

**Zasaka:**  
**Post-Harvest Grain Storage in Zambia**

**D-Lab 1: TTP 289A**

**Kellan Hays, Jake Reynolds, Jenny Mital**

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## Executive Summary

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Nationally, on average, Zambia loses around 30% of its maize post-harvest (Jensen). The Zambian government's maize programs are often late in providing farmers with inputs, as well as, credit payments for harvested maize (Silungwe). The resulting economic instability for smallholder farmers has kept the country from reaching its economic potential. Our clients business, Zasaka, aims to ameliorate the situation by providing hermetically sealed (air-tight) maize sacks, and buying dried maize from farmers at a competitive price. Zasaka will then store the maize and sell it at peak market price; Zasaka will then use the profits to expand the business. The feasibility advantages, as well as, the potential problems in Zasaka's business, value chain, and proposed pilot locations, were investigated via literature research and interviews with in-country contacts. Our goal was to provide go-to-market recommendations that would give Zasaka the best chance of success.

An overview of the agricultural, farm policy, and transportation sectors, produced an overall picture of the current agricultural situation in Zambia. Agriculturally, Zambia does not meet its potential to produce large crop surpluses of their staple crop, maize, due to: issues with transportation, a lack of crop diversity, and post-harvest losses. Zambian agricultural policy is composed of government farm input and buying programs. These programs often deliver goods and credit payments months late; they do not serve the segment of the population most in need of their aid. This problem is aggravated by Zambia's poor transportation infrastructure. Under-maintained roads are common in Zambia, as they were built without assuring the existence of future maintenance funds.

The two Zambian villages we focused our research on were graded for suitability as project locations; stakeholders were listed and evaluated. Both proposed pilot villages, Chitambala Village and Katete, were found to be feasible locations based on the following criteria: the presence of the target market, the likelihood of surplus maize crop, farmer receptiveness, road quality, and distance from storage. The stakeholders most important to project success are: hermetic storage companies, community leaders, groups with storage facilities for rent, and grain purchasers.

Based on our research, Zasaka can be a successful venture in Zambia. Trials should be conducted in both pilot villages to test both the 50 kg bags and community storage bags. It is important that our client observe the reception of the business within different regions of Zambia. Zasaka should minimize business risk by partnering with an established hermetic storage manufacturer such as PICS or GrainPro and hold early meetings with influential and connected stakeholders. Given the current political and social climate in Zambia, Zasaka is well poised for success, as it will fill a market niche within the Zambian agriculture sector.

## **Introduction and Problem Definition**

An average of 30% of Zambia's post-harvest maize is lost each year due to poor storage techniques. This leads to the loss of livelihoods and encourages grain price fluctuations, which hurt farmers economically, especially those operating on a small scale (Jensen). Zasaka aims to reduce home storage losses for farmers and provide a reliable selling price and mechanism, including cash on delivery, through the use of hermetic bags, as well as, cash on transaction payments.

Our role in this project was to create go-to-market recommendations for Zasaka. Literature research and conversations with contacts in Zambia allowed us to produce: a stakeholder analysis, detailed value chain maps, a profit calculator for farmers, rank the feasibility of two proposed pilot locations, and provide start-up recommendations. It is our hope that this information will help Zasaka have a smooth start, and help them to grow into a successful business within the Zambian agriculture sector.

## **Methodology**

Our group conducted exploratory and qualitative research, in order to, produce new ideas and provide insight to Zasaka. Through primary resources (interviews) and secondary sources (literature searching and case analysis), our group was able to generate a comprehensive list of go-to-market recommendations for Zasaka. Our literature search provided broad information on Zambia's government, transportation issues, and farming policy. The case analysis of Grain Pro and PICS provided us with a benchmark, which we could use to provide new recommendations for the improvement of Zasaka's business model.

The key informants our group contacted were in-country sources located around the region of the proposed pilot program (Chitambala Village and Katete). Our key informants had extensive knowledge of the region, communities, and cultures in which Zasaka would come into contact. Our key informants proved to be vital in the production of our go-to market recommendations for Zasaka. It is important to note that our key informants were biased, as they want Zasaka to succeed.

The limitations we encountered in the drafting of our recommendations to our client were: a lack of knowledge about Zambian culture and customs (which will very likely be a vital for the adoption of our client's product), difficulty contacting our key informants over email (due to internet connection issues), the time difference between California and Zambia, the inability to conduct other forms of exploratory research (e.g. surveys, questionnaires, focus groups) due to lack of access to potential clients and distributors, and the location of the case analysis and benchmark projects outside of Zambia.

## **Four Lenses of Sustainability**

The four lenses of sustainability were used, both in forming the interview questions that we asked our key informant, as well as in determining our final recommendations.

### **Environmental**

Environmental sustainability is not the main goal of Zasaka's, although it could be categorized as an environmentally sustainable business. Both Zasaka and their customers will presumably reuse the storage sacks until the end of their useful lifetime (2-3 years) (Jensen). The sacks can then be recycled to minimize environmental impact, as plastic recycling is available throughout Zambia.

Additionally, hermetic storage bags make the use of pesticides on stored grain unnecessary, which will improve the overall health of families and workers who handle the bags. This is especially important since most smallholder farmers store pesticide-dosed bags within their homes (Jensen).

Lastly, transport of the bags to and from market already occurs, so Zasaka will not add appreciable quantities of emissions from travel. The reusability of the bags and absence of pesticides make Zasaka's business venture a net improvement (environmentally) over Zambia's' current maize storage system.

### **Technical**

The only technology investigated in our project was hermetic storage sacks, which are the core of Zasaka's business model. There is significant research proving that they are a highly effective pest deterrent and can be incorporated for use with multiple varieties of crops. Due to the thick plastic interior of the bags, pesticides are no longer needed. The sacks prevent pest entry and kill whatever infestation maybe present in the crop when it is sealed inside the sack (One Acre Fund, GrainPro News).

### **Financial**

The business model and pricing structure Zasaka has developed should generate profits for the business and their customers. For this report, a simple calculator was designed to test if farmers would see a return on investment from using the bags (Zasaka D-Lab Estimated Net Rev Calculator for Farmers). Many test scenarios were run on the calculator based on a range of data. Farmers in the recommended target markets should expect an increase in profits if Zasaka sticks to the planned business model.

As in any new business, much of the financial modeling is based on assumption and proxies. One Acre Fund is the primary comparison for Zasaka's financials. While testing the numerical data of

the business was not in our scope, the basic business of storing maize and reselling the maize at a higher price to generate profits seemed important to keep in mind throughout our research.

The financial risks are clear. For example, if the maize is destroyed, the operating costs are higher than anticipated, or if the farmers do not adopt the new technology, the business can fail. Keeping capital investments low, at least during the pilot, and sharing risk with bag manufacturers can help hedge against financial failure. Specifically, partnering with bag manufacturers may allow shared transportation and marketing costs.

### Social

The interviews conducted and the recommendations made on behalf of our client always kept the culture, labor practices, and customs of our client's customers in mind. Social customs will play a large role in the business's acceptability and use by farmers.

## Business Model

The business model for Zasaka revolves around the annual maize crop cycle. Zasaka seeks to cut post-harvest storage losses of maize for small farmers. Zasaka will reach out to prospective customers just before the beginning of maize harvest season (March or April). Customers who choose to work with Zasaka will receive training on how to appropriately use the hermetic sacks they purchase.

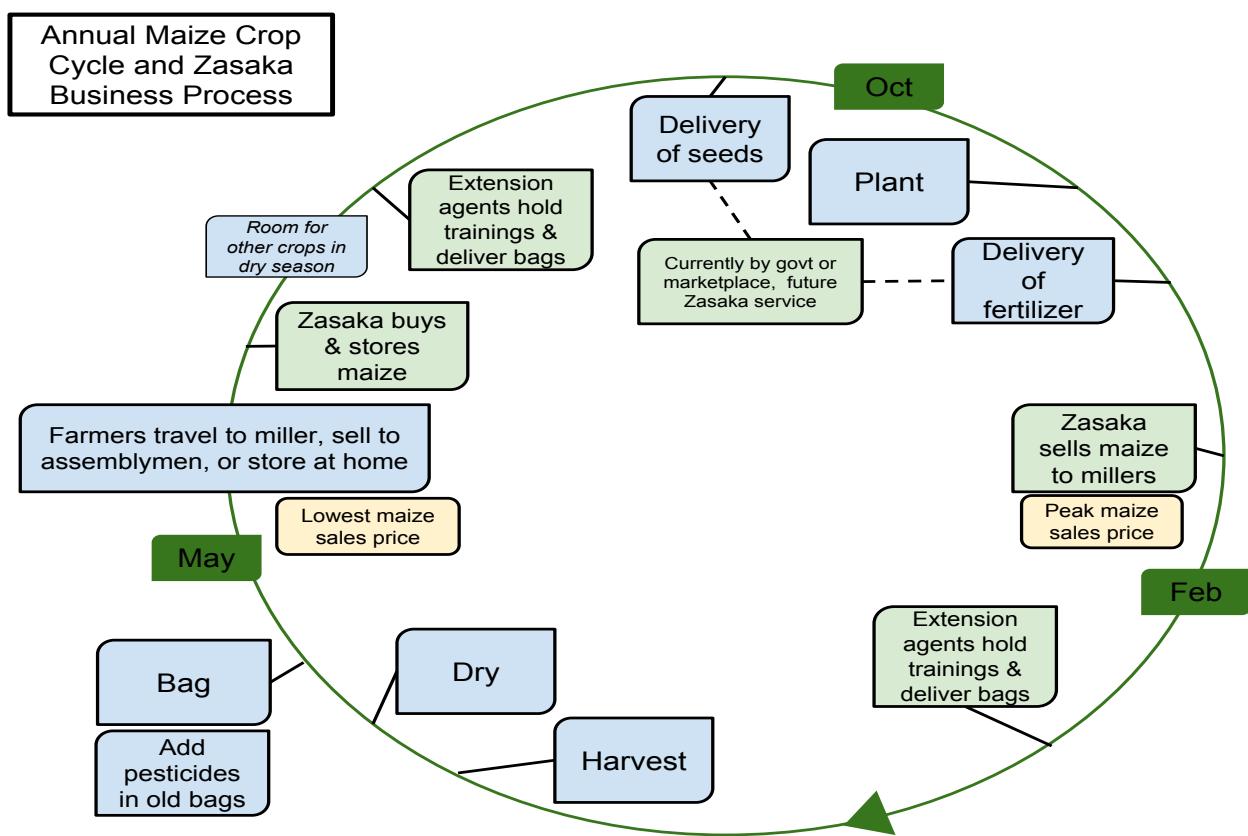
The second part of the Zasaka's business model takes place after the maize is dried and placed in the hermetic storage sacks. Pesticide application is unnecessary with hermetic storage sacks because the lack of oxygen kills any pests present in the grain (Gunter and Martin). Farmers pay for the bags of maize they keep, and bags full of maize sold back to Zasaka are free of charge. Zasaka will ensure their customers will sell the maize back to them because they offer something that their competition does not; Zasaka will pay cash at the point of sale at the same or higher-than market rate (i.e. the rate offered by the government). The Zambian government only pays in credit and is often late with payments (Silungwe). This is yet another reason why small farmers will choose to sell to Zasaka. With cash, Zasaka customers will have more financial flexibility in times of need.

