THE POTENTIAL TO COMMERCIALISE HERMETIC STORAGE BAGS IN ZAMBIA
AN ANALYSIS OF THE MARKET

Case Study No. 4
November 2018
ABOUT AGDEVCO – IMPACT INVESTOR

At AgDevCo we are contributing to the transformation of agriculture in Africa from subsistence farming to a modern, commercial sector. We do this by investing debt and equity and providing hands-on support to establish and develop commercial-scale agribusinesses.

Typically, we invest between $1 million and $5 million of debt and equity in early-stage enterprises, targeting primary food production and agro-processing companies where we believe we can make the most impact. Alongside financial support, we provide hands-on guidance to management teams. We work on the ground from the outset, collaborating with our investees to grow their businesses.

AgDevCo’s Smallholder Development Unit (SDU) works with rural agricultural enterprises to develop equitable outgrower schemes that boost productivity and incomes for smallholder farmers. The SDU is supported by the Mastercard Foundation and DFID and works in seven African countries: Zambia, Mozambique, Malawi, Tanzania, Uganda, Ghana, and Senegal.

ACKNOWLEDGEMENTS

Prepared for AgDevCo’s Smallholder Development Unit by Nadia Martinez, AgBizManagement

Design and layout of the study was by Frances Herrod.
EXECUTIVE SUMMARY

This study was commissioned by AgDevCo's Smallholder Development Unit (SDU) to assess the market demand and commercial potential of hermetic storage systems to improve maize storage and marketing in Zambia. It draws upon previous reports and studies related to maize storage and hermetic technology in Zambia and other countries, and is supported by a field survey carried out in December 2017.

KEY FINDINGS

- More than 90% of rural households store maize.
- Post-harvest losses are 20-30%.
- Hermetic storage technology reduces wastage by almost 100%.
- Current use of this technology is minimal.
- Distribution channels are weak.
- Market demand potential as high as 90 million bags.
- Cost of a hermetic storage bag can be recouped in a single year.
- High potential for commercialisation.

RECOMMENDATIONS

- Support investment in commercialisation of hermetic storage technology.
- Provide specialist technical assistance to improve distribution.
- Work with commodity traders to provide bags on a credit check-off system with contracted suppliers.
- Invest in mass media promotion, as well as demonstration and training.
- Collaborate with development partners and private sector suppliers.

98% of farmers surveyed hold maize for at least five months. While only 30% shell and bag their maize, more than half use chemicals to protect against pest damage. Using hermetic bags to store maize would not only increase the availability of food and create additional income but it would also have a significant impact on public health.
INTRODUCTION, OBJECTIVES AND METHODOLOGY

INTRODUCTION
Preventing post-harvest losses can make the difference between a hungry or healthy population. Zambia is the third largest maize producer in southern Africa, after South Africa and Malawi, with annual output of around three million tonnes.¹

Much has been done to improve production practices and increase yields, yet very little in relation to managing the crop after harvest.

As a result, as much as 30% in post-harvest losses are experienced, especially by small-scale farmers.² This is mainly due to lack of improved technologies or know-how.

This study was commissioned by AgDevCo's Smallholder Development Unit (SDU) in order to better understand the market potential, to inform its strategy, and to help design a project with high likelihood to deliver the desired development impact on a sustainable and commercial basis.

OBJECTIVES
The main purpose of this study was to review past trends and provide a best estimate of future market demand potential for hermetic storage bags. The key objectives were to:

> Verify the extent to which post-harvest losses are being experienced and validate the need to improve post-harvest practices;
> Establish baseline figures for current usage and sales of hermetic bags, and identify farmer segments with the greatest market potential;
> Recommend marketing and distribution strategies to meet demand; and
> Suggest interventions that can be made by SDU to support commercialisation of the technology

METHODOLOGY
The study was carried out by a contracted consultant and a team of interviewers, in collaboration with staff from the Conservation Farming Unit (CFU). The Eastern and Central provinces were targeted since they lead the country in maize production.

> Desk research based on public sources, donor studies, and NGO reports. Resources from Kenya and Uganda, where hermetic storage technology has been promoted heavily, were also reviewed.
> Key informant interviews with 26 relevant actors (see list in annex).
> Focus group discussions (in three districts in the Central and Eastern provinces. 56 farmers participated, 45% of whom were women. Participants in the Eastern Region were selected at random from CFU's farmer database (but including only those living within 35 km of the district centres); those in the Central Region were selected from among the smallholder suppliers to a processing company (Seba Foods).
> Household survey with 58 farmers (41% of whom were women) in two districts in the Eastern province. Again, respondents were selected at random from among those recorded in CFU's farmer database as living within 35 km of the district centres.

