparison, data from Ugandan on-farm assessments indicates 1.2 MT per Ha.[15] By contrast, similar yields in the US and Brazil are two to 2.5 MT per Ha. These figures demonstrate the potential productivity increases that can result from introduction of appropriate agronomic practices.

Production data for Tanzania shows large year-on-year variations, mainly caused by variable rainfall and rotation crop production of soybeans by large-scale farms. Several large-scale farms advertise soybeans as an occasional crop, including Selous Farms, Kilele Farms, and SAO Hill. Corresponding area estimated in year-on-year data is between 4,000 and 6,000 Ha at these levels, while yield rates are between 900 and 750 kg per Ha at these levels.

[10] Jinze, Xu "Soybean Development Strategy 2010-2020"

[11] Lewis, Jeffrey "Ihemi Cluster Soya Partnership – Draft Concept Note" SAGCOT, January 2012

[12] Unreleased

[13] For example, see Rusike, Joseph "Soybean Value Chains in Tanzania" IITA, December 2012, "Opportunities for Soya in Tanzania" Technoserve, December 17, 2010, and "Southern Agricultural Growth Corridor of Tanzania Appendix IV: Value Chain and Market Analysis" SAGCOT, 2010

[14] For example, see Technoserve Soybean Value Chain Assessments for Angola, DRC, Malawi, Zambia, and Zimbabwe

[15] "Increased Competitiveness of the Value Chain Through Improved Information on the Markets for Soya Bean in Uganda" SNV Ruwenzori Portfolio, April 2011

Figure 4: Annual Production, Productivity and Yield of Soybeans in Tanzania

	2006	2007	2008	2009	2010	AVERAGE
Production (MT)	5000	3000	5390	3900	3100	4078
Area (Ha)	5500	4000	6000	5000	4000	4900
Yield (MT/Ha)	909	750	898	780	775	832

Source: FAOSTAT

Despite the historical efforts of the government of Tanzania to promote soybean production through extension services, studies suggest that agronomic technologies currently employed by farmers in the production areas are consistent with those of other subsistence crops. This includes, limited application and knowledge of preparation, planting, and post-planting techniques.[16]

In order to optimize productivity, research has recommended two soil preparation practices 1) soil pH treatment, and 2) inoculation by rhizobium seed coating. The acidity of most soils in the production areas indicates that the addition of lime is essential if other inputs are to produce results. Despite its critical importance to soil pH management and crop production, very little use is currently made of lime on most farms.[17] Inoculation through rhizobium seed coating promotes increased nodulation, and hence improves soil fertility through increased nitrogen fixation.[18] Seed coating is a relatively simple process, accomplished through the adhesion of *rhizobium japonicum* bacteria powder to seeds using an adhesive such as *gum arabic* in a rotating drum in the case of individual farmers, or cement or dough mixer in the case of larger seed coating operations.[19] The Gates-funded Nitrogen to Africa (N2 Africa) program is also testing other strains of similar inputs, including *bradyrhizobia*, which may be alternatives.

Pre-planting variables that determine soybean productivity include tillage, correct sowing rates, and fertilization. Deep tillage is optimal but virtually non-existent in the production areas due to lack of access to equipment,[20] and cost prohibitive without significant re-organization of production techniques, such as the introduction of custom tillage services with tractors. In non-mechanized systems, broadcast sowing is possible, but seeds should be worked into the ground

[16] Chianu, Jonas et al "Baseline Progress Report on Soybean in Tanzania" TSBF CIAT, 2009
[17] Lewis, Jeffrey "Ihemi Cluster Soya Partnership – Draft Concept Note" SAGCOT, January 2012
[18] "Opportunities for Soya in Tanzania" Technoserve, December 17, 2010, "Southern Agricultural Growth Corridor of Tanzania Appendix IV: Value Chain and Market Analysis" SAGCOT, 2010, and Rehm, George "Fertilizing Soybeans for Profit" University of Michigan, 2010
[19] Deaker, Rosalind et al "Legume Seed Inoculation Technology – A Review" Elsevier University, School of Land Water and Crop Sciences, 2004
[20] Chianu, Jonas et al "Baseline Progress Report on Soybean in Tanzania" TSBF CIAT, 2009

after being sown.[21] Although sowing rates in mechanized systems are up to 80 kg per Ha, rates in non-mechanized systems are much lower. ASA recommended sowing rates for soybeans in the production areas is 30 kg per Ha,[22] while interviews and random sampling of farmers suggested 20 to 25 kg per Ha as the regional average.[23] Soybeans respond to phosphate and potash fertilization.[24] However, farmers in the production areas generally do not fertilize, and use pesticides only on a reactive basis for soybeans.[25] Reasons cited for non-use of fertilizer and pesticides are most commonly lack of availability, high costs, and lack of capital for inputs.[26]

Post-planting best practices for soybeans that determine productivity include weeding frequency, and correct timing of weeding. Soybeans can face challenges from both broadleaf and grass weeds early in their growing seasons. Weeds compete with soybeans for water, nutrients, and sunlight, and constitute the greatest hazard to soybeans productivity in terms of potential losses.[27] Most farmers in the production area are either unaware of the correct timing, or unable to apply this due to constraints on labor availability at the time of weeding.

[21] Islas-Rubio, A.R. "Soybeans: Post Harvest Operations" AGDI/FAO, July 6, 2002
[22] Interview with Andrew Kunda, Production Manager, ASA Morogoro November 29, 2012
[23] Farmer Interviews and random sampling
[24] Rehm, George "Fertilizing Soybeans for Profit" University of Michigan, 2010
[25] Interview with Andrew Kunda, Production Manager, ASA Morogoro November 29, 2012, Chianu, Jonas et al "Baseline Progress Report on Soybean in Tanzania" TSBF CIAT, 2009, and "Opportunities for Soya in Tanzania" Technoserve, December 17, 2010
[26] Ibid
[27] Islas-Rubio, A.R. "Soybeans: Post Harvest Operations" AGDI/FAO, July 6, 2002

Figure 5: Agronomic Practices for Soybean Production in Tanzania

Practice	Current Frequency	Cost
Preparation		
Soil pH Treatment	None	Medium
Inoculation (Rhizobium Seed Coating)	None	Low
Pre-Planting		
Deep Tillage	Low	High
Correct Sowing Rates	Low	Low
Fertilization and Pesticide Use	None	Medium
Post-Planting		
Timing of Weeding	Low	Low
Pre and Post-Planting		
Labor Optimization	Low	Low-High

Source: Farmer Interviews and random sampling

Several studies of production cited sub-optimal allocation of labor as both a pre and post-planting challenge to optimizing current production practices, and costs of production.[28] However, reluctance to lower labor is often constrained by the high use of family labor, which makes farmers reluctant to cut back on its use.

Limited farmer interviews and random samples of farmers in the production areas carried out over the course of this evaluation confirmed the limited knowledge and application of most these agronomic techniques cited in most studies of the soybean sector.

Cost of production for soybeans is estimated at between approximately 148,000 Tsh[29] and 244,000 Tsh[30] per MT (US$99 and US$163 per MT), while this evaluation produced a figure of 188,000 Tsh per MT (approximately US$125 per MT), which consisted of the capitalized value of family and hired labor, farmers' own labor, seeds in the form of saved grain, bags, and tools.

[28] Beatus, Malema "Production and Sustainable Use of Soybean in Tanzania" MFAC, Crop Promotion Services, 2007 and "Opportunities for Soya in Tanzania" Technoserve, December 17, 2010
[29] Beatus, Malema "Production and Sustainable Use of Soybean in Tanzania" MFAC, 2007
[30] "Opportunities for Soya in Tanzania" Technoserve, December 17, 2010

Labor costs are the largest input costs, at approximately 80 percent of the total cost of production.

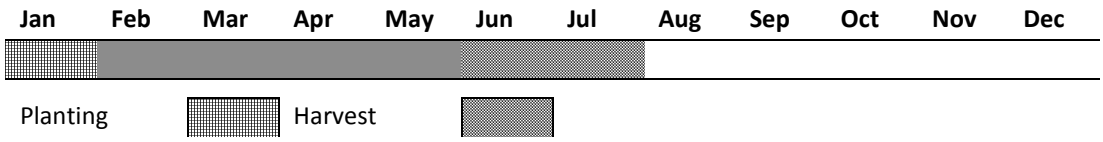
Figure 6: Estimated Current Cost of Production for Soybeans in Tanzania

Input	Tsh/MT	Percent (%)
Family Labor	58,000	31
Hired Labor	56,000	30
Farmers' Own Labor	35,000	19
Seeds	28,000	15
Fertilizer	0	0
Pesticide	0	0
Bags	3,000	2
Other (Tools)	8,000	4
Total	188,000	100%

Source: Farmer Interviews and random sampling

Soybeans are a "short" duration crop, meaning that the duration of growing time is less than other staple crops i.e. four months versus six month. The main planting season for soybeans in Tanzania is January, while harvest is May to June.[31]

Figure 7: Crop Calendar for Soybeans in Tanzania



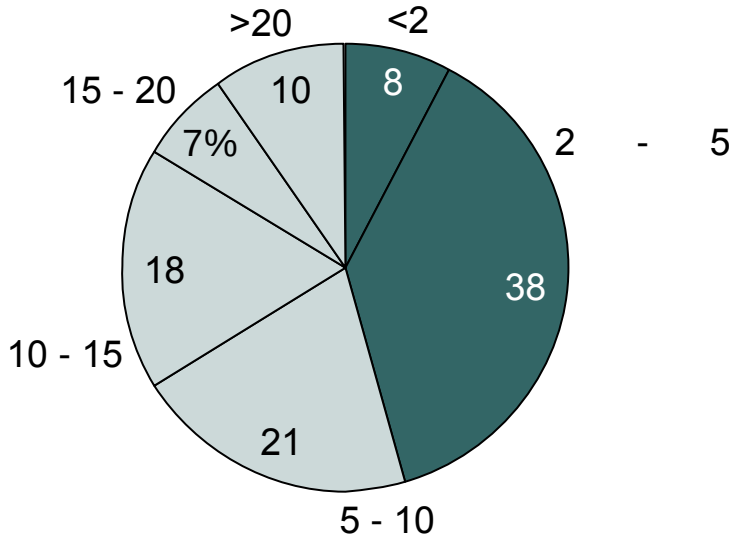
Most farmers in the production areas operate small-scale farm plots (less than two Ha). Farm sizes of less than five Ha represent approximately 46 percent of the farms in these areas, while farms over ten Ha represent approximately 35 percent of the farms in these areas.[32] These farms produce maize, other beans, and potatoes, in addition to soybeans. The area of these farms dedicated to soybeans varies between less than one Ha and up to two Ha.[33] In a random sample conducted over the course of this evaluation, only ten percent (five in 50 farmers surveyed) in the Songea and Njombe areas had produced soybeans in the past year. Farmers often regard soybeans as a "secondary" crop, and soybeans are frequently intercropped with maize, or are grown on marginal land or on irregularly shaped areas where other crops are difficult to produce.