After farmers sell their surplus maize to Zasaka, Zasaka will store the maize in a predetermined storage facility nearby. The storage facility will be protected in order to deter possible thieves, which is another incentive for small farmers to become customers; maize theft is a major problem in Zambia (Mate). The maize will remain in storage until the maize market has reached the peak price point (around January). Zasaka will then sell the maize to millers and receive a large return on the investment in the hermetic storage sacks. The profits will be used to purchase more sacks and increase extension services for their customers.

During the period in which the maize is in storage, Zasaka will have the opportunity to reach out to more prospective customers to increase the customer base and potentially offer them training

services in order to prepare them for maize planting season. As part of a complete package for their customer, Zasaka may eventually implement input delivery as part of the program just before and just after the maize is planted. If Zasaka can ensure timely delivery of inputs (fertilizer and seed) to their customers, they stand to replace the Farmers Input Support Program (FISP) as the main distributor of inputs to small farmers. Currently, small farmers using FISP do not typically receive inputs until months after those inputs are needed. This results in lower crop yield and potential hunger for small farmers and their families. By branching out in this direction, Zasaka could improve families' livelihoods and increase amount of surplus maize available for sale.

A schematic of the business model is shown in Figure 1.



**Figure 1. Zasaka Business Model and Value Chain**

## Background

In order to provide context for our recommendations, our group conducted exploratory research on: the economy of Zambia (specifically the smallholder farmer industry), federal agricultural programs and policies, transportation infrastructure, and our target communities.

### The Economy and Smallholder Farmer Industry in Zambia

The World Bank has regularly named Zambia as one of the Top 25 “Global Economic Prospects” (Boesler). World Bank cites the government’s ability to take advantage of large-scale market shifts. For example, the Zambian government increased copper exports when prices were on the rise. Unfortunately, The World Bank also forecasts that the country’s growth is slowing. Predictions show that Zambia’s GDP growth rate will decrease steadily—from 7.3% in 2012 to 5.8% in 2016—becoming on par with the average growth for Sub-Saharan African countries (The World Bank). The key reasons for this downturn is the lack of industry diversification, a rapid population growth, and a “stubbornly” high poverty rate (Central Intelligence Agency).

Poverty rates in Zambia’s urban provinces, the Copperbelt and Lusaka, range between 20% and 35%. Turn to the rural areas, where 64% of the population resides, and poverty rates range from 70% - 85%. In this range, the most remote and decentralized areas host the largest percentage of impoverished and malnourished residents (CIA).

Approximately 79.6% of the country’s GDP is created by services and industry. The service sector includes “government activities, communications, transportation, finance, and all other private economic activities that do not produce material goods” (CIA). Major industry is led by mining, which is historically an economic stronghold for Zambia, as well as manufacturing, energy, and construction. The global community continues to invest in Zambia’s mines to the tune of eight billion dollars (USD) since 2000, and for decades, their copper mines have remained some of the more active in the world (Zambia Development Agency).

Even though these industries provide the majority of the country’s money, they employ a mere 17% of the population. The rest of Zambians work in the agriculture sector. Seventy-eight percent of women in Zambia are engaged in agriculture, and sixty-nine percent of men (Tembo and Sitko).

## **Maize as the primary crop**

Farming in Zambia is dominated by maize. This is increasingly true as government subsidies for seeds, fertilizers, and purchasing maize from farmers become more widespread. The subsidies were first introduced in 2004. By the 2010/11 harvest cycle the amount of maize produced in Zambia had almost doubled. As shown in the Data on Crop Diversity for Zambian Smallholder Farmers appendix, while the percentage of farmers growing maize stayed relatively constant, the yield of maize per household rose 60% (Tembo and Sitko). Consequently, it's not surprising that 57% of the country's caloric intake is from maize.

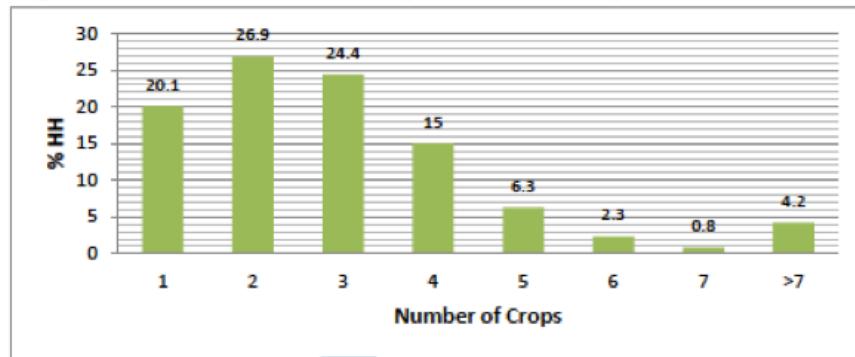
This overwhelming reliance on maize for food and funds, encouraged by the government and exacerbated by poverty levels, simply isn't matched by the quality storage technologies, transportation models, and fair market prices necessary to create a profitable way of life for small-scale farmers. It's a vicious cycle that could be addressed in several different ways.

## **Types of solutions – Transportation, Crops, Storage**

As we explore solutions for improving the livelihood for small-scale farmers, it's important to note that only in conjunction with a transportation model that reaches remote farmers will increased yields, crop subsidies, and improved storage systems truly make a difference across Zambia.

One solution to this problem is encouraging a diversification of crops. Twenty percent of small and medium size farmers only grow one crop, and more than 70% grow three or less (See table below from Tembo and Sitko). Encouraging even a few percentiles of these farmers to grow one extra crop could dramatically increase nutrition for families and potential for profit for millions of people.

**Figure 32. Percent Households by Number of Crops Grown Zambia, 2011**



Source: 2012 CSO/MAL/IAPRI Rural Agricultural Livelihoods Survey.

**Table 1. Crops grown by small and medium farmers in Zambia**

Smallholder farmers grow cassava, groundnuts and sweet potatoes in addition to maize. Medium and large-scale farmers have begun to layer in new types of products, including fish, goat, and other proteins (Fish Site, Zambeef, and Tembo and Sitko) Farmers of all size are also testing different farming practices to scale up, like oxen plowing, sustainable farming, and machinery.

Across all crops, yields for all farming in Zambia are below global averages (Tembo and Sitko). However, rains are well above average, so the potential for higher yield certainly exists, even without much technological intervention. As yields increase—or even if they don’t—better post-harvest storage solutions and transportation models are also key potential solutions to farmers’ vicious cycle.

A second solution to the vicious cycle is the integration of better post-harvest storage technologies. Common practice is to store dried kernels of post-harvest maize in jute bags, usually 50kg or 100kg in size. To keep insects and rodents out of stored bags, farmers commonly use pesticides, like aluminum phosphide, on their post-harvest maize. To prevent theft, farmers then keep these bags inside their home, where unfortunately their families are exposed to the toxic pesticides (Jensen).

In one farming community, Chitambala Village, which is west of Lusaka, 10 residents used a clay urn as a test for communal, semi-hermetic storage techniques during the last harvest season (Jensen). While the urn worked to prevent post-harvest losses, it is stationary and provides less overall flexibility for the farmers than grain sacks. In particular, the urn is a shared tool and comes with its own set of new community rules. This adoption of new group storage technology may make Chitambala Village more receptive to testing larger community-sized hermetic storage bags.

Two companies have been successful in reducing post-harvest losses with simple hermetic bag technology across the African continent. They’ve enabled an enormous amount of farmers around the world to more reliably feed their families and take advantage of market maize prices. The new 50kg bags cost farmers between \$2.00 USD and \$4.00 USD depending on distance traveled, compared to \$0.40 or \$0.60 USD for current jute bags.

### **Case Study: GrainPro**

GrainPro is a multi-product and international company working primarily in about twenty-five countries and storing twenty different types of crops. Not only do they sell hermetic bag storage solutions, but they also sell dryers, oxygen and aflatoxin testers, and moisture meters. In 2011, Grainpro cited a partnership with Africare where their bags were being distributed by local affiliates in two southern towns in Zambia. While the use of the bags may still be used in these

communities, and could even be growing in the country, no new Zambian stories or research have been found in the writing of this report (GrainPro).

Of the 22 nations that GrainPro lists as users of their technologies for maize, four are geographically close to Zambia. None of the four has a single-small-farmer distribution system outlined for maize. (See table below, created from data from GrainPro). However, their work with coffee farmer networks and collective storage options in these countries show that a collaborative farming method could also be tested in Zambia.