The assignment did not include an assessment of the manufacturers’ business plans or marketing strategies, so validation of individual companies’ financial performance, marketing funds or production costs was not possible. Estimates are based on interviews with suppliers.


Farmer at village weighing point.

Smallholder farmers receive training on post-harvest handling and correct HST storage procedures.
SECTION 1: HERMETIC STORAGE SYSTEMS

Hermetic technology refers to the process of storing respiring products – usually durable crops with low moisture content such as dry pulses, seeds or grains – in sealed, airtight or semi-airtight containment systems.

These systems can be plastic bags or metal silos of any size that stop or limit oxygen and water movement between the atmosphere outside and the stored product. By preventing or restricting the passage of air, the moisture content of the stored grain will remain the same as when the storage was sealed. At the same time, grain respiration inside the sealed container consumes the oxygen, and, as a result, most insects and other micro-organisms will die before they can consume or taint the stored product.

Advantages:
- Effective moisture and insect control without applying pesticides.
- Can be almost 100 percent effective over a period of months or even years.³
- Based on a simple and cost-effective technology.
- Enables storing grains and pulses safely for home consumption.
- Smallholders can profit from rising prices months after harvest.
- Can be used for both small-scale home storage and medium- to large-scale aggregation facilities.

Disadvantages:
- Hermetic bags are three times more expensive than traditional gunny sacks.
- To be cost effective and used for several seasons, the bags must be retained and stored when grain is sold or consumed.
- Training is needed in order to use hermetic bags optimally.
- If bags are adopted at population level the plastic liners will need to be collected and recycled or made from biodegradable polymers.
- Large-scale hermetic systems are difficult to maintain at low enough oxygen levels over long periods.

SMALL SCALE BAGS

To date, hermetic bags (of 100, 90 or 50 kg size) are by far the most common type of hermetic system promoted by suppliers and used by growers and traders. These consist of an outer, woven, polyfibre bag for protection, and an inner plastic bag (in some cases two bags) to create hermetic conditions around the product being stored.

The design, thickness, and type of material used for inner and outer bags differ but the principle is always the same.

There are at least five brands of bag available in east and southern Africa, some designed, manufactured and distributed by a vertically integrated company, and others produced to specification for distributors.

MAJOR BRANDS OF HERMETIC BAGS - CURRENTLY ONLY AGROZ AND PICS BRANDS ARE AVAILABLE IN ZAMBIA.

<table>
<thead>
<tr>
<th>AGROZ</th>
<th>PICS</th>
<th>GRAINPRO</th>
<th>ZEROFLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double layer bag, with single hermetic inner layer. Comes with tie strings. Manufactured by A to Z Textiles in Tanzania and distributed in Lusaka by Livestock Services. Newly established branch of AgroZ in Zambia has sales staff in Lusaka and Kitwe.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple layer, with woven outer sack and two plastic inner liners. Manufactured and distributed by Polythene Products Zambia under licence from Purdue University, the developer and patent holder.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double-layer polyethylene inner liner and low permeability outer layer. GrainPro has the largest variety of bags, from 15 kg &quot;sample bags&quot; for coffee to several-tonne cargo bags. Manufactured in Asia and sold to distributors.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The ZeroFly bag is a woven polypropylene bag that has insecticide incorporated into the individual yarns of the outer layer. The inner layer is hermetic. Manufactured by Vestergaard.</td>
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</tr>
</tbody>
</table>

MEDIUM-TO LARGE-SCALE STORAGE

- Metal silos have the advantage of being secure, long-lasting, safe from animals, and capable of storing up to 1,000 kg or more. New designs made of durable, rigid plastic are starting to come into the market.
- The GrainPro Cocoon™ is the best known commercially available hermetic system for large-scale storage and consists of two plastic halves that are joined together with an air-tight zipper after the cocoon is loaded with sacks of the commodity to be stored.
- Cocoons can fit into 20- or 40-foot shipping containers and others can take up to 1,000 tonnes for bulk storage.

LEVELS OF COMMERCIALIZATION

Hermetic bags have been designed, developed and tested over the past 30 years but commercialisation has been slow until recently. Support from donors like the Bill and Melinda Gates Foundation, USAID, AgResults and others is helping to drive sales due to increased public awareness. PICS’s distributors sold 5 million bags from 2007 to 2015. In Kenya alone, 2 million hermetic bags (from five different brands) were sold between 2015 and 2017. Estimates of the global sales potential have been cited at 500 million (GrainPro).