[31] "Crop Calendar of Tanzania" USDA FAS, March 24, 2003

[32] "Opportunities for Soya in Tanzania" Technoserve, December 17, 2010 and Chianu, Jonas et al "Baseline Progress Report on Soybean in Tanzania" TSBF CIAT, 2009

[33] Ibid

Figure 8: Land Size of Farms in the Soybean Production Areas of Tanzania



Source: Technoserve 2010

4.4 Post-Harvest Handling

Soybean is generally considered an "industrial crop", and in developed agricultural economies harvesting and post-harvest handling entails mechanized processes for tillage, harvesting, threshing, cleaning, drying, and transport and storage. For the majority of the smallholder farmers in Tanzania harvesting and postharvest is completely manual. Although mechanical processes offer higher productivity due to better seed disbursement, post-harvest losses are generally lower in manual systems due to lower spillage and breakage.[34] Manual threshing and cleaning can produce lower quantity and quality losses than mechanical threshing and cleaning.

Small-scale storage is generally available to individuals throughout the production areas under several scenarios:

- Government and community-owned warehouses
- Private grain traders
- Farmer's own storage

However, the legacy of state control of agricultural marketing in Tanzania is still apparent in the large-scale storage sector where facilities are poorly maintained, under-utilized, and subject to confusing ownership and leasing regulations that discourage their use.

Prior to the liberalization of marketing policies between 2003-6, the government of Tanzania constructed extensive storage facilities with total capacity of 400,000 MT for use as a Strategic Grain Reserve (SGR), which later came under the management of the National Food Reserve

[34] Islas-Rubio, A.R. "Soybeans: Post Harvest Operations" AGDI/FAO, July 6, 2002

Agency (NFRA) with a broadened mandate. This included silos, bins and warehouses, 90 percent of which are still existent.[35] Following liberalization, most of these facilities were made available for use by private sector enterprises at below market costs. Users have included UN agencies, SACCOs and retail trading companies, in addition to agricultural commodity traders during crop seasons. This scenario has tended to under-fund maintenance, while also reducing investments into new structures. The new owners have converted use of many of these facilities into storage for soft drinks, stocks of manufactured products and factories for curing coffee.[36] This situation serves as a disincentive for farmer associations to use these warehouses to aggregate soybeans, including in silos.

4.5 SUPPLY SUMMARY

Assuming a baseline of 5,000 MT of annual production in the 2011/12 crop season, a seed stock of 180,000 kg, a sowing rate of 25 kg per Ha, a germination rate of 80 percent, and a yield rate of 35 kg of production per kg of seed to produce an estimated yield of 700 kg per Ha, produces an estimate 7,200 Ha of land under soybean production. Assuming no interventions into soybean production, and no variation in rainfall or introduction of new contract farming or out-grower schemes, or rotation crop production of soybeans by large-scale farms, these figures would remain static over the life of the *Soya ni Pesa* project.

Figure 9: Estimated Producer Supply Projection – No CRS Intervention (Baseline)

ITEM	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Saved Soybean for Seed Stock (Kgs)	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**
Distributed Soybean for Seed Stock (Kgs)	0	0	0	0	0
Multiplication Rate for Seed	0	0	0	0	0
Seed Production (Kgs)	0	0	0	0	0
Total Seed Available (Kgs)	180,000	180,000	180,000	180,000	180,000
% of Seed to New Multiplication	**0.444%**	**0.444%**	**0.444%**	**0.444%**	**0.444%**
% of Seed to Soybean Production	99.6%	99.6%	99.6%	99.6%	99.6%
Sowing Rate (Kgs of Seed/Ha)	**25**	**25**	**25**	**25**	**25**
Germination Rate	**80.0%**	**80.0%**	**80.0%**	**80.0%**	**80.0%**
Estimated Yield Rate (Kg of Production/Kg of Seed)	**35**	**35**	**35**	**35**	**35**
Estimated Yield (Kgs/Ha)	700.0	700.0	700.0	700.0	700.0
Estimated Hectares in Production	7,200.0	7,200.0	7,200.0	7,200.0	7,200.0
Total Kgs	5,040,000	5,040,000	5,040,000	5,040,000	5,040,000
Total MT	5,040	5,040	5,040	5,040	5,040

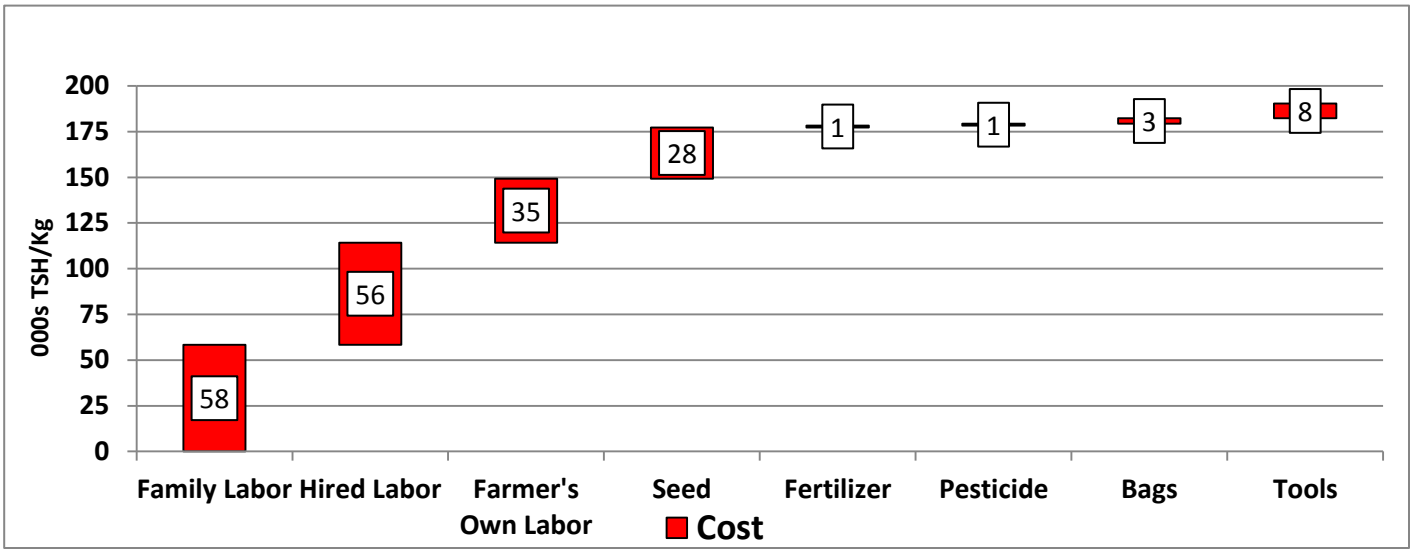
The current total cost of production for soybeans in the production areas of Tanzania is estimated at 188,000 Tsh per MT. This includes approximately 149,000 Tsh of labor, comprising

[35] Nyange, David "Effects of Strategic Grain Reserve, Trade and Regional Production on Maize Price Volatility in Tanzania: An ARCH Model Analysis" Sokoine University of Agriculture, March 2005

[36] "Survey and Mapping of Grain Storage Facilities in Tanzania" USAID COMPETE Project, September 2011

family labor, hired labor, and farmers' own labor. Additional costs of production also include 28,000 Tsh of seeds. At the estimated sowing rate of 25 kg per Ha, and the estimated yield of 700 kg per Ha, the implied cost of seeds is approximately 800 Tsh per kg, which is roughly consistent with planting season prices for soybeans. Additional current costs also include 3,000 Tsh of bags and 8,000 Tsh of tools.

Figure 10: Estimated Cost of Production Cascade for Soybeans in Tanzania



The *Soya ni Pesa* project will introduce a package of agronomic interventions beginning in the 2012/13 crop season in order to improve productivity of soybeans in the production areas. Given the tenuous nature of current market linkages for soybeans faced by producers, an initial package of no to low-cost of supply interventions is required. Such interventions (including estimated cost, production and productivity, and marketing implications) to include:

- Specialized five to 25 kg small packaging for saved seed (approximately 100 Tsh per five kg, increased germination due to lower breakage and exposure to infestation and mold threats)
- Inoculation with rhizobium seed coating (approximately 200 Tsh per five kg of seed, increased productivity of soybeans and other crops due to increased soil fertility)
- Application of correct sowing rates (additional seed requirements of five kg per Ha, increased production of soybeans)
- Application of correct weeding timing (adjusted labor application, increased productivity of soybeans)
- Careful threshing and cleaning (adjusted labor application, increased germination rates)

Based on these initial interventions, the higher cost of packaging and inoculation will increase estimated cost of inputs slightly. However, this increase should be offset by higher productivity, so that net cost of production will decrease only marginally.

Figure 11: Estimated Cost of Production Post-Initial Interventions for Soybeans in Tanzania

Input	Tsh/MT
Family Labor	58,000
Hired Labor	56,000
Farmers' Own Labor	35,000
Seeds	25,000
Fertilizer	0
Pesticide	0
Bags	3,000
Other (Tools)	8,000
Total	185,000

Over the course of the following two crop seasons, these initial interventions would increase plant density and yields toward ranges cited by soybeans researchers, increasing the total supply of soybeans in line with the project's goal. Realistic targets for these rates are 85 percent germination. With improved weeding, a target yield range of one to 1.5 metric tons per Ha is realistic.

Figure 12: Current Estimated and Target Germination and Yield Rates for Soybeans in Tanzania

Rate	Current (est.)	Target
Germination (%)	80	85
Yield (kg/Ha)	700	1,000-1,500

In line with this package of interventions, annual soybean production can be expected to increase from approximately 5,000 MT to approximately 6,700 MT over the course of the project. However, in the absence of improved market linkages that would spur investments into soybean farming systems, it is likely that Ha under soybeans would actually decrease slightly as farmers raise sowing rates in line with recommended rates, but hold saved seed quantities and labor application constant.