GrainPro Ultra-Hermetic Storage Products are currently used in the following countries for maize storage:	
Brazil	
Bangladesh	
Bolivia	
China	
Costa Rica	
Dominican Republic	
Ecuador	
El Salvador	
Ethiopia	
India	
Indonesia	
* Kenya - no research found on intro biz model. Seems used by larger farmers?	
Myanmar	
Mexico	
* Rwanda - used communal storage options	
Sri Lanka	
* Tanzania - NGO partnership model - primarily for coffee in Kigoma	
Thailand	
Turkey	
* Uganda - use case is for coffee only and GrainPro praise of dryer system	
Venezuela	
Vietnam	
* neighbor - learn about their distribution process and look at possibility for a distribution partner	

**Table 2. Countries in which GrainPro Hermetic Storage Bags are used**

### Case Study: PICS

The second successful company is Purdue Improved Cowpea Storage (PICS). They are also a multinational organization. PICS works in West and Central Africa exclusively and only sells hermetic bags for single farmer use. The organization uses local distributors, including storefronts (agro-dealers), farmers, cell phone vendors, and other entrepreneurs (Coulibaly, Nouhoheflin, Aitchedji, et.al.). They use a creative combination of trainers in the villages to distribute “how-to” pamphlets and teach farmers a variety of marketing strategies to raise awareness, acceptance, and popularity. For example, they have run radio ads, led public demonstrations in villages and markets, hosted “open-the-bag” ceremonies, and trained NGOs as well as journalists. One lesson learned in Togo and Niger for example, is to have cost sharing of promotional activities with vendors. Another lesson learned is to piggyback upon existing distribution networks, like the

agro-dealer, but also school supplies or mobile phone cards (Coulibaly).

Currently, PICS does not operate in Zambia. But, with a new batch of funding, the organization is looking to grow. Additionally, case studies show that in a few countries, farmers are already using the bags for maize with good results, and distributor demand for bags is increasing.

Country by country, there are individual strengths and weaknesses in the PICS system. The organization created a list of key and incredibly valuable lessons learned across PICS' operations, which is included in the appendix. Those lessons with an asterisk are applicable to Zasaka.

### **Case Study: One Acre Fund**

One Acre Fund is a farming aid, training, and entrepreneurial systematic approach in Kenya, Tanzania, and Burundi. Much like the challenges described in Zambian farmers' vicious cycle, One Acre Fund realized the farmers they work with aren't held back by one thing, but the combination of multiple barriers. So their approach is systematic and includes: creation of farmer groups, farm inputs on credit, walking distance delivery, training for farmers, and improved access to storage and markets for harvest sales (One Acre Fund).

## **Agricultural Policy in Zambia**

Government policy and structural issues affecting farm inputs and the maize market have implicit consequences for the rural poor (i.e. small-scale farmers). The poor are affected by maize policy far more than policy governing other crops (Govereh et al.).

Small-scale farming in Zambia is subsistence farming. In fact, less than 30% of farmers produce enough grain to sell. [6] Poverty rates and decentralization impede farmer's abilities to get affordable inputs in a timely fashion, which impacts yields. Inputs include seed, labor, fertilizer, and other up-front needs. While the Zambian government subsidizes and provides many maize inputs to farmers, the international commodity price of inputs is unreliable and could certainly impact the Zambian subsidies model. For example of the extreme, One Acre Fund, a farmers' aid organization in Africa, recently saw a 200% price fluctuation for fertilizer over just one year (One Acre Fund).

Farmers that have the capacity to sell their grain currently are subject to low post-harvest prices and have crude methods to learn about selling prices for crops. One organization, Zambia National Farmers Unions (ZNFU), is attempting make crop price communications faster and more reliable through a mobile phone and website network—encouraging users to share mobile

phones and seek out internet cafes (ZNFU). The prices and needs distributed by ZNFU are also at the miller-level, not market-wide level, so farmers can match up with specific buyers.

Overall, Zambian agricultural policy is dynamic in that it seems to constantly change. Since the 1980's, maize policy in particular has changed numerous times and had major impacts on the maize market. The Food Reserve Agency (FRA) and FISP are two of the most critical actors in the government's attempt to reduce rural poverty through the manipulation of the maize market and increase in farming inputs. However, neither program is helping small farmers as intended; small farmers that operate on less than 1-2 hectare of land are not targeted by the FISP subsidies, and therefore only 56% of smallholders receive subsidized farming inputs through this program (Bhalla, Govereh et al.). Subsidies instead go to the most prosperous 2%-5% of farmers who produce 40-50% of Zambia's maize due to larger farms and proximity to tarmac roads (Zulu V, Govereh et al., Bhalla). FISP, by law, should be delivering four bags of fertilizer and a bag of seed to each farmer at a subsidized price (Bhalla). The FISP has been accused of not delivering on its promises to farmers and giving some farmers more than their allotted input amount. An estimated 40% of FISP inputs distributed do not make it to farmers and only about 50% of the fertilizer received by farmers is used (Navuyanda). The FRA and FISP subsidies have major consequences for the private fertilizer and seed industries in Zambia, who are being pushed out of the market by the government programs because of their inability to compete with the government's low prices (Mukuka).

The FRA continues to purchase maize at an increasing amount and at a subsidized rate every year, even though it does not have the capacity to store all of the maize it purchases. The FRA is responsible for driving up the price of maize because private grain millers purchasing maize must compete with the FRA to purchase grain. The price increase is then passed onto consumers (Bhalla).

The government programs have further hurt the maize market by creating a poor relationship with private industry. The government has constantly changed export and import policy, and vastly understated their intention for purchasing maize. This has led to mistrust of the government by private industry, which is equally mistrusted by the government due to the belief that private companies will exploit maize farmers and cause an increase in poverty. The tension between the two factions hurts everyone in the maize value chain. Despite the government stating that they will curb these subsidy programs, the trends continue to cause harm to the already disparaged smallholder in rural Zambia (Bhalla).

## Transportation in Zambia and in our Target Communities

Transportation is an integral part of the Zasaka business model and maize industry. A Zasaka employee will need to travel to and from villages in urban Zambia to sell the hermetically sealed

bags, train farmers on proper bag usage, and deliver the maize to the storage and sale points. Therefore, the safety, distance, and road quality of the selected travel route will be a central part of the business strategy.

Zambia borders eight countries and has a large road and railroad network, lending it the potential to be a hub of South African trade (NEA). International transport to and from Zambia consists of air, rail, and vehicle travel. There are four main international airports, the largest of which is the Kenneth Kaunda International Airport in Lusaka. Roads and railroads convey the majority of trade and goods and are very widespread within the country. Main roads connect the four main regions of the country and run from Solwezi to Kazungula, Kapiri Mposhi to Nakonde, Lusaka to Mchinji, as shown below in Figure 2 (Zambia Development Agency).



**Figure 2. Major Roads in Zambia (Zambia Development Agency)**

The government of Zambia currently maintains the roads shown in Figure 2. To improve maintenance frequency and promote ownership in road quality, the Zambian government has proposed that private companies (mostly mining companies) maintain and upgrade these roads. Construction would be paid back via a toll system, unlike previous construction projects that left no funding for maintenance (Zambia Development Agency).

The majority of Zambian roads have little traffic and are underutilized (according to the standards in Figure 3) due to the large distance of constructed roads through the sparsely populated land (ECFA, Raballand and Whitworth).

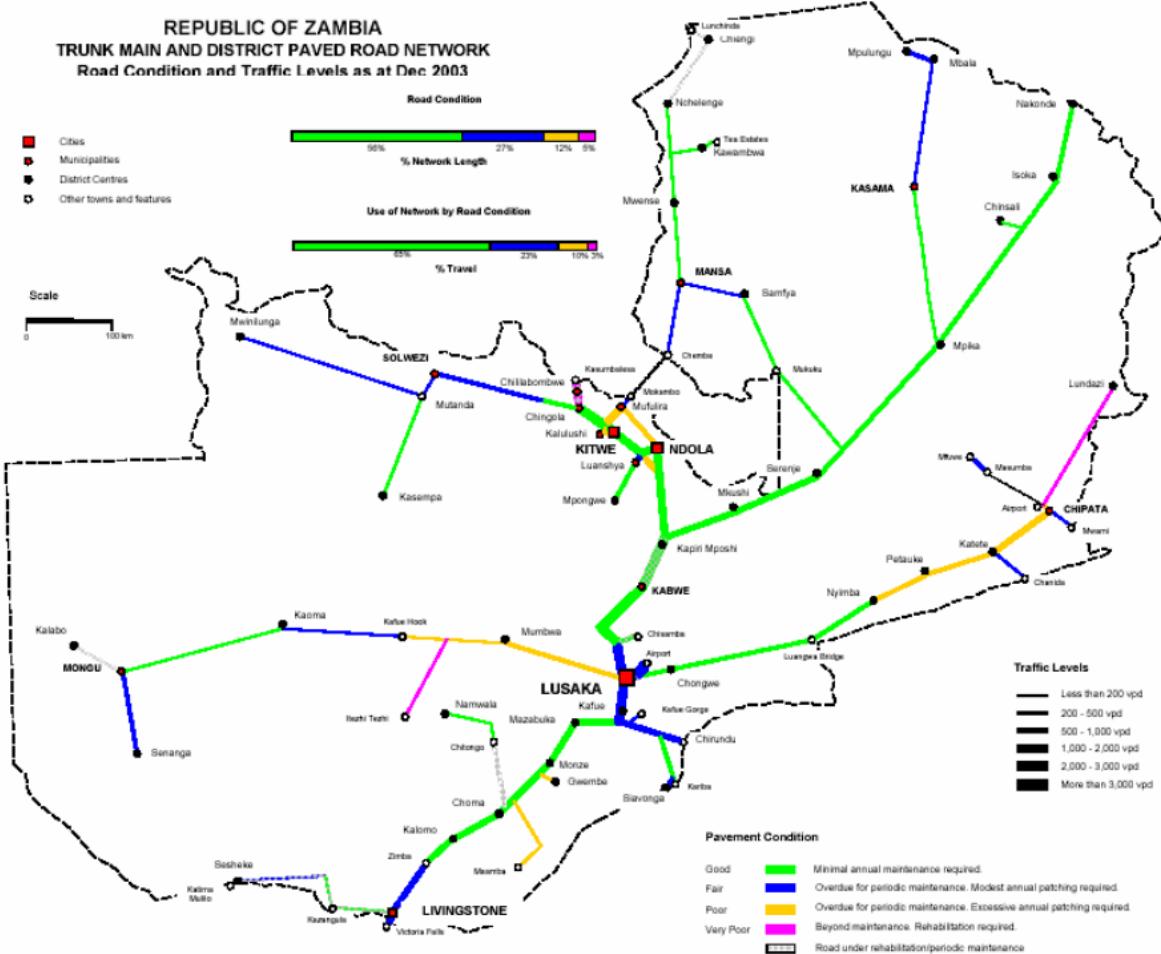
Interestingly, the First Highway Programme in Zambia recommended the following thresholds / surface standards for different traffic levels back in the 1960s:

- a) *Earth* surface, with occasional graveling if required, for roads with traffic volumes of *less than 20 vehicles per day*.
- b) Full gravel standard for roads with *20 to 150 vehicles per day*.
- c) Bituminous surface for roads with *more than 150 vehicles per day*.