Livestock Services is a major inputs supplier in Lusaka. It supplies individuals and agrodealers, and is the exclusive distributor of the AgroZ bag. Data from 2017 show that approximately 14,000 hermetic bags (PICS and AgroZ) were sold, compared with 220,000 ordinary bags. While this may not reflect the national picture, it is indicative of the potential for grain bags generally and the initial interest in the hermetic option.

INDICATIVE SALES, 2017

Hermetic bags Ordinary bags
6% 94%

SOURCE: Livestock Services Cooperative Ltd

COST OF HERMETIC TECHNOLOGY

The cost of hermetic storage systems depends on the size of the commercial storage unit or the cost of locally manufactured or recycled containers being used.

<table>
<thead>
<tr>
<th>LARGE COMMERCIAL SYSTEMS</th>
<th>250 KG SILO*</th>
<th>90/100 KG BAG</th>
<th>50 KG BAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50-100</td>
<td>$45-120</td>
<td>$2.20</td>
<td>$1.90</td>
</tr>
<tr>
<td>per metric tonne</td>
<td>average</td>
<td>average</td>
<td></td>
</tr>
</tbody>
</table>

With an expected life of at least 10 years this equates to a cost of approximately $5–10 per MT per year (excluding depreciation and finance costs).

These can easily last for 10 years with a theoretical price of $18 to $48 per MT per year, but the purchase price is still probably too high for the average smallholder.

Prices in Zambia are in line with other African countries. Although more expensive (per kg) than larger units that can last up to three times longer, in practice the low up-front cost of a bag is an important factor for smallholder buyers.

Studies in Kenya show that the cost a bag was recovered within one year and often farmers made more than 100% return per bag as market prices for maize increased during storage.

As the staple food in Zambia, maize is a key crop in terms of food security and income for the majority of low-income smallholder farmers. These farmers account for 90% of total national production of maize, as well as being major consumers.6

**SMALLHOLDER FARMERS CONSTITUTE A LARGE AND GROWING MARKET FOR HERMETIC STORAGE BAGS**

- **98%**
  - of farmers grow and store maize

- **83%**
  - of farmers store maize in bags

- **34**
  - Average number of bags stored

Source: SDU market survey, 2017

- **up to 30%**
  - Estimated post-harvest losses incurred by growers

Source: WFP; substantiated by the SDU market survey, 2017

Based on interviews with the main companies supplying hermetic bags into the Zambian market, it is clear that they see great potential for their bags but lack the resources or expertise to promote them to a tipping point where sales will gain their own momentum. They also make the point that promotion and training on the technology need to be generic and shared, because the potential for brand differentiation is limited.

**MAIZE VALUE CHAIN ACTORS AND HERMETIC STORAGE**

- **Growers:** An estimated 1.4 million smallholders produce approximately 90% of maize; 77% of production comes from the Eastern and Central provinces. Since most maize-growing families attempt to store at least a portion of the crop year-round (both for home consumption and for income), they constitute a large and growing market for hermetic storage bags.

- **Inputs:** Availability of agricultural inputs and equipment depends on a few importers and manufacturers based in or around Lusaka. These companies sell nationally through a network of local agents and small retailers spread across the country. In general terms, the national suppliers depend on relatively high margins and low volumes of sales. They do not have the supply chains, technical outreach, or credit management systems necessary to address the potential demand for hermetic bags. This potential is greatest among low-income farmers, who often located far from urban centres, in areas where specialist input suppliers are few and far between.

- **Buyers:** Farmers sell by the bag to the Food Reserve Agency (FRA) or to locally-based aggregators who work for, or sell by the truck load to, larger buyers. Much buying and selling through intermediaries takes place after the grain has left the farm: large grain traders such as NWK Agri-Services and AFGRI eventually receive 12% of the total maize sold and account for 40% of the marketed surplus in 2016/17.8 Because they only buy to specification, quality is not generally cited as a challenge by large buyers, and maize is treated with pesticides in warehouses or silos. Smaller traders report insect infestation as a specific problem, which they also control by regular use of insecticide. Since this is an additional cost, it further reduces the price that can be paid to farmers and local aggregators.