Figure 13: Estimated Producer Supply Projection – CRS Production (Supply) Interventions

ITEM	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Saved Soybean for Seed Stock (Kgs)	**180,000**	**180,000**	**180,000**	**180,000**	**180,000**
Distributed Soybean for Seed Stock (Kgs)	0	6,000	0	0	0
Multiplication Rate for Seed	20	20	20	20	20
Seed Production (Kgs)	0	16,000	17,956	17,422	17,596
Total Seed Available (Kgs)	180,000	202,000	196,000	197,956	197,422
% of Seed to New Multiplication	**0.444%**	**0.444%**	**0.444%**	**0.444%**	**0.444%**
% of Seed to Soybean Production	99.6%	99.6%	99.6%	99.6%	99.6%
Sowing Rate (Kgs of Seed/Ha)	**25**	**30**	**30**	**30**	**30**
Germination Rate	**80.0%**	**80.0%**	**85.0%**	**85.0%**	**85.0%**
Estimated Yield Rate (Kg of Production/Kg of Seed)	**35**	**35**	**40**	**40**	**40**
Estimated Yield (Kgs/Ha)	700.0	840.0	1,020.0	1,020.0	1,020.0
Estimated Hectares in Production	7,200.0	6,733.3	6,533.3	6,598.5	6,580.7
Total Kgs	5,040,000	5,656,000	6,664,000	6,730,489	6,712,356
Total MT	5,040	5,656	6,664	6,730	6,712

These figures suggest that agronomic practices alone can be expected to account for only approximately one third of the aim of the *Soya ni Pesa* project *to double soybean production and make an additional 5,000 MT of grain available per year within four years.*

Additional gains in soybean production will require investments by producers into soybean farming systems, including extensification of land under soybean, either through opening of new previously unused land or through conversion of existing cultivated land, as well as a net increase in seed for soybean through additional seed production. In addition to increased land planted to soybean, farmers will have to invest in additional seed and more importantly in additional labor for land preparation and weeding.

Figure 14: Estimated Producer Supply Projection – CRS Production (Supply) and Market Linkage (Demand) Interventions

ITEM	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Saved Soybean for Seed Stock (Kgs)	**180,000**	**180,000**	**169,260**	**200,044**	**227,052**
Distributed Soybean for Seed Stock (Kgs)	0	6,000	24,000	30,000	0
Multiplication Rate for Seed	0	0	20	25	30
Seed Production (Kgs)	0	0	46,500	74,925	137,236
Total Seed Available (Kgs)	180,000	186,000	239,760	304,969	364,288
% of Seed to New Multiplication	**0.00%**	**1.25%**	**1.25%**	**1.50%**	**2.00%**
% of Seed to Soybean Production	99.6%	99.6%	99.6%	99.6%	99.6%
Sowing Rate (Kgs of Seed/Ha)	**25**	**25.5**	**27**	**28**	**30**
Germination Rate	**80.0%**	**80.0%**	**82.0%**	**83.0%**	**85.0%**
Estimated Yield Rate (Kg of Production/Kg of Seed)	***35***	***35***	***37***	***39***	***40***
Estimated Yield (Kgs/Ha)	*700.0*	714.0	819.2	906.4	1,020.0
Estimated Hectares in Production	*7,200.0*	7,294.1	8,880.0	10,891.7	12,142.9
Total Kgs	5,040,000	5,208,000	7,274,318	9,871,839	12,385,800
Total MT	5,040	5,208	7,274	9,872	12,386

As market linkages develop, farmer investments into production can also include: Soil treatment with lime (increased production costs, increased productivity) Fertilization (increased production costs, increased productivity), and Aggregation in large-scale storage, optimally silos (increased costs, decreased marketing costs). The critical factor determining whether producers make these investments will be strengthened market linkages, which is the subject of the following sections of this evaluation.

4.6 Markets

The quality factors usually included in soybean export contracts are protein and oil content, percentage of foreign material, moisture level, and free fatty acid content. Post-harvest specifications include test weight, content of foreign matter such as husks, and content of damaged or usable beans.[37] US soybeans are graded according to these standards on a scale of one to five with no. 2 beans being the most common standard for internationally traded beans.

[37] Hill, L. et al "Quality Choices in the International Soybean Markets" World Soybean Conference V: Proceedings, Kasetsarts University Press, 1997

Figure 15: US Grading for Traded Soybeans

Soybeans: US Grade 2
Origin: USA
Test Weight: 54 lbs /bu
Protein: 35% Minimum
Moisture: 14% Maximum
Foreign Matter: 1% basis; 2% Maximum
Poisonous seed/husks: None
Oil Content: 18.5% Basis
Splits: 20% Max
Other Color: 2% Max
Damaged Beans: 3% Max

Source: National Oilseed Processors Association (NOPA)

Soybeans produced in Tanzania typically have a protein content of 38 to 40 percent, and an oil content of 18 percent,[38] which renders them competitive with internationally traded beans based on inherent qualities. On the other hand, post-harvest quality factors such as content of foreign matter, and content of damaged or unusable beans, is highly variable. Tanzanian soybeans are uniformly small in size, though most processors do not take this into account when purchasing supplies since they are milled.

Soybean prices in Tanzania are highly seasonal with farm gate prices rising from the harvest season in May to June from approximately 400 to 600 Tsh per kg, or US$267 to US$400 per MT, to the planting season, when farm gate prices reach 600 Tsh to 800 Tsh per kg, or US$400 to US534 per MT.[39] Retail prices fluctuate between 1,000 and 2,000 Tsh per kilo over the same period.

Figure 16: Price Calendar for Soybeans in Tanzania

Price (Tsh/kg)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Farm Gate	800	800	800	800	500	500	500	500	600	600	800	800
Retail	2,000	2,000	2,000	2,000	1,500	1,000	1,000	1,000	1,500	1,500	2,000	2,000

Source: Trader and Farmer Interviews

Prices in Dar es Salaam for local soybean are approximately US$100 per MT higher, reflecting transport costs from the production areas. Against local prices, import parity price (IPP) represents an effective price ceiling. Current world market price for soybeans are approximately US$550 per MT, with bulk shipping from the United States at approximately US$50 to US$60 per MT, resulting in an Import parity price (IPP) of approximately US$600 cost and freight (C&F) Dar es Salaam.

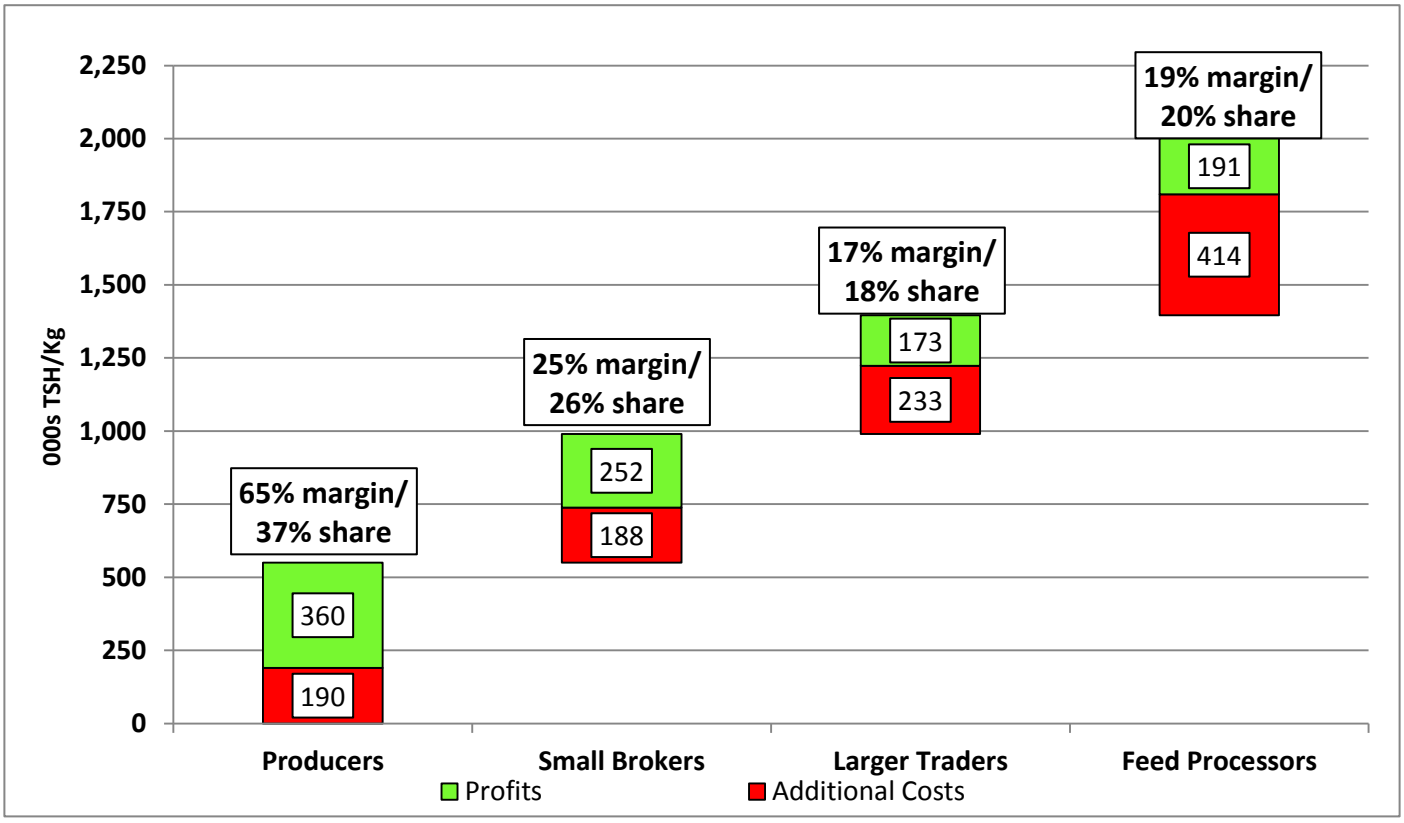
[38] Interview with Fanda Kunda, Production Manager, ASA Morogoro November 29, 2012
[39] The exchange rate at the time of writing was approximately US$1 = Tsh 1,500

Figure 17: Price Indicators for Soybeans in Tanzania

Planting Season Retail Market (Jan):	2,000/kg = US$1,334/MT
Planting Season (Dec-Jan) Farm Gate:	600-800/kg = US$400-US$534/MT
Harvest Season Dar es Salaam (May-June):	400-600/kg = US$267-US$400/MT + US$100 (transport) = US$367-US$500/MT
Harvest Season (June-July) Farm Gate:	400-600/kg = US$267-US$400/MT
World Market Price:	US$548 + US$50 (shipping) = US$598 (C&F)

Based on interviews with producers, brokers (singular *dalali,* plural *madalali*), traders, and feed processors, and assuming the estimated cost of production of approximately 188,000 Tsh per MT (or US$125 per MT), and farm gate prices of approximately 550 Tsh per kg, production represents a margin of approximately 67 percent, while small brokers and larger trader represent 25 and 17 percent margins respectively, and feed processors a further 19 percent margin. Based on these margins, producer profits represent 37 percent of their margin, small brokers and larger trader profits represent 26 and 18 percent respectively. Finally, feed processor margins represent 20 percent.

Figure 18: Value Chain Profit Capture at Harvest for Soybeans Tanzania



Absolute Options

As described above, demand for soybeans in Tanzania can be divided into six market segments:

1. Small-Scale Soyfoods
2. Large-Scale Soyfoods
3. Small-Scale Animal Feed
4. Large-scale Animal Feed
5. Household Consumption
6. Exports

Based on demand studies and interviews with soybean users in Tanzania, demand from large-scale animal processors is estimated at approximately 65 percent market share, or 3,250 MT. A realistic estimate is that large-scale soyfoods producers (including food aid production, though this is sporadic) and small-scale animal feed processors make up approximately ten percent of demand, translating to 500 each. Next in magnitude, household consumption accounts for eight percent of demand, or 250 MT, while small-scale soyfoods processors account for five percent of demand, or 250 MT. Finally, exports account for less than two percent of demand, or 100 MT.