(World Bank 1997)

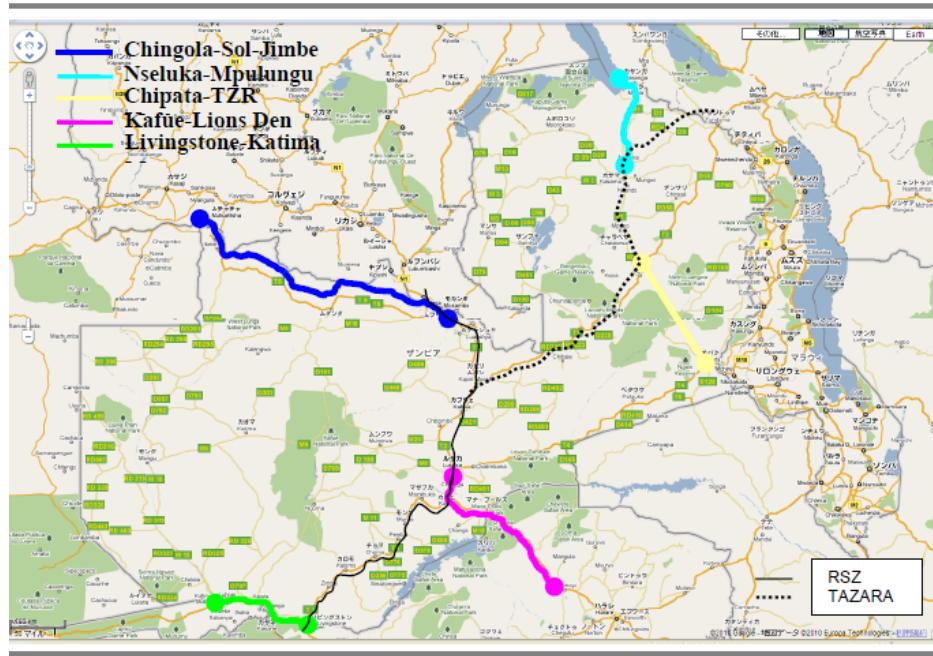
**Figure 3. Zambian Road Construction Criteria Based on Traffic (Raballand and Whitworth)**

The construction of too many improved roads with little usage overwhelmed the existing maintenance system. In 1995, 51% of Zambia's main roads were deemed to be in poor condition by the World Bank. Fortunately, the Zambian government undertook a major effort to remedy this by increasing road maintenance funds from 30 million USD in 1995 to 648 million USD in 2013, thereby decreasing the percentage of "poor" quality main roads to 6%. However, the smaller roads connecting the rural areas that make up the bulk of the country are still under maintained, with an average of 60% still rated "poor" (Raballand and Whitworth). Other issues for roads are seasonal impassability of dirt roads for several weeks during the rainy season and damage to all roads due to overloaded trucks (NEA). Figure 4 shows road quality and usage in Zambia.



**Figure 4. Road quality and usage in Zambia (NEA 2004).**

The other major mode of goods transport is railroad. Figure 5 shows the current and proposed rail lines in Zambia.



**Figure 5. Existing and proposed railroads in Zambia (Zambia Development Agency)**

Railroad offers the movement of goods within Zambia and into Mozambique, Malawi, Angola, and Tanzania. The existing major railroads are shown in black on the map (TARARA and RSZ), and proposed railroads are in color. As with roads, railroads suffer from a lack of maintenance and facilities (Zambia Development Agency). The RSZ has promised 60 million USD will be committed to railroads from 2004 through 2024, so hopefully this is changing (NEA).

### Small-Scale Transport

Few people in the country can take advantage of the road infrastructure. Sixty percent of the population resides in rural areas, yet only 2% of rural citizens own a vehicle (Chapoto and Jayne, Central Statistical Office of Zambia). This impedes trade and the delivery of needed government inputs of seed and fertilizer, especially in the more remote regions of the country, which typically experience lower crop yields for that reason.

However, for the majority of the country, viable if somewhat time-consuming transport options exist. Rural citizens utilize bicycle, oxcart, or foot transport and the network of small feeder roads to go to local markets and do business with traders who transport goods via truck. Approximately 50% of rural farmers live within 3 km of an accessible feeder road, and the remaining 50% travel an average of 9-10 km to the nearest trader or government crop seller to sell maize. Small farmers typically travel the shortest distance possible to sell their crop, often selling to “briefcase buyers” who underpay for the crop but are often the only accessible option (ECFA, Chapoto and Jayne).

Bus and taxi transport are available in the capital, Lusaka, and between some major cities. Private companies operate “mini-buses” based on demand (ECFA). Other bus services, including private European-style buses and express buses, are more expensive and cater toward tourists. Cars are available for rent for upwards of \$51 USD per day plus \$0.38 USD per kilometer, much too expensive for the average Zambian or for Zazaka’s business needs (Lonely Planet).

## Travel Planning

The main travel planning that can be accomplished outside of Zambia is investigating the distance and road quality from each proposed pilot village to the storage site and capital, Lusaka. There are no toll roads between either city and the capitol, but road quality and prices of gasoline along the route may have a large impact on costs to the business (Public Monitoring and Research Centre). Transporting maize by rail is not an option because neither city is located along the railroad line (Figure 5, Zambian Development Agency). If maize is sold outside of the country, railroad transport from a major city such as Lusaka might become a viable option. This will be determined after the maize buyer is selected.

The distance from Chitambala Village to Lusaka (the current proposed storage location) is 160 km, or approximately 3 hours of travel in a personal vehicle (Google Maps). One hundred and thirty km of the trip are on fairly large roads, based on Google Maps. According to Marc Mate with the International Development and Innovation Network (IDIN), the road from Chitambala Village to Mumbwa is an approximately 5-kilometer long dirt road easily passable by truck. From Mumbwa to Lusaka (the capital and proposed storage location), the road is a good quality gravel surface (Mate). There are no major towns on the route according to Google Maps.

Grain storage facilities will likely be available within Katete, so travel to storage will be minimal. The distance from Katete to Lusaka is 488 km all along a tar road in good condition, with an estimated vehicle travel time of 6.25 hours (Mate, Google Maps). All travel occurs on highway T4, which crosses into Mozambique for part of the trip (Google Maps). It is that a toll or customs office will be present at the two border crossings. Towns along the route include: Munale, Chongwe, Karoma, Talabuko, Mukunku, Kacholola, Chitizauwe, Mawanda, Chilye, Chiabala Village, Sinda, and Mpoto (Google Maps).

## Results

Research results include: an in-depth investigation of the two proposed pilot villages, project stakeholders, current maize market policies, and key points about the governing sectors of transportation, farm policy, and agricultural. Each point in the value chain was investigated to find potential problems in the business model and validate Zasaka’s plan, based on the specific circumstances of Zambia. Through literature research and conversations with in-country

contacts, an in-depth investigation of the Zasaka business model is presented. Further research will take place on the ground when our client visits Zambia.

The feasibility of the two proposed pilot villages was evaluated and compared for their potential for Zasaka's success. First, an evaluation criteria for the two cities was established. The presence and potential interest of the target market were considered, followed by the likelihood that the target market would have a maize surplus to sell. Then, the distance from proposed maize storage locations to the pilot villages was considered along with the road quality along those routes. Lastly, the distance from the manufacturer of PICS hermetically sealed bags in Malawi was considered. (GrainPro bags may be selected by our client instead, but the Malawi location was used for the analysis.) Accessibility of the location to potential maize purchasers was not included because Zasaka has not determined which of the many potential business partners in and out of the country it will sell to. The criteria and analysis of Chitambala Village and Katete are shown below in Table 3.

**Table 3. Pilot location feasibility analysis**

Criteria	Village		Region	
	Katete	Chitambala Village	East	West
Access to target market (maize farmers <2ha)	5	5	5	2
Farmers' willingness to try hermetic bags	3-4	5	3	3
Farmers have surplus to sell	3-4	3	3-4	1-3
Distance from storage	5	3	5	2-3
Road quality to storage and Lusaka	4	3	4	2-3
Distance from hermetic bag manufacturers	5	2	5	2
<b>Total score:</b>	<b>26</b>	<b>21</b>	<b>25.5</b>	<b>14</b>
<b>Average category score:</b>	<b>4.3</b>	<b>3.5</b>	<b>4.3</b>	<b>2.3</b>

Categories are ranked from 1-5 for suitability; 1= poor, 5= good. All categories are weighted equally.