- **Service providers:** Researchers, extension workers, investors, lenders and credit providers all have a role to play in supporting commercialisation of new technologies. Hermetic bags have been tested extensively by researchers elsewhere but independent testing by the Zambia Agricultural Research Institute may be needed under local conditions. This will also inform the eventual establishment of quality standards and minimum specifications for hermetic bags placed on the market.

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Extension staff from both the government and the private sector will play a major role in sensitising farmers to the benefits of improved storage systems. Any investment in technical assistance, training and promotion should initially focus on them.

Investors in commodities have focused mainly on infrastructure and grain handling equipment for industrial scale drying, grading and bulking for export.

The major advantage of the hermetic bag is that it has a very low unit price relative to most new technologies, and can be tested and accumulated over time by individual households. So no major institutional investment is needed. However, experience has shown that the cost of reaching a critical number of rural buyers to jump start adoption, is beyond the reach of any individual company. Companies can invest in improved distribution systems, local advertising, basic extension services, and even local manufacturing of bags, but the extensive and dispersed need for technical messaging requires joint investment with public-sector stakeholders.

**MAIZE PRODUCTION IS INCREASING**

Despite attempts by government and donors to improve smallholder maize productivity, yields have not increased in recent years. Although the average yields of 1.7 to 2.2 MT/ha are low by international standards, the acreage planted and total production have been increasing. Zambia regularly produces a national surplus which it exports to regional markets.

Technologies that have the potential to improve yields – such as hybrid seed and fertilizer – have to be applied early in the production cycle and so involve significant risk for smallholder farmers. In contrast, investment in a hermetic bag reduces wastage of a crop that has already been produced, so involves very little risk. Hermetic bags may therefore be a more effective approach to improving net margins than those other technologies. This could be a strong selling point when marketing hermetic bags to smallholder farmers.

Better storage at household level would contribute significantly to Zambia’s competitiveness in the maize market.

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**MAIZE VALUE CHAIN ACTORS AND HERMETIC STORAGE**

**R&D, policy and institutional support**  
Ministry of Agriculture, industry networks, farmers’ unions and research institutes

**Financial Institutions** (credit along value chain)

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**Key**

- Input
- Unprocessed maize flow
- Processed mealie meal

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SECTION 3: SURVEY FINDINGS

59 smallholder maize farmers and seven small and large traders were interviewed in maize-producing areas of Eastern and Central provinces in December 2017. 41% of respondents were women and 17% were aged 35 years or below.

SMALLHOLDER PRODUCTION BY CROP

<table>
<thead>
<tr>
<th>CROP</th>
<th>MAIZE</th>
<th>SOYA</th>
<th>GROUNDNUT</th>
<th>OTHER*</th>
</tr>
</thead>
<tbody>
<tr>
<td>FARMERS %</td>
<td>98</td>
<td>59</td>
<td>91</td>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCTION (kg)</th>
<th>2,364</th>
<th>681</th>
<th>617</th>
<th>n/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVERAGE YIELD (kg/ha)</td>
<td>1,653</td>
<td>1,202</td>
<td>1,246</td>
<td>n/a</td>
</tr>
<tr>
<td>HARVEST PERIOD</td>
<td>May/June</td>
<td>June/July</td>
<td>May/June</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Most cited: sunflower, cotton, tobacco, cowpea

Most of the farmers interviewed grew maize (98%) and groundnuts (91%), both for home consumption and in order to sell surplus production. Soya was the main cash crop but sunflower, cotton and tobacco were also grown primarily to sell. Most of the farmers harvested their maize (84%) and groundnuts (67%) between May and June. Soya was harvested in June and July, after the maize and groundnut crops.

Overall, the survey data confirmed other reports of the high level of post-harvest losses experienced by smallholders, and the need for improved post-harvest systems that are affordable, cost-effective over the short term and easy to use. Inspection of stored crops showed high levels of insect infestation and mould in every case. However, farmers are so used to losing product and quality during storage that they regard it as normal and at first were unable to answer questions about levels and types of losses. The few farmers who have used the bags reported that they were extremely effective in eliminating wastage but that more training would be useful to ensure proper use.

97% of respondents said that they stored maize in order to provide food for their family, while 62% held it to sell either in an emergency or in anticipation of prices increasing. In previous years they had benefitted from the gradual increase in price between seasons. However, in 2017, after government intervention to ban exports, the price in December had dropped below its level at harvest time (see the chart on page 10). Other reasons for storage mentioned by farmers were to pay labour, to keep seed for the next season, or to contribute to community donations. All soya and groundnut growers were keeping one or two bags to use for seed in 2018. Since optimum yields depend upon good seed that is free from pests, hermetic bags could be a useful tool for these growers.