Figure 19: Estimated Market Share and Hypothetical Tonnage by Soybean Market Segments in Tanzania

Market Segment	Market Share (%) (est.)	Tonnage (MT) (est.)
Small-scale Soyfoods Producers	5	250
Large-scale Soyfoods Producers	10	500
Small-scale Animal Feed Processors	10	500
Large-scale Animal Feed Processors	65	3,250
Household Consumption	8	400
Exports	2	100
TOTAL	100	5,000

The following sub-sections describe each of these market segments in Tanzania, noting their demand growth profiles and trends, as well as barriers to entry. They also provide examples of specific enterprises in each sector.

Soyfoods: Notwithstanding the emerging controversy on the human health risks associated with over-consumption of soy products with regard to hormones, and the perceived economic threats associated with their dissemination into developing countries,[40] soyfoods represent an

[40] See for example, Daniel, Kaayla "How Much is Too Much" UTNE Reader, July 2007 and Terrain, Mary Vance "The Dark Side of Soy" UTNE Reader, July 2007

important market segment for domestic soybean producers. While less developed in Tanzania compared to neighboring countries, soyfoods produced by both small and large-scale producers are consumed in a variety of forms, including as soymeal, whole soyflour, soymilk, hot beverages, tofu, and as roasted beans. Demand for these foods is largely dependent on public perceptions of positive health benefits.

Figure 20: Soyfoods in Tanzania

Soymeal for porridges (*uji, ugali*, weaning food)
Soymeal for food aid (CSB, RUTF)
Soymeal for confectionary goods fortification
Whole soyflour
Soymilk
Hot soy powder drink (*Kinywaji cha Soya*)
Tofu
Snack (roasted soybeans)

Small-Scale Soyfoods Producers: Small-scale soyfoods producers in Tanzania are located throughout the production areas, as well as in major urban areas, such as Dar es Salaam and along the Arusha to Moshi corridor. The quantities of soybeans required by these producers are very limited, in most cases less than two MT per year. An example of these enterprises interviewed during the course of this evaluation is Jean's Foods located in Ruvuma. Jean's Foods produces *Kinwaji cha Soya*. Their individual annual consumption of soybeans is less than one MT per year. The technologies that small-scale soyfoods processors in Tanzania employ include milling, extrusion, and pressure-cooking in the case of soymilk and tofu. Jean's Foods buys from local producers, and cooks and mills beans. Barriers to entry into this market segment are low, due to their low quantity and quality requirements. These companies purchase lots of ten to 20 kgs. Sought after specifications include protein content, and low content of foreign matter.

Figure 21: Small-Scale Soyfoods Producers Segment Profile

Market Share	5% (est.)
Market Volume	250 MT
Growth Drivers	Health perceptions
Lot Sizes	10-20 kgs
Technologies	Milling, extrusion, pressure cooking
Barriers to Entry	Low
Specifications	Protein content, foreign matter
Example Companies	Jean's Foods

Large-Scale Soyfoods Producers: There are few large-scale soyfoods producers in Tanzania, compared to neighboring countries. Currently, the only large-scale soyfoods producer is Power

Foods Ltd, located in Dar es Salaam.[41] Established in 1993, Power Foods specializes in fortified food products made from locally grown crops including millet, sorghum, maize, cassava, and soybeans. Products have included food aid commodities produced on contract with the WFP. However, at the time of writing, Power Foods had suspended soyfoods production in order to focus on extrusion of peanuts for the food aid market. If production resumes, the capacity of this company to process soybeans is approximately 500 MT annually. Processing technologies that Power Foods uses include milling, pressure-cooking, and extrusion.[42] Additional companies in this market segment that may present future market opportunities include Export Trading Group (ETG) and Mohammed Enterprises Tanzania. ETG is the largest grain trader and processors in Tanzania, and has operations in a number of African countries. Although ETG does not currently have soyfoods production operations in Tanzania, its sister companies Seba Foods Malawi, and Seba Foods Zambia, are leading large-scale soyfoods producers, and ETG could purchase soybeans in Tanzania for export, or eventual domestic use.[43] Mohammed Enterprises Tanzania handles soybean cake imports, and could purchase domestic soybeans.

Barriers to entry into this market segment are similar to small-scale soyfoods producers in terms of quality, with buyers specifying protein content, and low content of foreign matter. In terms of quantity, companies in this segment require significant quantities of standardized products, such as lot sizes of approximately 20 to 100 MT. On the other hand, companies in this segment are willing and able to enter into forward contract with soybean producers.

Figure 22: Large-Scale Soyfoods Producers Segment Profile

Market Share	10% (est.)
Market Volume	500 MT
Growth Drivers	Health perceptions
Lot Sizes	20-100 kgs
Technologies	Milling, extrusion, pressure cooking
Barriers to Entry	Low
Specifications	Protein content, foreign matter
Example Companies	Power Foods Ltd, ETG, Mohammed Enterprises

Feed Sector: The small and large-scale animal feed processing sectors, especially poultry, represent the largest segment of demand for domestic soybeans. The potential annual demand for these segments for protein components are estimated at 150,000 MT.[44] This demand is currently largely satisfied by imports of soybean meal and cake, or from fishmeal (*dagaa*) from Lakes Victoria and Nyanza. Fishmeal has several disadvantages compared to soybean meal.

[41] Chianu, Jonas et al "Soybean Situation and Outlook Analysis: The Case of Tanzania" TSBF CIAT
[42] Interview with Anna Temu, General Manager Power Foods Ltd, November 20, 2012
[43] Interview with Mahesh Patel, Chairman ETG, November 20, 2012
[44] Laswei, H.S. "An Overview of the Use of Soy in Tanzania" Sokoine University of Agriculture, August 22, 2006 and Beatus, Malema "Production and Sustainable Use of Soybean in Tanzania" MFAC, 2007

Protein content of fishmeal is highly variable, and can be as low as 32 percent. It also often contains contaminants such sand, stones, grass, and snails etc. Other disadvantages include high levels of bacteria e.g. salmonella, and a fishy taint or smell to eggs and meat.[45]

Prices for fishmeal vary according to end use. Higher quality fishmeal for human consumption sells for approximately 5,000 Tsh per kg (US$.3.33), while lower quality fishmeal appropriate for use as a protein component in animal feeds sells for a range of 1,000 to 1,200 Tsh per kg (US$.66 to US.80).[46] In contrast to retail soybean prices, fishmeal prices and supplies are not seasonal, but remain constant throughout the year. Given milling costs, the breakeven point for farm gate purchase of soybeans is approximately 950 Tsh per kg (US$.63), which renders soybeans relatively competitive against fishmeal, not withstanding seasonal variation.

Figure 23: Price Indicators for Domestic Animal Feed Protein Components

Item	Price (Tsh/Kg)
Fishmeal (animal feed quality)	1,000 – 1,200
Soybeans farm gate (planting season)	600 – 800
Soybeans farm gate (harvest season)	400 – 600

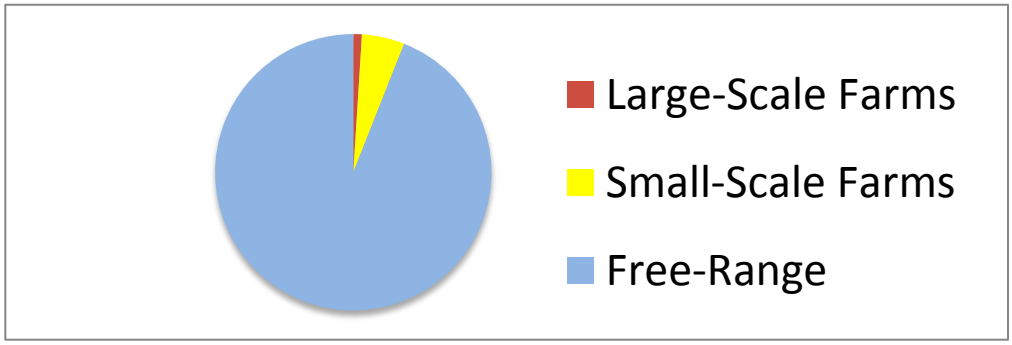
Source: Interviews with traders

Despite the price stability for fishmeal, animal feed prices experience some seasonal variation due to the seasonal nature of prices for other components. During the November to February period, animal feed prices average approximately 36,000 Tsh per 50 kg bag, while in the period from June to July prices rise to 40,000 Tsh per 50 kg bag.

The poultry sector is currently growing at a rate of 2.6 percent per year.[47] Growth is fueled by the rapid expansion of urban centers, such as Dar es Salaam. The poultry sector consists of approximately one percent large-scale farms, five percent small-scale farms, and a balance of approximately 94 percent free-range chickens kept by about 400,000 farmers with a total population of approximately 38,200,000 chickens.[48]

[45] Chianu, Jonas et al "Soybean Situation and Outlook Analysis: The Case of Tanzania" TSBF CIAT
[46] Interviews with animal feed traders, Tazara Market, November 20, 2012
[47] "Taking the Poultry Subsector to Scale: A Call for Commercial Expansion of the Indigenous Poultry Industry" Muvek Development Solutions, Policy Brief 1
[48] "Poultry Sector Country Review" FAO, 2010

Figure 24: The Poultry Sector in Tanzania



Source: Muvek Development Solutions

Domestic soybeans currently provide a very small share of the total estimated 150,000 MT of protein required by the animal feed sector. However, industry representatives suggest several initiatives to convert greater share to domestic soybeans. These include:

- Marketing Demonstrations: Extension workers in the production areas have suggested marketing demonstrations of the positive impact of soy protein on animal production as a method to promote the use of soybeans in animal feed. They have specifically cited annual farm fairs as a venue for demonstrating the benefits of soy protein.[49]
- Public Awareness Campaigns: ASA and representatives of the large-scale animal feed processing sector propose public awareness campaigns of the health risks and quality problems associated with fishmeal-fed poultry products.[50]
- Expansion of Out-Grower Poultry Farming: Muvek Development Solutions proposes an out-grower model for expansion of the poultry sector, with smallholders receiving a package of 100 chicks, vouchers for initial feed and veterinary supplies, and extension services.[51]

Small-Scale Animal Feed Processors: Small-scale animal feed processors are located throughout the country, with concentrations in the large urban areas, such as Dar es Salaam. Most markets in the country include small-scale animal feed vendors. These processors rely almost exclusively on fishmeal (*dagaa*) as a protein component in animal feed, and produce a low-quality product with little to no specialization for various feed requirements over the lifecycle of the animal. They employ feed formulation techniques as their only processing technology.