The table also includes scores for the eastern and western portions of Zambia. The eastern, central, and Copperbelt (mining) regions of the country are known as the Maize Belt and produce the majority of the country's maize due to a more suitable climate than the western region, where frequent flooding make cassava and rice more suitable crops. Maize is not cultivated as frequently in western Zambia, and typically less maize is produced. A map of the cassava and maize producing regions of the country is shown in the Appendix.

Both Chitambala Village and Katete are in the Maize Belt. Based on the interviews we conducted, both locations likely have similar access to the target market and farmers in both locations would probably be willing to try the bags based on economics alone, as shown in the Estimated Net Revenue Calculator for Farmers.

Members of Chitambala Village in particular are very interested in improvements in storage technology due to an IDIN communal storage project jointly owned and used by ten families. The scale does not reflect this, but the enthusiasm and willingness to try group storage seen in Chitambala Village should greatly increase the probability of project success in that area. The community storage utilized in Chitambala Village could also make the village more willing to try the GrainPro Cocoon group storage bag rather than the more common 50 kg bags (GrainPro, Mate).

Farmers in both villages would probably be equally likely to have surplus maize to sell, with a slight bias toward Katete due to its location in the higher-producing eastern region. Katete has new government storage facilities in the city, so it has a very short distance to storage compared to Chitambala Village; the current plan is to store maize from Chitambala Village in Lusaka, 3 hours (160 km) away, since Lusaka is the closest location with known storage. It's noted for future business growth that roads in the western portion of the country are of poorer quality than those in the east.

Lastly, bag manufacturers for PICS are located in Malawi, which borders eastern Zambia, close to Katete. The distance from Chitambala to Malawi would increase transportation costs somewhat (Mate, Silungwe).

All rankings are estimates based on literature research and conversations with in-country contacts. The proposed rank of each category may vary by one to two points from the actual score, and will have to be determined by visiting Zambia; a score greater than 3 should indicate a suitable location. From these criteria, both Katete and Chitambala Village are suitable for the pilot project; however, western Zambia, in general, is not suitable.

## Stakeholder Analysis

Project stakeholders were investigated, categorized, listed, and ranked to provide an overview of all people who could influence Zasaka's business model and overall success. Groups and rankings are shown below in Figure 6.

Stakeholder	Individual or Group	Notes	Level of Interest	Level of Influence
Zambian farmers	Formal community Leader		4	4
	Informal community leaders - women's groups		4	2
	NGO extension workers		2-3	1-2
Groups with storage space for	Aggregation depots, gov. and other		3	2
	Large-scale farm enterprise			
	Grain purchasers		3	2
Input Distributors/Potential business partners	Zambia National Farmers Union	Talk with regional reps.	3	3
	Zambian government, FISP		2-3	2-4
	Burlap sack manufacturers		2	2
	Local burlap sack purveyors		3-4	3
	Hermetic bag manufacturers in Malawi (PICS)		3	3
	Hermetic bag manufacturers, Grainpro		3	3
	Grain purchasers		3	3
	Assemblymen ("briefcase buyers")		5	2
	Drivers for hire		3	1
	Agricultural lenders/microlenders		2	2
Grain purchasers	Fertilizer manufacturers: Nitrogen Chemicals of Zambia Ltd. (NCZ)	20% of gov. fertilizer contracts		
	Zamseed	Seed purveyor, storage, transport, agro-dealer network	3	3
	Other seed purveyors: Seedco International, Zambia Ltd, Pannar Sed (Zambia) Ltd, MRI Seed Zambia Ltd, Pioneer, DuPont Zambia Limited, Monsanto		3	2
	National Milling Corp. Ltd (NMC)	Animal feed producer, buys maize from small farmers and FRA	3	2
	Hybrid Poultry Farm	Animal feed, buys locally	3	2
	Amigo Food Ltd.	Buys 50-60% of materials	3	2
	Zambian Breweries, National Breweries	Buy from local farmers	3	2

Source: Sutton and Langmead 2013

Scale: 1= Lowest, 5= Highest

#### Figure 6. Stakeholder Analysis

Based on our analysis of all stakeholders in the Zasaka business model, we identified the four most influential groups in the value chain. In sequential order down the business model, they are the hermetically sealed bag companies, formal community leaders, groups with storage facilities

for rent, and grain purchasers. For the hermetically sealed bags that are the core of the business, Zasaka is already considering a potential partnership with hermetic storage companies PICS and Grainpro.

A partnership would allow Zasaka to use well-proven storage bags and affiliate with the positive reputations of these companies instead of starting off completely unknown. This would help simplify Zasaka's business model by providing well-tested and reputable storage bags and is attractive to the hermetic storage companies because it would help them expand the product market into Zambia.

Next, the community leaders represent the villages where Zasaka can do business by purchasing maize and selling storage bags to local farmers. With the approval of the community leader, the project can move forward, and the leader's trust may make farmers more likely to trust Zasaka in turn.

Next in the value chain, the purchased grain must be stored prior to sale at the peak market price several months later. The storage location would ideally be located near the proposed pilot cities and will need to be determined in-country. Lastly, grain purchasers must buy the maize so that Zasaka can make a profit and expand. Talks with grain purchasers will involve the sale timeline and price negotiations. Grain purchasers are one of the most important parts of the value chain because they provide the means for Zasaka's income and expansion. Current briefcase buyers may feel threatened by Zasaka's competition, but it may be possible to integrate them into the business model by employing them as maize buyers for Zasaka.

Other key players include the Zambia National Farmer's Union, current maize buyers that will be in competition with Zasaka (assemblymen or briefcase buyers who travel to local villages and then sell farmers' maize to a third party), vehicle/transportation services, and inputs deliverymen (FISP and traders). The support of the Zambia National Farmer's Union may allow Zasaka access to the ZNFU's text-message and radio advertising service used by many farmers, increasing the customer base.

Transportation services will be integral in traveling between the multiple steps on the value chain. Transportation options will be evaluated in country, as little pricing information is available online.

Many other projects involving hermetic storage of grains to combat postharvest loss have occurred successfully in Africa. However, there is no current program in Zambia, and only scant evidence that a previous program of this nature was tested in the country (GrainPro News, One Acre Fund). This led to the question of why no such program was currently situated in Zambia and how Zasaka could best succeed where others have not ventured. Therefore, all research was assessed to determine the suitability of Zasaka's business model for the political and social situation in Zambia. Major findings were a lack of trust in the Zambian government agricultural input and purchasing organizations, gender roles, and farming practices heavily dictated by

tradition, and a dearth of agricultural education, but overall receptiveness toward improved storage technologies. None of these significantly harm Zasaka's potential for success, and many improve it. Zasaka is well situated to succeed in Zambia because its business model complements the current social, political, and agricultural issues in the country.

The current lack of trust in the government due to late delivery of subsidized seed and fertilizer, as well as late payment delivery for dried maize, improves the chances of farmers preferentially choosing Zasaka as a maize purchaser. Furthermore, the government input program does not supply maize storage sacks any longer as subsidized inputs, and farmers currently have to purchase their own burlap storage sacks and pesticide to keep bugs out of the non-hermetically sealed sacks. Zasaka has another advantage in their business model here since they do not charge for bags used to store grain sold to the company, and no pesticide application is required due to the hermetic storage technique that both prevents entry of insects and kills any already present in the grain.

Based on the profit calculator, Zasaka's purchasing plan would economically comparable, or better than, the government's plan for farmers cultivating less than 2 hectares of land. These small farmers are also the group that would see the highest percent increase in income and food to feed their families from decreased storage losses. For these reasons, Zasaka's business plan will likely be highly successful among small farmers. Once it is established, Zasaka may also be able to capitalize on the government's late delivery of inputs by selling those as well (Mate, Silungwe).

A potential barrier to any improved agricultural technology is the inertia of tradition. Traditional farming methods for farmers in the target market involves: allowing maize to dry on the husk for 1-2 months after maturity, filling 50 kg burlap sacks with grain, dosing it with pesticide to deter insects, and storing the sacks in the home to prevent theft prior to sale (Jensen 2014, FAO). Although Zasaka's business model may seem like it only creates small changes to this system, but people are skeptical of new things. For this reason, Zasaka will hold demonstration and instructional sessions in the pilot villages prior to selling bags to teach people how to properly use the bags and demonstrate that they work better than the traditional burlap sacks. In-country contact Sunday Silungwe recommends introducing 50 kg hermetically sealed bags first in Katete, then other sizes of storage bags later, as one way to minimize the changes from the current storage practices (Silungwe). Introducing several new storage practices conjointly would decrease the likelihood of adoption in villages (Mate, Silungwe). In locations where individuals have already formed a community storage initiative, such as Chitambala Village, the larger GrainPro Cocoon sacks could be introduced at the pilot trial as well.

Our research brought to light how gender roles play out in the agricultural sector and a result in a lack of farming education and extension training for women. While crucial to the prosperity of farmers in Zambia, neither of these is directly related to the core success of Zasaka, which depends mainly on farmers' willingness to buy hermetic storage bags or sell crops to the

company and Zasaka's ability to make a profit off of the grain by selling it to large maize purchasers at peak price. However, this presents a potential area for future expansion of the business model, as Zasaka's overarching mission is to improve small farmers' livelihoods.

Currently, the gender gap decreases the overall prosperity of the family. Women perform the majority of farm labor, while men act as supervisors. At sale, men take the majority of the profits to use for themselves instead of improving the family's lot (Silungwe). These gender roles are probably not true in all families, but they are fairly common in Zambia. Zasaka could help ameliorate the situation by giving women more of a role in the decision making process. Gender roles are slowly changing, and this would provide another small step in the right direction.

According to in-country contacts Marc Mate and Sunday Silungwe, farming education is one of the biggest unmet needs in rural Zambia today, and training on basic practices, such as the application of fertilizer, are greatly needed (Mate, Silungwe). Typically, governments in developing countries provide one extension worker for agricultural training per 1500-3000 people (Pye-Smith). Considering the dispersed population and poor quality of small roads leading to most rural villages, the number of people who actually have access to agricultural education is even lower. While neither of these findings are part of Zasaka's business model, they represent a need that Zasaka could fill in the future.