45% of the stored maize was remaining after 5 months

83% of farmers use gunny bags to store maize

52% of farmers apply pesticide to stored maize

Farmers cited common reasons for storing their maize and other crops:

97% for household consumption

62% waiting to sell when prices increase

53% to use as seed, to pay for labour, or to contribute to community donations
POST-HARVEST LOSSES

Farmers either shell their maize and store in gunny bags or keep it on the cob in traditional bamboo cribs protected from the rain by thatched roofs. They normally refer to maize quantities in terms of cartloads or bags without necessarily defining whether it is shelled or not. Initially they were unable to understand the concept of “losses” and 12% claimed to have no post-harvest problems. However, on inspection, all of the stored maize, whether in bags or cribs, showed significant damage from borers and weevils (referred to by the farmers as “termites”). This made the quantification of losses difficult, although one respondent who originally claimed storage was not a problem said after discussion “That’s why when we take a 50 kg bag to the mill we only get 35 kg back”.

Insect damage is by far the most significant loss for the farmers interviewed, but other post-harvest problems included:

- Cobs lost during transport in ox carts from field to home
- Lack of secure and dry storage space
- High cost of chemicals
- Low quality of gunny bags

SALES AND PRICES

Maize prices in late 2017 were down more than 50% on the previous year, due to a bumper harvest, a government ban on maize exports, and the availability of surplus stocks from 2016. In this type of situation, where farmers are not able to sell their crop, a reliable form of storage is an advantage.

<table>
<thead>
<tr>
<th>CROP</th>
<th>AVERAGE 50 KG BAGS SOLD*</th>
<th>AVERAGE PRICES (Zambian kwacha per 50 kg bag)</th>
<th>% CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIZE</td>
<td>26 27</td>
<td>99 47</td>
<td>53</td>
</tr>
<tr>
<td>SOYA</td>
<td>8 13</td>
<td>199 88</td>
<td>56</td>
</tr>
<tr>
<td>GROUNDNUT</td>
<td>10 8</td>
<td>190 163</td>
<td>14</td>
</tr>
</tbody>
</table>

*Among farmers who farmed the corresponding crop

The 2017 marketing season contrasts significantly with the past five years, in which maize prices increased by 30 to 100% from year to year and farmers gained by saving maize to sell later in the season.

MAIZE GRAIN PRICES - 20 LITRE TIN, KWACHA

Source: http://www.zamstats.gov.zm

FARMERS STORE IN BAGS IN THE HOME OR IN TRADITIONAL GRANARIES OUTSIDE

Maize inside traditional granary; losses high & difficult to quantify
Every cob sampled showed signs of insect damage
Maize stored in bags inside the home, infested with pests and wet from rain
### SECTION 4: MARKET POTENTIAL FOR HERMETIC STORAGE TECHNOLOGY

Five reasons why there is a strong market opportunity for smallholder-friendly hermetic bags to reduce post-harvest losses in maize and other grains in Zambia.

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<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Current methods for home storage of maize are ineffective and up to 30% of stored maize is wasted.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Hermetic storage bags are highly effective in reducing post-harvest infestation and wastage for the farmers who are using them. The plastic inner bag also protects grain from rain and high humidity, which increase mould development and the accumulation of aflatoxins.</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>The cost of a 100 kg hermetic bag can be recovered in one year through reductions in wastage, through cost savings on insecticide, and through the expected increase in maize prices during storage.</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Maize production is increasing.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>This estimation of market size translates into a potential retail market value of $35 million/year assuming a five-year period to reach countrywide adoption. The three-year life of the bag ensures that a continuous replacement market will exist into the future.</td>
</tr>
</tbody>
</table>

With a smallholder population of 1.4 million producing an average of 2,300 kg of maize per year, the total national market can be estimated at 64 million bags (50 kg) per year. If probable increases in farming population, total production, and the use of bags for other crops are included, the market rises to 90 million bags per year.
Many previous reports and studies suggest that hermetic bags could reduce this wastage to almost zero if used correctly. The rationale underpinning this study was that if there are cost, convenience and quality advantages in using hermetic bags for home storage of maize, smallholder households in Zambia will adopt the technology and benefit in terms of food security and income.

At the same time, bag manufacturers, distributors and retailers will be able to supply the market demand at a fair price that generates reasonable profit for each actor. The findings in relation to market opportunity, product, price, placement and promotion are outlined below. On page 13 we list the main components of an implementation strategy for commercialisation.