[49] Interviews with Songea Catholic Diocese, November 25, 2012
[50] Interview with Fanda Kunda, Production Manager, ASA Morogoro November 29, 2012
[51] "Sustaining New Scales: A Call for Stronger Institutional Support for the Indigenous Poultry Subsector" Muvek Development Solutions, Policy Brief 3

Barriers to entry are associated with their choice of fishmeal (*dagga*) as a protein component. Although they would have low quality requirements for soybean, limited to protein content and low content of foreign matter, they usually do not have access to required de-hulling and heat treatment processes required to render soybeans usable for feed. In order to develop market share with these processors, they will require technical training, and development of a client base for soy-based animal feeds through demonstration activities or public awareness campaigns. An example of the type of mills in this segment is Afya Mills located in Dar es Salaam. Afya mills produces approximately 200 MT of poultry feed per year, but relies solely on fishmeal as a protein component. Additional companies in this sector include numerous small-scale feed formulators located in small towns across the country. These enterprises reply solely on fishmeal, and their client base perceives fishmeal as a required component of poultry feed.

Figure 25: Small-Scale Animal Feed Processors Segment Profile

Market Share	10% (est.)
Market Volume	500 MT
Growth Drivers	None
Lot Sizes	N/a
Technologies	N/a
Barriers to Entry	High
Specifications	N/a
Example Companies	Afya Mills

Large-Scale Animal Feed Processors: The large-scale animal feed sector is concentrated around Dar es Salaam, with significant enterprises near Morogoro, and also on the Arusha to Moshi corridor, and a unique case in the production area near Njombe (Matembwe Village Company). Enterprises in this sector use imported soybean cake, fishmeal, as well as domestic soybeans, as a protein component in their product. Their annual total protein component requirement is estimated at 150,000 MT. This sector comprises several business models:

- Vertically integrated poultry operations: These enterprises generally produce animal feed for their own use, but sell surpluses to individual consumers as available. This model includes Matembwe Village Company, Interchick, Farmer's Center, and Hill Farms.
- Specialized poultry feed producers: include Tanfeeds, Ukambozi, and AtoZ Company.
- Soymeal Producers: These companies use extrusion technology to produce soybean meal from cake or whole bean, though some occasionally formulate feeds as well. They include Eagle, Nassad Mansour, and Falcon.

Barriers to entry are medium for these companies. Quality requirements include protein and moisture content, as well as content of foreign matter. Quantity requirements are lots of ten

MT upwards, according to storage capacities. Several of these companies are willing to enter into advance contracts on domestic production, which include specifications as described above.

Figure 26: Large-Scale Animal Feed Processors Segment Profile

Market Share	65% (est.)
Market Volume	3,250 MT
Growth Drivers	Poultry Sector Growth (2.6%)
Lot Sizes	Over 10 MT
Technologies	Milling, extrusion, feed formulation
Barriers to Entry	Medium
Specifications	Protein, Moisture content, foreign matter
Example Companies	Matembwe, Interchick, Farmer's Center, Hill Farms, TanFeeds, Ukambozi, AtoZ Company, Eagle, Nassad Mansour, Falcon

Household Consumption: Household consumption includes smallholder consumption of production and small-scale sales of dried soybeans in local markets located throughout the production areas. Demand is constrained by limited knowledge of cooking processes for rendering soybeans edible and limited integration of soybeans into local diets. Market venders also cite limited knowledge of health benefits of soyfoods as a constraining factor to demand. Small-scale sales of dried soybeans consist of sales of several kg to individual consumers who use the beans to make porridges (*uji*) and fortify meal and dough for products such as chapatis. Sales at each individual market are ten to 20 kg per day.[52] No processing technologies are employed by this sector. Barriers to entry are low, and limited to low content of foreign matter.

Figure 27: Household Consumption Segment Profile

Market Share	8% (est.)
Market Volume	400 MT
Growth Drivers	Health perceptions, knowledge of cooking processes
Lot Sizes	5 to 20 kgs
Technologies	None
Barriers to Entry	Low
Specifications	Foreign matter
Example Companies	Local market traders

Exports: Current levels of exports of soybeans are a source of debate, and evidence of exports is based on anecdotal information regarding the reported presence of Kenyan traders in the production areas during harvest times. Official trade statistics for Tanzania do not record exports of soybeans, and the country does not have an active policy to encourage their trade.

[52] Interviews with market traders in Songea and Njombe, November 22-26, 2012

Figure 28: Trade Balances for Soybean in Neighboring Countries

Country	Trade Balance
Mozambique	Uncertain
Malawi	Marginal net exporter
Zambia	Marginal net exporter
Burundi	Domestic consumption only
Rwanda	Domestic consumption only
Uganda	Major net exporter
Kenya	*Major net Importer*

Source: Jeffrey Lewis

Although trade data for soybean is unreliable, a look at the trade balances of neighboring countries shows that potential export destinations are effectively limited to Kenya, which is the only neighboring country with a major trade deficit in soybeans. Kenya has significant soy industries, including soyfoods producers and animal feed processors, located in Nairobi, and to a lesser extent in Mombassa and Kisimu. An example of these companies is ProFoods, which produces soyfoods for local consumption, as well as for food aid markets. ProFoods procures approximately 1,200 MT of soybeans annually, from both Uganda and international markets.

Figure 29: Export Segment Profile

Market Share	2% (est.)
Market Volume	100 MT
Growth Drivers	Poultry Sector Growth (2.6%)
Lot Sizes	Over 10 MT
Technologies	Milling, extrusion, feed formulation
Barriers to Entry	N/a
Specifications	Protein, Moisture content, foreign matter
Example Companies	ProFoods (Kenya)

4.7 Processing Technologies

Whole soybeans are used to produce a variety of primary, secondary and derived products, the most important of which in terms of world trade, include soybean meal, soybean oil, and soybean cake.[53] Soybeans are most widely traded in Tanzania as whole beans, soybean meal and soybean cake. While whole beans and soybean meal are produced domestically in Tanzania, soybean cake is a byproduct of the oil extraction industry and therefore an import for protein components of large-scale animal feed processors.[54]

[53] Islas-Rubio, A.R. "Soybeans: Post Harvest Operations" AGDI/FAO, July 6, 2002

[54] The Mount Meru Group based in Arusha operates an integrated edible oils processing plants in Lira, Uganda, and solvent extraction and refining plants for edible oil in Arusha and Singida, Tanzania. However, although the Ugandan plant processes soybean oil, the plants in Tanzania process only sunflower.

Prior to most processing, soybeans are cracked and *de-hulled* (decorticated). Both industrial and manual processes are available for cracking and de-hulling, though in Tanzania the most common methods are manual. De-hulling is essential for the processing of soybeans into soyfoods for human consumption. However, de-hulling lowers the fiber content of soybeans, and so may not be desirable for certain types of animal feed processing.

All soybeans require some level of processing prior to use in order to render their nutritional qualities available for use by deactivating trypsin inhibitors (trypsin is an enzyme that is involved in the digestion of protein) such as urease and haemaglutinins, all of which adversely affect protein digestion.

Trypsin indicators are deactivated, or reduced to low levels, by *heat processing*. Post-decortication processing technologies for soybeans include milling, pressure-cooking for soymilk production, extrusion, feed formulation, protein extraction for production of soy protein isolate (SPI), crushing, oil extraction, and flaking and solvent extraction. The first four of these currently exist in Tanzania.

Figure 30: Processing Technologies for Soybean in Tanzania

Milling
Pressure-Cooking for Soy Milk Production
Extrusion
Feed Formulation

Figure 31: Small-Scale Hammer Mill

Milling: Prior to milling, soybeans require de-hulling and heat treatment, as described above. Once de-hulled and heat treated, soybeans can be milled in general use mills, such as large mills or local hammer mills to produce soymeal for use as a protein component in animal feeds.

Mills are located throughout the production areas, and can be accessed by processors on a toll-milling basis for use in soybean milling.

Figure 32: VitaGoat Soymilk Production System

Pressure Cooking for Soymilk Production: Pressure-cooking produces soymilk and other similar products, which simultaneously heat-treats and sterilizes the soybeans. Beginning in the 1980s, soymilk-processing equipment produced in Africa, branded as the VitaCow, and has become widely available through the efforts of organizations such as Malnutrition Matters, and the ASA-sponsored World Initiative for Soy in Human Health (WISHH). A smaller unit branded the VitaGoat is also available. Over 100 units are reported in operation in Tanzania at present. This or similar equipment is also used in the initial phase of tofu production. The cost of a VitaCow is approximately US$10,000, while a VitaGoat is US$5,000.[55]

Figure 33: Small-Scale Soybean Extruder

Extrusion: Extrusion of soybeans refers to the process of rapidly cooking the beans under pressure, by forcing them through a heated barrel by means of a screw**.** The extrusion process is one heat treatment method of deactivating anti-nutritional factors present in oilseeds.[56] Extrusion produces "full-fat" soybean meal. It also improves the protein content of the soybeans, which once extruded rises to approximately 45 percent. Animal feed processors can use extrusion as an alternative to milling in the production of pellets. Specialized extruders are available for the production of textured soy protein (TSP). This technology is used by Seba Foods in Malawi and Zambia, but is not currently in use in Tanzania.[57] The smallest extruders can cost as low as US$2,000 to US$4,000, while larger capacity extruder cost in excess of US$100,000.

[55] Harrigan, Brian and Leah A.J. Cohen "Africare's Experience with VitaCow and VitaGoat Food Processing Systems" USAID Affricate Food Security Review no. 18, December 2008 and "The VitaGoat: A Food Processing System for Nutrition and Micro-enterprise Development" Malnutrition Matters

[56] "Soy Extrusion technologies for development programs" ASA WISHH, March 12, 2009

[57] Riaz, Norman N. "Low Cost Extrusion Expelling Technology for TSP Production" Food Protein R&D Center, Texas A&M University

Feed Formulation: Feed formulation refers to the process of combining nutritional components of animal feed in required proportions. High quality poultry feed comprises 15 nutritional components, including protein, carbohydrates, and micronutrients. Components are adjusted to reflect the dietary requirements of animals over their lifecycle.[58]

Figure 34: Components of Typical Poultry Feed Formulation

- Energy sources: cereals (mainly maize), cereal by-products, animal fats and vegetable oils
- Plant protein sources: soybean meal
- Animal protein sources: fishmeal, meat and bone meal
- Mineral supplements: calcium supplements: limestone, shell grit, calcium and phosphorus supplements trace minerals: trace mineral premixes, sodium sources: salt, sodium bicarbonate
- Miscellaneous: vitamin supplements, vitamin premixes, crystalline amino acids (methionine), lysine, threonine, non-nutritive feed

Source: FAO Poultry Development Review

Though less than optimal, lower quality animal feeds can be produced in small quantities using simple mixing equipment, such as a "cement mixer" or rotating drum. Initial investments into small-scale feed formulation are relatively modest. These can include protein tests, moisture meters, and simple mixing and packaging equipment. A total state-up investment can total less than US$1,000. Of course, feed formulators will require adequate storage space for component stocks, and feed stocks. Although pelletizing feed reduces scattering, the technical process of pelletizing is relatively expensive.