## Recommendations

### Core Business

When designing a bottom-of-the-pyramid social entrepreneurial venture, it's incredibly easy to get caught up in the variety of health, environmental, poverty, or gender-related issues your business may be addressing. For the success of Zasaka, it is important to remember that the core business must be the primary focus. Concentrating on the function of bringing hermetically sealed bag storage solutions to specific towns in Zambia and generating profit on its own is an incredibly challenging undertaking. It is only with success in this simple business objective that the business can grow and continue to serve farmers in their goal to improve their families' quality of life.

### Margin-mission relationship

For the long-term sustainability of the business and its positive impacts, it is also crucial to draw the line between business operations and operations that are aid-related. When being pushed to make decisions that are margin vs. mission, Zasaka must continuously look for ways to improve margins so that the mission can be supported. First, margins can be supported through a cost management strategy. For example, making creative efficiency and cost-management decisions on transportation, for which there is a recommendation later in this report. Second, margins can be supported by looking for the optimal price to charge farmers for the bags. As C.K. Prahalad

states, “This is not about lowering prices. It is about altering the price-performance envelope” (Pralahad). Zasaka can charge \$2 - \$4 per bag if the services that come along with the bag are that valuable and highly regarded. One tactic PICS recommends, is not setting a reference price for the bags or giving too many test bags away for free. This allows the perceived value of the bags remains high (PICS). In fact, PICS states as a top ten key lesson from their operations that, “First-year reference price programs have substantial negative effects on market development in subsequent years.”

As the Zasaka business grows, there is the possibility that the company would lose money-delivering bags and purchasing maize in the most rural areas of Zambia, places where farmers are typically the poorest. Increased transportation costs and/or limited and/or no bag sales (only bags used to sell maize back to Zasaka) could easily cause this situation. By establishing profit-generating operations in other communities, Zasaka could have the ability to subsidize the operations in the most hard to reach rural towns. This mission-driven decision should only be made after profitable operations have been established and the bookkeeping should reflect these specific decisions. It follows that by making margin-driven decisions, Zasaka can be even better suited to serve their mission.

### **Searcher vs. Planner**

As much as the teams at Zasaka, D-Lab, and the Big Bang business plan competition have spent planning and iterating on the Zasaka business plan and go-to-market recommendations, it's only after one or two growing seasons that we will know if it works. With a searcher versus planner mentality, the Zasaka team (Carl Jensen and Sunday Silungwe) can be flexible enough to find a model that works through experimentation and build a “homegrown” solution (Easterly). Key recommendations from the searcher model include:

- Admitting that you don't know all the answers in advance
- Find things that work for their audience and get some reward
- Take responsibility for their actions (this will be key for Zasaka as they promise on timely deliveries)
- Adapt to local conditions (each community has different current best practices and cultures around agriculture)
- Find out if the customer is satisfied (Zasaka cannot assume that each farmer enjoyed using the bags or the process of selling maize to the company. Building feedback mechanisms will be essential.) (Easterly).

### **Stakeholders**

The searcher model is best done by considering all stakeholders and asking many questions. As stated in the stakeholder analysis, the four most influential groups are: the hermetically sealed

bag companies, formal community leaders, groups with storage facilities for rent, and grain purchasers. The farmers themselves are the fifth and most important group.

Zasaka is already actively building relationships with bag manufacturers and will be touring a PICS bag manufacturing facility in Malawi this month. Being on the ground in Chitambala and Katete during the same means that the Zasaka team can talk directly to community leaders and farmers. In Chitambala, Carl Jensen can use his existing contacts to be introduced to community leaders. In Katete, Sunday Silungwe can aid with introductions, and the team should use the community center, Tikondane, as a hub. Tikondane also provided two a community maps that can aid in networking throughout the town, as shown below.

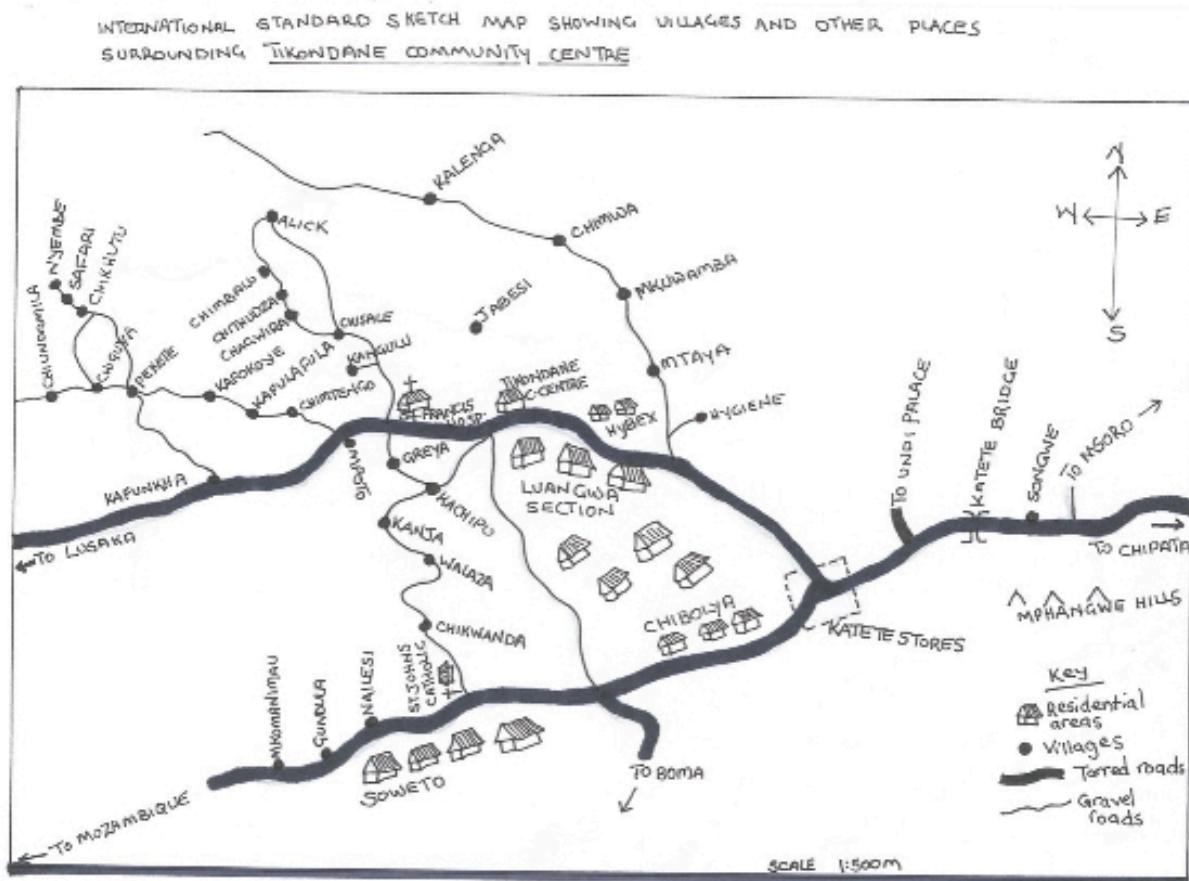


Figure 7. Tikondale community map of Katete



**Figure 8. Tikondale community map of Katete**

In the appendix Purveyors and Purchasers of Interest, four distinctive grain purchasers to approach are suggested. National Milling Corporation, Amigo Food, and Zambian Breweries each seem to value higher quality, local maize and could be ideal customers for Zasaka. In order to be introduced to a diversity of grain purchasers, storage facility owners, and farmers, Zasaka should reach out to the Zambian National Farmers Union on the trip in March as well.

### Testing in Chitambala and Katete

From the pilot location feasibility analysis, both Chitambala Village and Katete remain realistic locations for the first year of Zasaka. Considering the searcher framework, it would be ideal to run tests in both locations. It's also important to recognize that while the technology is being proven to farmers, they will certainly be using a combination of jute and hermetic bags for their maize. Understandably, this combination would tend to be hermetic bags for maize they will sell to Zasaka, and jute for home storage, until the return on investment was proven.

In Chitambala, Zasaka should be able to run two simultaneous storage tests, one with shared storage similar to the shared ceramic urn that is already working in the village, and one with individual 50 kg bags. Growing beyond the ceramic urn system from the IDIN project, shared storage technology could be with the GrainPro Cocoon product. By running two tests, Zasaka can discover what farmers actually prefer and better serve their needs. Additionally, since Carl has already spent time in Chitambala, he already had built relationships that can aid his business and inform his pilot test.

In Katete, the pilot should include 50 kg bags only; introducing one new technology at a time can

help with tests and adoption in new communities. Since Katete is farther from Lusaka, Zasaka should look for options to rent storage space closer to Katete in addition to hub location in Lusaka in order to save on transportation costs and hedge their capital cost investments.

If for capital cost and time reasons Zasaka just chooses one city, it should be Chitambala because the community has a history of being very receptive to new storage technologies and the previous IDIN community storage project located there was successful. As Zasaka identifies other potential towns for business growth, they should continue to use the location feasibility analysis shared in this report.

## Target Market

From analysis of expected maize sales by area cultivated (See table below from Tembo and Sitko) and the Zasaka business model, combined with other research and results in this report, the recommended target market is farmers that are growing on 2 hectares or less in towns that meet the requirements in the location feasibility analysis. The Zasaka D-Lab Estimated Net Revenue Calculator for Farmers showed that it was financially beneficial for these smallholder farmers to use hermetic bags for some or all of their maize.