4.8 DEMAND SUMMARY

Trends in demand for Tanzanian soybeans are based on population growth, estimated at three percent per annum, and the growth of the poultry sector, which is estimated at 2.6 percent per annum. Rapid urbanization is also fueling growth of demand for poultry products. Dar es Salaam, with a population of three to four million people, and an estimated growth rate of 4.39 percent annually, is the third fastest growing city in Africa.[59]

Figure 35: Endogenous Variables in Demand for Soybean in Tanzania

Variable	Rate (%)
Population Growth	3
Poultry Sector Growth	2.6
Urban growth	4.39

[58] Ravindran, Velmurugu "Poultry Feed Availability and Nutrition in Developing Countries: Main Ingredients Used in Poultry Feed Formulations" FAO Poultry Development Review

[59] Kironde, J. M. Lusugga "Understanding land markets in African urban areas: the case of Dar es Salaam, Tanzania" University of Lands and Architectural Studies, Habitat International 2000

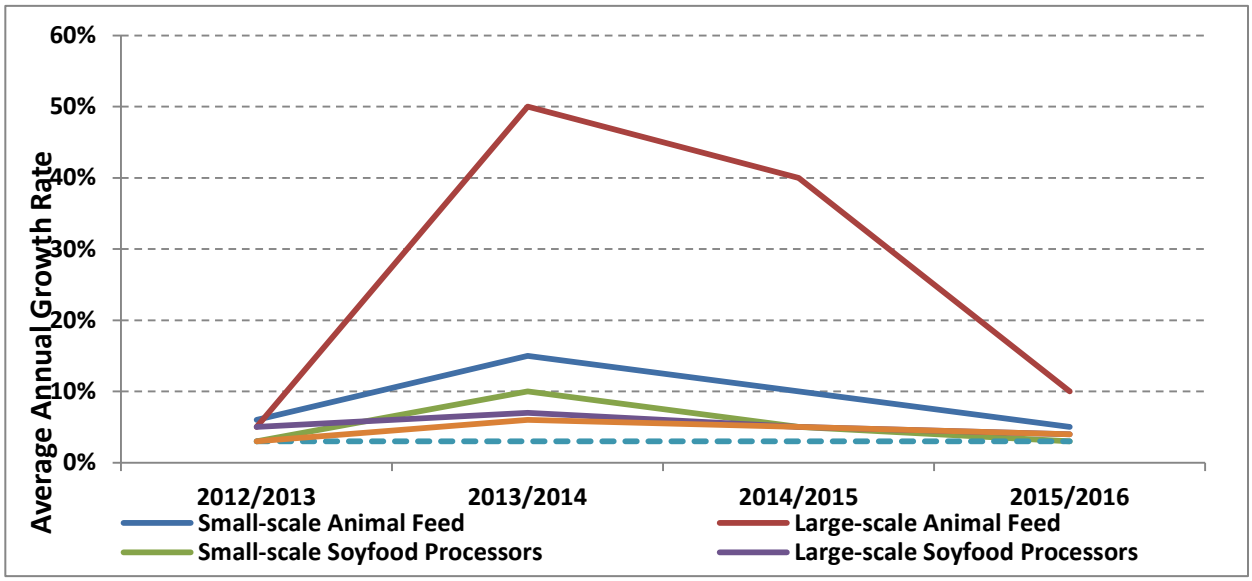
Supply interventions that increase soybean production at rates sufficient to meet the stated target of the *Soy ni Pesa* project, are likely to result in oversupply to the existing market, without significant, multi-segment, corollary demand interventions.

Figure 36: Supply Growth Under Three Demand Scenarios for Soybeans in Tanzania

ITEM	KILOGRAMS OF SOYBEAN				
	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Scenario 1: Best Case Supply Scenario; Limited Demand Growth					
No new large scale processors; exports flat.					
Hectares in Production	6,444	7,048	9,022	10,544	10,602
Average Yield Per Hectare	776	788	840	893	944
Projected Supply (MT)	5,003	5,550	7,579	9,410	10,003
Projected Demand	**5,003**	**5,135**	**5,270**	**5,410**	**5,553**
(Over)/Under Supply	**0**	**(415)**	**(2,308)**	**(4,001)**	**(4,451)**
Scenario 2: Best Case Supply Scenario; Medium Demand Growth					
Outgrower scheme implemented; conservative export growth					
Hectares in Production	6,444	7,048	9,022	10,544	10,602
Average Yield Per Hectare	776	788	840	893	944
Projected Supply (MT)	5003	5550	7579	9410	10003
Projected Demand	**5,003**	**5,149**	**6,105**	**7,049**	**7,891**
(Over)/Under Supply	**0**	**(401)**	**(1,474)**	**(2,361)**	**(2,113)**
Scenario 3: Best Case Supply Scenario; Aggressive Demand					
Successful outgrower scheme; 1 - 2 large processors enter market.					
Hectares in Production	6,444	7,048	9,022	10,544	10,602
Average Yield Per Hectare	776	788	840	893	944
Projected Supply (MT)	5,003	5,550	7,579	9,410	10,003
Projected Demand	**5,003**	**5,153**	**6,976**	**9,095**	**9,877**
(Over)/Under Supply	**0**	**(397)**	**(603)**	**(315)**	**(126)**

Soya ni Pesa will need to prioritize market segments according to their relative scale. Given the preponderance of the large-scale animal feed segment, this segment is a critical target for a concurrent increase in demand for soybeans at the scale required by the project. However, as described above, small-scale animal feed processing, and both large and small-scale soyfoods producers are useful segments, in that they comprise an easily accessible demand for smallholder producers.

Figure 37: Required Demand Growth Rates for Market Segments for Soybean in Tanzania



Demand interventions will need to be tailored according to their scale and target, taking into account the unique challenges and opportunities of each segment:

Large-Scale Segments: While critical in terms of meeting the project objectives, large-scale segments (soyfoods producers and animal feed processors) present unique challenges. The cost of most processing technologies is beyond the reasonable scale of investment of the *Soya ni Pesa* project. These technologies currently include large-scale milling and extrusion, and sophisticated feed formulation. Additional processing technologies may in the future include crushing and solvent extraction. Likewise, the barriers to entry are somewhat more demanding, in that in terms of quality, these segments require more standardized products, and in terms of quantity, they require significant quantities of soybeans. On the other hand, producers in these segments have indicated they are willing to enter into forward contracts, or purchase agreements, with producers, based on mutually agreed price indicators.

Small-Scale Segments: Small-scale segments (soyfoods producers and animal feed processors) employ lower cost processing technologies, including milling, smaller scale-extrusion, pressure-cooking, and feed formulation. With access to micro-finance products, or village savings (VSL) schemes, these processing technologies, including the VitaGoat or VitaCow, and small-scale extruders, could be promoted. Producers in these segments are also less demanding in terms of barriers to entry, and can accept lower quality and quantities of soybeans.

Household Consumption: Household consumption entails simple roasting and cooking techniques, and is entirely dependent on the level of consumer knowledge of these techniques and local dietary preferences, including perceptions of health benefits.

Exports: Like their domestic counterparts, exports will require the development of market linkages between the large-scale segments in target countries, primarily Kenya. As producers develop these linkages with their domestic counterparts, outreach to the more robust Kenyan market will increase the number of potential buyers for their products.

Consumer Awareness and Marketing Campaigns: A common factor between all of the market segments described above the level of consumer awareness of advantages of soybeans use. These consumers include poultry farmers and soyfoods consumers, and entail poultry quality and profitability issues, as well as issues related to human health respectively.

The following section lays out in greater detail recommendations on key interventions, as well as an operational plan and suggested business models for farmers.

5. RECOMMENDATIONS

5.1 Key Areas of Intervention

The successful development of the soybean value chain in Tanzania implies linking production from smallholder farmers with demand by industrial users. In order to bridge the gap between these small-scale producers, and critical large-scale market segments, researchers have developed a three-tier approach, which is adopted here.[60] At each tier, businesses from appropriate market segments are registered as stakeholders in the project (see below: **Stakeholder Registration Form**).

Tier One: The first tier focuses on developing household-level production and basic business plans, knowledge of processing, and consumption:

- Production is strengthened through dissemination of no to low-cost agronomic technologies at this tier.
- Famers develop basic business plans based on their cost of production records (see below: **Cost of Production Worksheet**),[61] which is employed to assess individual farmer profitability, and at later tiers is aggregated to document quantities on offer.
- Development of processing and consumption is aimed at integrating soybeans into local dishes and diets.

This tier strengthens the linkage to the household consumption market segment. This tier is rolled out over the first crop season.

Tier Two: The second tier continues to strengthen production, while focusing on the community level, by linking surplus soybean production to basic local processed products such as soymilk, soy beverages, and soy-fortified dough.

- Farmer investments into production, processing and post-harvest management systems are facilitated through demonstrations and access to credit. Several marketing functions including produce aggregation, grading, and storage, etc are strengthened in preparation for the third tier.
- Small-scale producers and processors are also engaged through access to credit for processing facilities.

This tier strengthens farmer linkages to the small-scale soyfoods producers and small-scale animal feed processor market segments. This tier is rolled out over the second and third crop seasons.

[60] Adopted from Chianu, Joseph et al "Promoting a Versatile but yet Minor Crop: Soybean in the Farming Systems of Kenya" Journal of Sustainable Development in Africa, Volume 10, No.4, 2009

[61] The *Farmbook* application developed through the CRS-led Southern Africa Learning Alliance is an appropriate alternative tool for this purpose

Tier Three: The third tier is large-scale soybean market development. In this tier, producers and large-scale buyers negotiate terms of sale and delivery based on mutually agreed price indicators, and premiums or discounts.

- Farmers are linked to producers and processors for conversion of fishmeal processing mills to soy consumption, and import substitution with large-scale soy users.

This tier strengthens producer linkages with large-scale soyfoods producers and large-scale animal feed processors. It also aims to ultimately develop the exports market segment. This tier is rolled out over the third and fourth crop seasons.

Three central themes of the three-tier approach are:

1. Building a strategic alliance of stakeholders
2. Extensive awareness creation
3. Capacity building and training

5.2 Strategic Allies and Potential Roles

Strategic Alliance of Stakeholders: In Tanzania market linkages for soybeans are currently unstructured, with little common understanding between buyer and sellers of their respective supply and demand. The creation of an umbrella group for soybean promotion will unite stakeholders in the value chain around this common theme (see below: **Stakeholder Registration Form**).[62] Some examples of objectives include:

- Dissemination of production techniques and processing technologies
- Establish communication channels through which buyers and sellers learn about current and expected supply and demand
- Mutually agreed standards and grades for trade
- Expectations regarding pricing of soybeans under various packaging, location, and quantity delivery scenarios
- Policy advocacy priorities for enhancing the policy environment for soybean production, processing, and trade
- Communication and outreach objectives regarding the promotion of soy products for human and animal consumption

Sub-groups in this group are structured about the three tiers outlined above as follows:

[62] For a concept note on a soybean stakeholder alliance, see: Lewis, Jeffrey "Ihemi Cluster Soya Partnership – Draft Concept Note" SAGCOT, January 2012

Tier One: Tier one stakeholders includes producers, as well as extension agents, and organizations working with soy in human and animal health, as well as market venders that provide linkages to the household consumption market segment. Specific members and their roles include:

- The Agricultural Seed Agency (ASA) – provision of agronomic technology
- Sokoine University of Agriculture - authors of *"Soya kwa Lishe Bora"*
- The Ministry of Agriculture Food Security and Cooperatives (MFAC) - authors of *"Mapishi na Vyaku la vya Soya"*

Tier Two: Tier two includes producers, as well as small-scale soyfoods producers and small-scale animal feed processors. Providers of small-scale storage technologies, as well as agro-input dealers, are also included. Specific members and their roles include:

- MalNutrition Matters – local promotion of VitaCow and VitaGoat soymilk processing technology
- Muvek Development Solutions – promotion of contract poultry farming
- Helvetas Swiss Intercooperation – small-scale storage technology
- Technoserve – larger-scale storage and time arbitrage mechanisms

Tier Three: In terms of linkages to actors in the major market segments, this evaluation of market opportunities takes a "sector approach", which highlights the barriers to entry of for the market segments that comprise demand for soybeans in Tanzania, as opposed to focusing on partnerships with specific market actors. This is particularly important in tier three, which targets large-scale producers and processors, as well as exports. This tier includes large-scale soyfoods producers as well as large-scale animal feed producers. Ultimately, as conditions warrant, additional soybean industry representatives from Kenya should be include as well. Specific members and their roles include:

- Export Trading Group (ETG) – soyfoods market information, information on grading and standards
- Mohammed Enterprises – soyfoods market information, information on grading and standards
- Tanfoods – animal feed market information, information on grading and standards

5.3 Operational Plan to Meet Demand Targets

The following basic operational plan outlines the three tiers approach in terms of engaging producer, and processor stakeholders, as well as consumers, according to crop seasons over the life of the project.

Figure 38: Operational Plan

Tier 1 (Crop Seasons 1)	NOTES
Producers ▪ No to low-cost agronomic practices o Specialized five to 25-kg small packaging for saved seed o Inoculation with rhizobium seed coating o Application of correct sowing rates o Application of correct weeding timing o Careful threshing and cleaning ▪ Basic business plans for assessment of profitability (cost of production worksheets) ▪ Consumers ▪ Training on basic processing and cooking to integrate soybeans into local dishes and diets	Production Target: 5,000 - 6,200 MT Seed Requirements: 180,000 to 186,000 kg Materials: ▪ Cost of Production ▪ Soyfoods Manuals ▪ Stakeholder Registration
Tier 2 (Crop Seasons 2 and 3)	
Producers ▪ Demonstration and access to finance for production investments o Soil treatment with lime o Fertilization o Aggregation in large-scale storage, optimally silos ▪ Demonstration and access to finance for post-harvest management ▪ Aggregation of business plans to document quantities on offer Small-Scale Soyfoods Producers and Animal Feed Processors ▪ Demonstration and access to capital for small-scale processing Consumers ▪ Public awareness of health qualities of soyfoods ▪ Public awareness of soy-fed poultry	Production Target: 6,200 – 6,500 MT Seed Requirements: 215,000 to 250,000 kgs Materials: ▪ Aggregated Production Data ▪ Stakeholder Registration
Tier 3 (Crops Seasons 3 and 4)	
Producers ▪ Aggregate business plans to quantify offers Large-Scale Soyfoods Producers and Animal Feed Processors, Exporters ▪ Develop mutually agreed price indicators ▪ Develop terms of delivery and sale	Production Target: 8,000 – 10,000 MT Seed Requirements: 250,000 to 295,000 kgs

5.4 Farmer Business Models

A random sampling carried out over the course of this evaluation produced an average total cost of production of 188,000 Tsh per MT (US$125 per MT). In the absence of economies of scale, this holds true for smallholders with up to 10 Ha of land.

Figure 39: Estimated Current Cost of Production for Soybeans in Tanzania

Input	Tsh/MT	Percent (%)
Family Labor	58,000	31
Hired Labor	56,000	30
Farmers' Own Labor	35,000	19
Seeds	28,000	15
Fertilizer	0	0
Pesticide	0	0
Bags	3,000	2
Other (Tools)	8,000	4
Total	188,000	100%

Source: Farmer Interviews and random sampling

Following the introduction of the initial supply interventions, slightly higher costs will increase estimated cost of inputs slightly. However, this increase is offset by higher productivity and net cost of production will decrease marginally to Tsh 185,000 per MT (US$123 per MT).

Figure 40: Estimated Cost of Production Post-Initial Interventions for Soybeans in Tanzania

Input	Tsh/MT
Family Labor	58,000
Hired Labor	56,000
Farmers' Own Labor	35,000
Seeds	25,000
Fertilizer	0
Pesticide	0
Bags	3,000
Other (Tools)	8,000
Total	185,000

Prevailing wholesale (farm gate) prices at the time of this evaluation are between Tsh 600 and Tsh 800 per kg, or US$400 to US$534 per MT during the planting season (January), and Tsh 400 and Tsh 600 per kg or US$267 to US$400 per MT during the harvest season (May to June). Prices in Dar es Salaam include a transport premium of approximately US$100. In contracts, import parity prices for soybeans from world markets are approximately US$600 per MT C&F Dar es Salaam.

Figure 41: Wholesale Price Indicators for Soybeans in Tanzania

Planting Season (Jan) Farm Gate:	600-800/kg = US$400-US$534/MT
Harvest Season (May-June) Farm Gate:	400-600/kg = US$267-US$400/MT
Harvest Season Dar es Salaam (May-June):	400-600/kg = US$267-US$400/MT + US$100 (transport) = US$367-US$500/MT
World Market Price:	US$548 + US$50 (shipping) = US$598 (C&F)

Based the post-initial intervention cost of production of Tsh 185,000 per MT (US$123 per MT), producer profitability ranges between US$277 per MT and US$411 during planting season. Profitability ranges between US$144 and US$277 per MT during harvest season. Given IPP of approximately US$600 per MT in Dar es Salaam, and the transport cost of approximately US$100 per MT, producers can negotiate a price indicator of approximately US$500 delivered to Dar es Salaam less up to US$133 for harvest season deliveries, and up to US$100 for planting season deliveries.

5.5 Additional Research

Areas for additional research include:

Small-Scale Soy Production and Handling Mechanization: Given the preponderant cost of labor in overall cost of production, and the opportunities for introducing small-scale mechanized processes into soybean farming systems, additional research into these methods will be useful. This may include both animal and motorized traction for tillage, and mechanized drying processes. However, mechanized processes fall clearly into the category of farmer "investments", and should be linked to finance mechanisms.

Policy analysis for promotion of soybean: Additional research should include specific policies that impact the enabling environment for soybean production, processing, and trade. Policy activity can also include "positive promotion" i.e. an officially sanctioned campaign to develop selected sectors. Additional policy research should include the potential for government-sponsored *sector promotions initiatives* that would support the development of the soybean sector.

Feasibility of Micro-Enterprise Development for Rhizobium Seed-Coating: Although rhizobium seed coating is clearly indicated as a recommended agronomic technology to increase yields through improved soil fertility, the technical demands of this activity were not clear at the time of this evaluation. Additional research is required to determine the optimal structure of seed coating activities i.e. an individual farmer activity, or a viable micro-enterprise linked to a commercial seed enterprise.

Availability and Cost-Benefit of Vertical Storage: Producers and processors in East Africa traditionally purchase bagged soybeans. However, as noted, world trade and hence imports of soybean are via bulk shipment. Vertical storage i.e. silage is reportedly residually available through the government of Tanzania. Additional research is required to determine the actual availability and cost feasibility of vertical storage, especially for stock intended for the large-scale market segments. The assessment of storage options should recognize the challenges in working with government-owned facilities.

Feasibility of Time Arbitrage Mechanisms: Given the similarities of the crop calendars for soybeans in Tanzania and Uganda, a viable strategy for development of exports to Kenya could include storage of soybeans until after the Ugandan export crop is sold to Kenyan producers and processors under a time arbitrage system (warehouse receipts scheme). Seasonal variations within the domestic market present opportunities for time arbitrage as well. Tanzania has rudimentary policies and structures in place for the expansion of time arbitrage mechanisms.[63] However, further research is required to determine the suitability and current functionality of these schemes in order to determine the feasibility of such a strategy.

[63] Pascal, Robert "The Experience of Warehouse Receipt Systems in Tanzania" National Microfinance Bank

6. LIST OF CONTACTS

Name	Organization	Title
Bashir Jama	AGRA	Country Officer
Anne Mbaabu	AGRA	Director
Georgina Mbawala	Archdiocese of Songea	CARITAS Director
Andrew Kunda	ASA Morogoro	Production Manager
Michael Turner	Consultant	Seed Consultant
Jeffrey Lewis	Consultant	Consultant
Shaun Ferris	CRS	Senior Advisor - Agriculture and Environment
Amsalu Gebreselassie	CRS Tanzania	*Soya ni Pesa* Project Director
Ruth Junkin	CRS Tanzania	Head of Programming
Dale Kabat	CRS	Regional Monetization Adviser
Lembris Lazier	CRS Tanzania	Project Coordinator
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Conor Walsh	CRS Tanzania	Country Representative
Fr. Nestor Mtweve	Dioceses of Njombe	Executive Director
Mahesh Patel	Export Trading Group	Chairman
Tom Kocsis	FINCA Tanzania Limited	Chief Executive Officer
Alain Cuvier	Helvetas Swiss Intercooperaton	Country Director
Hillary Shoo	Hill Group Company	Managing Director
Fen Beed	ICRISAT	Researcher
Harun Murithi	ICRISAT	Researcher
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Vera Florida Mugittu	Muvek Development Solutions	Managing Director
Jeffrey Kirenga	MFAC	Assistant Director
Beautus Malema	MFAC	Assistant Director
Kevin Boekestein	NutraFoods Kenya Limited	Director
Anna Temu	Power Foods Limited	Managing Director
Faustin Lekule	Sokoine University of Agriculture/Tanfeeds	Professor/Managing Director
Ones Karuho	Technoserve	Regional Program Manager
Rebecca Savoie	Technoserve Tanzania	Country Director
Joshua Mike	USAID	Agriculture Officer
Tabari Dosett	U.S. State Department	Economic and Commercial Officer
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7. Attachment One: Terms of Reference

Evaluating the Marketing Opportunities for Soybean as a local product for input into the emerging poultry feed market in Tanzania

1. Background

The CRS Tanzania soybean project "Soya ni Pesa" (see annex 1) is a market driven project designed to accelerate the commercialization of soybeans from smallholder farmers to supply the emerging demand for poultry feed. This project supports the general shift in donor strategy towards market-oriented poverty alleviation for smallholder farmers. The Tanzanian poultry feed industry is currently dependent upon dried fish as the main protein source, however, dried fish causes an unwanted taint in the poultry meat and poor handling means that fish is a regular source of salmonella, making local poultry meat unattractive to buyers for the more lucrative urban and tourist markets.