**Table 4. FISP Fertilizer Received (2010/11 Crop Season) and Expected Maize Sales, 2011, by Farm Size Category**

Total area cultivated (maize + all other crops)	Number of farms (A)	% of farms (B)	Poverty Rate (%) (C)	% of farmers receiving FISP fertilizer (D)	kg of FISP fertilizer received per farm household (E)	% of Total FISP fertilizer by land size (F)	% of farmers expecting to sell maize (G)	Expected maize sales (kg/farm household) (H)
0-0.99 ha	596,334	39.6%	81%	14.3%	24.1	12%	22.2	135
1-1.99 ha	499,026	33.1%	81%	30.6%	69.3	30%	47.7	609
2-4.99 ha	354,116	23.5%	66%	45.1%	139.7	43%	64.0	1,729
5-9.99 ha	49,410	3.3%	38%	58.5%	309.7	13%	82.1	6,613
10-20 ha	6,999	0.5%	15%	52.6%	345.6	2%	86.8	15,144
Total	1,505,885	100%	76%	28.6%	77.1	100%	42.7	950

Source: MAL/CSO Crop Forecast Survey, 2010/11. Reproduced from Jayne et al. 2011.

One key lesson from the PICS projects was that “bags are well adapted to the storage needs of smallholder farmers, but not as well accepted by large scale grain traders.” Larger farmers have economies of scale with existing technologies and, in Zambia, also actively take advantage government subsidies. As stated previously, research shows that one reason inputs can skip or be late to smaller farmers is that both the FRA and the FISP’s distribution of benefits are skewed towards farmers that are, on average, better off (Bhalla). By targeting smallholder farmers, Zasaka is also filling a gap in the government’s program.

Research also showed that women are highly involved in the work of subsistence farming in Zambia. Even if women aren’t typically the one managing the family’s finances, Zasaka can take

advantage of this active population by hosting trainings and bag demonstrations at times when women can attend. This can both help generate more revenue for Zasaka and appeal to the mission of the organization.

In order to further segment their market and target appropriately, the Zasaka team must keep excellent records on the types of farmers who are served best by the business. Noting attrition and retention rates for different farmer types and families will also help Zasaka in their business growth strategy.

## **Transportation**

Most smallholder farmers in Zambia lack motorized transportation for themselves and their crops (Central Statistical Office Zambia 2013, Raballand and Whitworth 2013). Therefore, a reliable and efficient transportation strategy is vital for Zasaka since farmers will not dependably be able to travel to take advantage of the business.

Major highways are typically better maintained, so a route that minimizes back-road travel by staying on the highway as much as possible will reduce transportation time, costs, and problems (Raballand and Whitworth). Due to recent investment in road maintenance, Zambia's road quality has improved, and most roads will present no problem to maize transport by Zasaka (Zambia Development Agency). According to Marc Mate of IDIN, roads from both Chitambala and Katete to Lusaka, the capitol city and major trade center, will pose no problem for Zasaka.

Additionally, relatively population-dense areas will be the most cost effective for Zasaka. Understandably, in these areas they can serve more farmers at one time and spread costs, like transportation and training, out over larger groups. When Zasaka is more established, it can branch out into more isolated areas where farmers are more likely to be overlooked by other maize buyers.

## **Shared Risk and Costs**

Starting any business is a risky proposition and Zasaka is starting with limited funds. Looking for ways to share risks and costs throughout the value chain can help protect the business as it tests for the right revenue model. PICS highly recommends sharing marketing costs with distribution partners, but Zasaka's model distributors are employees of the company. So, we must look to other partners. First, since PICS and GrainPro are both interested in growing into Zambia, they may be open to sharing marketing costs or transportation costs as Zasaka gets off the ground.

Second, since all Zasaka drivers do not need to be full-time employees and the capital cost investment of cars carries lots of back-end maintenance costs, a rental or subscription payment model could work well to spread out costs and share risk with the drivers and their own cars. This is one of the first cost items that Zasaka staff should be researching and resolving, since timely delivery is a key part of their value proposition.

Leasing storage space versus buying any facilities can also serve to spread out costs over time and mitigate risk associated with committing to a storage location.

### **Future Scalability and Business Growth**

To truly enable farmers to take advantage of the hermetic bag technology and better market prices, timely inputs are fundamental. Since the current governmental programs for inputs are unreliable at best, there is certainly an unmet need that could be addressed by Zasaka. Selling inputs would be a natural add-on to the business, especially if one of their core capabilities is timely delivery, and most importantly, because their customers are in need and probably have a willingness to pay for well-timed inputs.

Combined with farm management education, proper inputs can also increase yields, food for farmer's families, and sales revenue for Zasaka. Extension workers are scarce, and Zasaka will already be in communities delivering bags. So another natural add-on to the business would be providing some level of training in good agricultural practices to farmer customers. If Zasaka can find a solid wholesale input supplier and trustworthy employees for agricultural trainings, these two business growth opportunities can be piloted by year two.

While maize is the most popular crop in Zambia, it certainly isn't the only crop that needs to be protected and stored. Additionally, PICS and GrainPro bags are used around the world for a wide diversity of crops from coffee to cassava. Zambia's western region is the rice belt, and, like maize, rice is susceptible to weevils and other damage from improper storage. Cassava and sweet potatoes are also popular crops throughout Zambia and cased studies showed both types of crops stored in hermetic bags. By examining the market price fluctuations for these different crops, Zasaka can see if there is room for them to take advantage of peak prices and expand their business model to include other crops. They should also expect that their customers will use the hermetic bags throughout the year to store more than maize. See the appendix for more data on crop diversity.

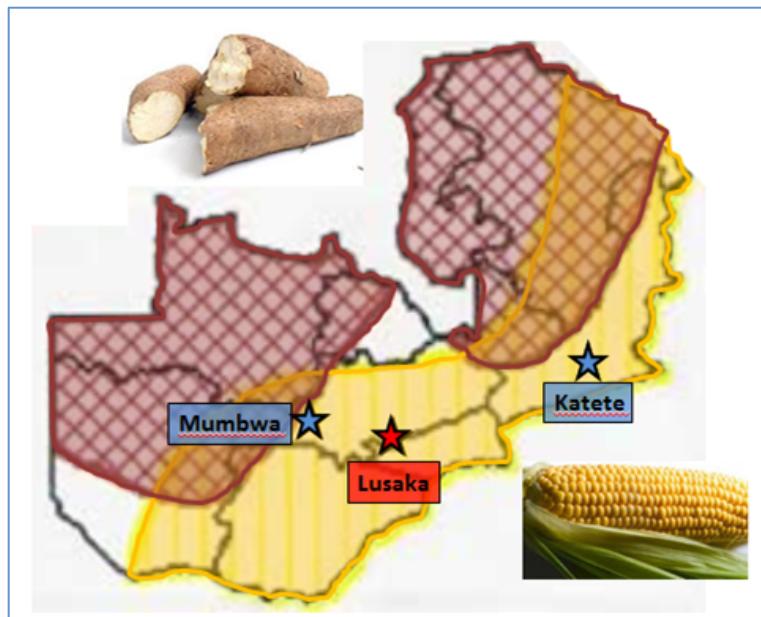
Two additional growth opportunities for Zasaka address existing businesses in Zambia and bring them greater potential economy opportunity. First, the current sellers of the jute storage bags make their livelihood off of a technology Zasaka is trying to phase out. Instead of looking at these retailers as competitors, they could be brought on board as additional distributors of the bags. Whether they become employees of Zasaka as a trainer/distributor or they are just selling bags at market and bring some extra revenue to the company, they could prove to be a valuable stakeholder. Solar power, candle, and cookstove retailers were cited by Sunday Silungwe as other groups that were already excited by new technologies and might also want to start distributing bags. Zasaka could alternatively stay out of the retail market, introduce PICS or GrainPro to interested parties, and receive a commission for the referral.

Second, the existing plastics manufacturers in Zambia could be brought into the business or introduced to PICS and GrainPro. Producing hermetic bags in country would reduce costs for Zasaka, and bring new business to other Zambian companies. There are 11 plastics manufacturers in Zambia. Sunday Silungwe believed that while the factories that he's familiar with tend to have older technology and machinery, the ideas of in-country bag manufacturing seemed very promising.

## Conclusion

Now is an excellent time for Zasaka's leadership team to launch and test their business. The traditional barriers to entry have been lowered through the backlash and failure of the governmental maize subsidy programs, combined with the interest of bag manufacturers to expand into the Zambia. Farmers are eager for new solutions and ways to improve their livelihoods. Bag suppliers are eager to partner with those familiar with the Zambian landscape. The go-to-market recommendations, opportunities in the value chain, and addressed challenges that this research team has provided will greatly aid Zasaka's talented team in their business launch and first growing season.

## Appendix



**Figure 1. Maize and cassava producing regions of Zambia**

The yellow shaded area of the map constitutes the main maize producing region of Zambia, the “Maize Belt.” Cassava and rice are the main crops in the red-shaded portion of the map. Either crop may be grown in any part of the country, but the crops are cultivated predominantly in these specific regions due to climate patterns; western Zambia has frequent flooding, so it is better suited to rice or cassava than maize (Mate).

**Table 4. Mumbwa to Lusaka Travel**

Road	Distance (km)	Road size	Estimated travel time (hours driving)
Other	30		
Mungwi	48	Medium	0.77
M9	82	Highway	1.8
<b>Total</b>	160		3

Notes: There are no towns on the route large enough to be displayed on Google Maps.

**Table 5. Katete to Lusaka**

Road	Distance (km)	Road size	Estimated travel time (hours driving)
T4	488	Highway	6.25
<b>Total</b>			6.25

Towns along the route: Munale, Chongwe, Karoma, Talabuko, Mukunku, Kacholola, Chitizauwe, Mawanda, Chilye, Chiabala Village, Sinda, Mpoto

Notes: T4 crosses into Mozambique for part of the journey. It is unclear whether there will be customs or other border offices related to this border crossing.