This study will provide the project team with an update on market conditions and business prospects for soybean within the poultry feed industry and results from the study will provide a critical first step in making better decisions on where to focus investments within particular geographic areas and farmer segments. The study will focus on:

(i) Expected domestic growth in the feed sector, with specific analysis of new investments being made in the poultry sector,
(ii) Potential for smallholders to supply locally grown soybeans to target companies,
(iii) The comparative / competitive advantage for Tanzanian smallholder farmers to compete with existing domestic feed inputs and imported feed inputs,
(iv) Key interventions required to change or upgrade supply chain to transform the crop to a commercial value proposition for the feed industry, and
(v) Outlines for initial business plans with target companies,
(vi) The potential of the commodity or sub-products to supply both domestic and regional markets.

This study will assess these questions in relation to the potential for local soybean production to supply the emerging feed sectors in Tanzania. In addition, the study will also provide a theory of change model, to show the impact of an improved soybean sector on poverty alleviation on different farmer segments within the target districts.

2. Purpose of the Study

This market linkage study is being conducted to support the development of investment options and strategies for CRS and its partners for the production and use of soybeans in poultry feed rations.

Specifically, this study will investigate the following areas:

- Demand for soybeans in Tanzania, with an emphasis on the animal feed industry (including volumes, varieties, minimum quality and delivery standards, seasonality). The demand side of the study should focus on the prospects for farmers to supply a new hatchery operation in Morogoro that is being financed through African Poultry development Ltd, but should also include other potential buyers in the Morogoro and Dar es Salaam area.

- Soy production processes, constraints and opportunities in relation to demand characteristics, with a specific emphasis on three farmer segments targeted by the project (i) farmers with less than 2 acres of grain crops, (ii) farmers with between 2 and 10 acres and (iii) farmers with more than 10 acres.)
- Input availability and accessibility, with a special focus on high-quality seed that meets market specifications and in relation to the three key farmer segments targeted by the project
- Competitiveness analysis of soybean production and supply in Tanzania, with respect to the three key farmer segments and production areas in Tanzania against imports of same or substitute products to supply formal and informal feed buyers in Dar es Salaam and Morogoro.
- Key production and marketing channels for soybean products including costs and margins.
- Processing capacity of local poultry feed companies, equipment options to upgrade local processing and possible investment programs to upgrade local processing of soybeans into full fat soybean feed products.

3. Tasks and Methodologies

The study will use both secondary and primary data to determine the market prospects of soybean for the feed markets. Primary data will be obtained through quantitative and qualitative surveys of producers, traders and retailers and potential investors in each sector to identify the constraints they face and the potential of the markets to absorb additional outputs. These studies should build on and complement existing surveys and studies. Initial work should focus on reviewing existing information from past and current projects. Consultations with USAID and EU missions may also shed light on existing information related to the sector.

The methodology to appraise the markets should follow the basic ideas described by Holzman or similar, in the World Bank agri-business guide. http://wbln0018.worldbank.org/essd/essd.nsf/Agroenterprise/agro_guide with business model development and planning to follow the Business model canvas, outlined by Osterwalder http://www.businessmodelgeneration.com/book or similar Biz plan approach.

As a general approach, the report will make use of demand studies and value-chain analysis of each market segment to illustrate specific points and highlight the potential for and constraints to, ensuring competitiveness for soybean at each stage of production and marketing. Each segment analysis will be based on the issues and experiences of a sample of producers, traders, processors and poultry producers. It is envisaged that most of the demand for this commodity will be focused around the Dar es Salaam and Morogoro regions but information from other districts in Tanzania may also be required to build a sound business plan. In this case some analysis of the global market / industry sector data will be required.

The supply chain analyses will address issues such as industry and market structure, current policies and regulations governing the sub-sector, the economic and financial needs of farmers, viability of expansion, factors influencing the competitiveness (at the local and possibly regional levels) of the soybean supply chain and recommended policy interventions involving the efficient use of project resources.

Illustrative specific activities include:

- Review literature on soybean use in poultry feed products, paying particular attention to markets in Tanzania. This review should start with the TNS study (to be provided by CRS), identify gaps and then ascertain needs beyond this recent study.
- Conduct a rapid market survey to establish demands for soybean products from major buyers in the feed industry and outline roles and responsibilities of key chain actors in a proposed new business model.
- Interview technical specialists in soybean production and processing, with a view to evaluating technical upgrades required to improve supply chain competitiveness,
- Conduct a market share analysis for key feed millers and feed buyers (hatcheries, broiler and layer industries), including their plans for expansion and key opportunities and barriers to the poultry industry, with an initial focus on APDL, TanFeeds, MOVEK, Superior feeds and others that emerge in the study.
- The study should specifically evaluate seed supply systems for soybeans and outline plans for the input supply part of the chain, with public and commercial seed options, at the scale required by the project within a 3-4 year timeframe.
- Evaluate key constraints in the feed millers sector, hatchery and broiler and layer sectors; assess their interest in procurement of domestically produced soybean products from local producers and processors. This information should provide basic information on existing volumes for their feed and expected growth in the market. This analysis will pay particular attention to the APDL company that has recently been acquired by Seaboard International, who is a key partner in this project.
- Assess the costs of production and profitability of soybean producers in target areas, including the existing soybean production areas of Songea and new target areas in the vicinity of Morogoro. This evaluation should specify varieties and any specific production technologies in the analysis, for target farmer segments.
- The report should provide outlines of proposed most viable supply/value chain maps with associated business plans, including financial forecasts and co-investment scenario's for the project, farmers, and processing partners.

4. Products/deliverables

The study report should contain the following (but not limited to):

I. Findings

Context

Literature review of past activities and investments in the Tanzanian feed sector and a current situation analysis of the soybean and poultry markets in the target districts of Tanzania

Economic overview of the sector with relevant competitive criteria for market growth

Demand Characteristics

- Demand for soybeans from the Tanzanian feed industry as outlined above, with a focus on the prospects for farmers to supply a new hatchery operation in Morogoro that is being financed through African Poultry development Ltd, and other potential buyers in the Morogoro and Dar es Salaam area.
- The parity value of exported soybeans/meal to neighboring countries such as Mozambique, Zambia, Uganda

Production processes, constraints and opportunities

- Soy production processes, constraints and opportunities in relation to target farmers as described above.
- Most competitive areas for growing soybean including key production technologies - preferred varieties, use of productivity enhancing technologies such as fertilizer, irrigation, inoculums and other good agricultural practices.

Input issues and strategies

- Input availability and accessibility, with a special focus on high-quality seed that meets market specifications and in relation to the three key farmer segments targeted by the project
- A business process and costs involved in developing a seed supply system that will enable farmers to produce 5,000 mt of soybean within a 4 year timeframe

Supply chain competitiveness

- Competitiveness analysis of soybean production and supply in Tanzania, with respect to the three key farmer segments and production areas in Tanzania against imports of same or substitute products to supply formal and informal feed buyers in Dar es Salaam and Morogoro.
- Development of import parity value for soy meal in Dar and providing names and contacts for major importers/users of soybeans or soy meal in Tanzania
- Outline the effect of fluctuation in maize prices on demand and competitiveness of feed
- Key production and marketing channels for soybean products including costs and margins
- Identification of key barriers or opportunities for value chain strengthening, with a focus on insertion of targeted farmer segments within the chain
- Key risks in terms of environment, finance, private sector capacity and market dynamics in the commercial prospects of smallholder farmers' supply to the emerging feed markets.

II. Recommendations

Suggested strategic priorities for improving smallholder participation in the supply/value chain, including key elements of investment, technology, financing, capacity building, and business relationships for the development of soybean production and marketing. Outline of business models, upgrading plans and trading relations for specific farmer segments based on location and land size; including farmers with:

- < 2 hectares,
- 2-5 hectares,
- > 5 hectares

The suggested business models for each farmer segment should detail:

- Target growth markets and product areas
- Priority requirements (changes in production, processing and quality control and enhancement, product differentiation, technology and investment. For target farmer segments.
- Costs of production and initial profitability analysis,
- Respective roles and actions of farmers, industry, NGOs, Government agencies.
- Short term and longer term actions needed (balancing poverty reduction and growth objectives)

- Suggested strategic allies and their potential roles for the Soya ni Pesa project
- Prioritized recommendations on key areas of intervention / investment at the technical, organizational, financial and policy levels for the Soya ni Pesa Project
- Recommended operational plan for enabling farmers to access the variety and volume of seed needed to meet the demand targets for the project
- Key areas of intervention and additional research that needs to be done to further develop links between smallholder producers of soybean to supply the feed industry.

8. ATTACHMENT TWO: COST OF PRODUCTION WORKSHEET

CROP BUDGET
Name:
Male Female *(circle one)*
Location:
Crop: **Planting Date:** **Reconciliation Date:**

EXPENSES	**Unit**	**Cost per Unit**	**Number of Units**	**Total**	**Cost per Unit**	**Number of Units**	**Total**
Land							
Labor							
Seeds:							
Fertilizer 1:							
Fertilizer 2:							
Fertilizer 3:							
Tools 1:							
Tools 2:							
Tools 3:							
Other:							
Other:							
Other:							
TOTAL EXPENSES							
INCOME							
Sales 1:							
Sales 2:							
Sales 3:							
TOTAL INCOME							
PROFIT/LOSS							

9. ATTACHMENT THREE: STAKEHOLDER REGISTRATION FORM

CRS *Soy ni Pesa* Project		
Company Name:		
Market Segment		
Small-Scale Soyfoods___	Large-Scale Soyfoods___	Household Consumption___
Small –Scale Animal Feed___	Large-Scale Animal Feed___	Exporter___
Contact		
Name:	Phone:	
Title:	Address:	
Email:		
Current Inputs Products and MT/Kg (soybeans, soymeal, cake, fishmeal, other)		
Current Inputs Products Sources (domestic, imports, etc., and specifications)		
Current Sales Products/Volumes and Price per Unit (soybean, soyfoods (specify), animal feed (specify)		
Target Markets for Sales		
Interest in buying soybean locally?		
What amount?		
Challenges to buying soybean?		