## Purveyors and Purchasers of Interest

### Seeds and fertilizers

Zamseed

- Zamseed is a seed company that has a large warehouse, transportation and agro-dealer network. Zamseed sells maize seed as well as seed for other foods, including legumes, which are often rotated with other crops to replenish soil nitrogen. Distribution warehouses are located in Kitwe (5.3hrs from Lusaka), Chipata (7.33hr), Mazabuka (1.83 hr), Chisamba (1.12hr) and Kapiri (2.8hrs). Chisamba is the closest to Lusaka.
- Other seed purveyors in Zambia include Seedco International, Zambia Ltd, Pannar Seed (Zambia) Ltd, MRI Seed Zambia Ltd, Pioneer, DuPont Zambia Limited, and Monsanto (Sutton and Langmead 2013).

Nitrogen Chemicals of Zambia Limited (NCZ)

- Produce a basal dressing fertilizer used in maize farming
- Responsible for 20% of government fertilizer contracts
- Goes to local markets to sell fertilizer (nothing more specific)

## **Large corporations that purchase maize**

National Milling Corporation Limited (NMC)

- Second largest producer of animal feed by volume
- Purchases most maize from small scale farmers because it is higher quality than commercial farmers
- Purchases approximately half of its maize from the FRA. The other half is purchased in Lusaka and Livingstone.
- Products exported to Mozambique, Malawi, and the Democratic Republic of the Congo

Hybrid Poultry Farm

- Purchases maize for animal feed from local farmers

Amigo Food Limited

- Purchases 50-60% of raw materials locally, including maize

Zambian Breweries, National Breweries (owned by SAB Miller group of South Africa)

National Breweries

- Purchases maize from local farmers
- Factories at: Kitwe, Ndola, Kabwe, Lusaka and Chipata

## **Purdue Improved Cowpea Storage (PICS) key lessons learned:**

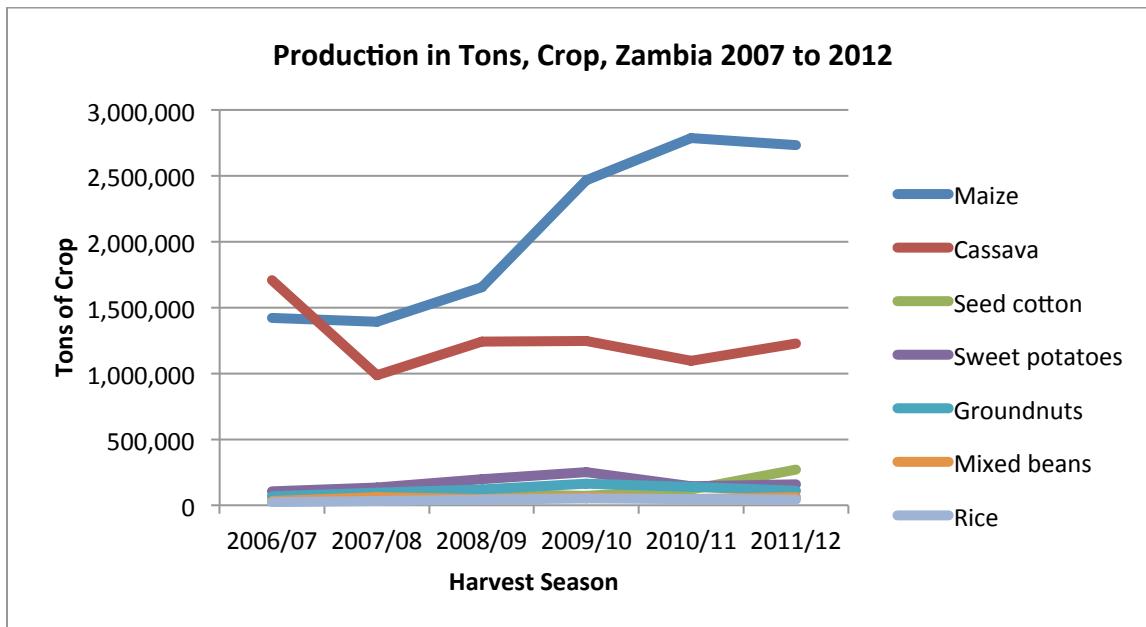
- \*\*PICS bags are well adapted to the storage needs of smallholder farmers, but not as well accepted by large scale grain traders;
- \*\*The PICS incremental rollout strategy over five years allowed for learning in the early years to be incorporated in subsequent countries;
- \*\*Risk sharing strategies are needed for manufacturers and distributors of PICS bags;
- Agro-dealers are some of the best PICS vendors, but cell phone vendors and other entrepreneurs can be effective PICS retailers;
- Public sector institutions like national extension services are not well suited to sales of PICS bags, but individual public sector employees can be good vendors as a supplementary activity;
- Credit is not a key constraint for most PICS vendors, but low profitability and risk are;
- \*\*First-year reference price programs have substantial negative effects on market development in subsequent years;

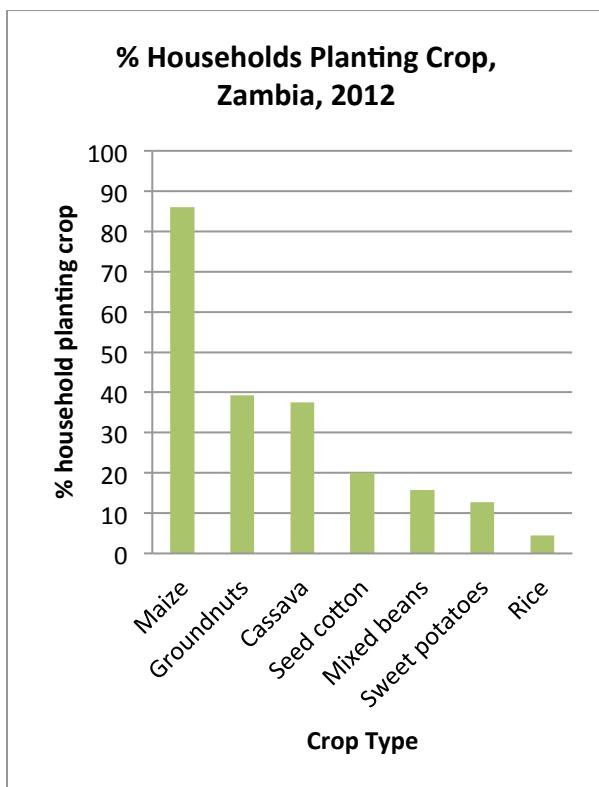
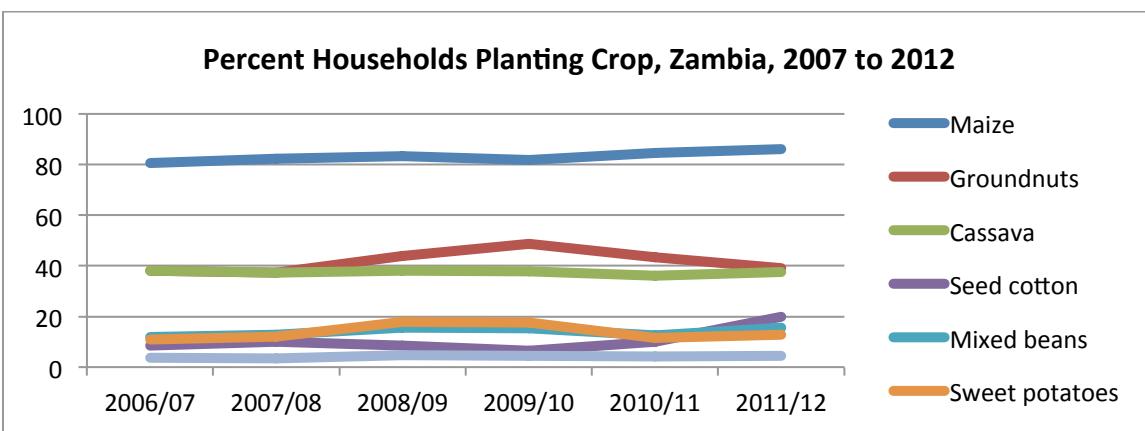
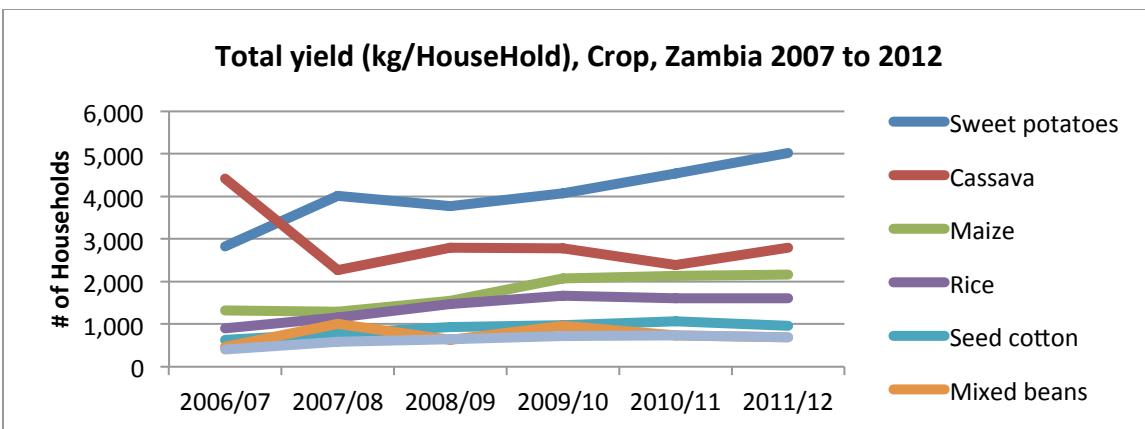
- \*\*Crop forecasts are key to timely availability of PICS bags;
- Trademarking the PICS logo was a useful step, but it is not a substitute for patent protection; and
- PICS project business consultants played a key role in market development, which should be gradually shifted to the private sector.

\*\* Denotes that this lesson is applicable and of particular importance to the Zasaka business strategy

## Data on Crop Diversity for Zambian Smallholder Farmers

\*All four charts created from data from Tembo and Sitko





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