**PRODUCT**

Given the low market penetration currently, the ideal product for Zambia is the double- or triple-layer bag of 50 kg or 100 kg capacity. This recommendation is based on cost, convenience, effectiveness and similarity with existing products (ordinary bags).

**Uses**
- Home or institutional storage (e.g. school food stocks, small traders).
- Keep grains fresh and dry for intermittent use.
- Store grains without weight loss for future marketing.
- Maintain good quality seed for at least eight months.

**Features**
- Made of tough, durable materials, not easily pierced and reusable.
- Include ties with each bag for sealing the inner plastic liner, sealing tape to repair small leaks in the plastic, and instructions for use printed on the bag or included as an insert.
- Biodegradable or recyclable material.

**Competitors**
- Large plastic or metal silos can be more cost effective if the capital cost is depreciated over longer periods, but they are beyond the price range and investment horizon of most smallholder families.
- There is long-term potential for entrepreneurial farmers or groups who may start by testing and using hermetic bags and graduate to bulking grains as cash crops.

**PRICE**

At current price, there is a strong economic case for adoption. According to the manufacturers interviewed, the production cost for a hermetic bag is $0.90 to $1.10 depending on the type, volume and source of raw materials.

For all suppliers except Polythene Products Zambia, there is an additional transport cost to Zambia of $0.05 to $0.10 per bag. For bags made outside a SADC or COMESA country, there is also an import tariff of between 5% and 25%. Marketing, distribution and other overhead costs vary according to the company but are discretionary and controllable. Clearly there is a cost-benefit equation which cannot be solved accurately in such a new market as Zambia, and this could be the major barrier to commercialisation unless development agencies are willing to take on part of the cost and share the risk.

The optimum price point must take into account the real and perceived benefit that the buyer is expecting to obtain from investing in a bag. Of course, it is important that this price does not exceed the cost of conversion from their current system.

**SECTION 5: MARKETING MIX**

**PLACE**

To successfully tap into the smallholder market, manufacturers must create a wide-reaching distribution channel.

**STRATEGY A**
- Mass market to smallholder farmers who typically buy small amounts of seed and inputs from village-level retailers.
- Will need inclusive distribution systems, resources and tailored business models to establish and fund technical sales teams, promotional events and advertising campaigns.

**STRATEGY B**
- Humanitarian and development agencies, including WFP, SNV, CFU and Musika, which are already promoting hermetic bags to farmers.
- If donations or subsidies are used to stimulate or test the market, pricing and distribution strategies should be agreed with other commercial stakeholders to avoid distortions.

**STRATEGY C**
- Institutional buyers, particularly schools, hospitals and government residential facilities.
- Significant consumers of maize and bags, smallholders are also a means of accessing a high proportion of decision-makers and thought leaders in rural communities and in government.

**STRATEGY D**
- Offtakers providing bags to their contracted suppliers on a credit check-off system.
- These companies have more leverage to finance this investment than smallholder farmers themselves do.
- There is evidence that marketing arrangements like this can drive uptake of new technologies.
The breakeven price for a maize grower who moves from two traditional 50 kg gunny bags to a 100 kg hermetic bag can be calculated as:

\[
\text{Breakeven price of hermetic bag} = \text{Cost of 2 ordinary gunny bag} + \text{Cost of wastage} + \text{Cost of insecticide} + \text{Average price increase during storage of 100kg of grain}
\]

In Zambian kwacha, the calculation may be:

\[
K6 \text{ gunny bags} + K40 \text{ (20% wastage)} + K7 \text{ (insecticide)} + K40 \text{ (median price increase in 2016/17)} = K93
\]

PROMOTION
A well-planned and executed promotional campaign for the technology has the potential to increase sales and reduce costs even further for both suppliers and buyers.

Direct uptake of hermetic bags by farmers has been minimal to date. However, since the current retail price includes an acceptable profit margin for the manufacturer while also providing a cost-benefit to the user, there is a strong case for promoting their use.

10 STEPS TOWARD COMMERCIALIZATION

Based on the 4P marketing mix factors described above, there is a strong case for SDU and others to invest in the hermetic storage market in Zambia. The key support activities that need be addressed from the outset are as follows:

1. Enter into partnership agreements with commodity traders and/or suppliers.
2. Bring together public and private actors to agree on a shared strategy, work plan, funding and areas of cooperation. Select target communities for promotion in Eastern, Central and Lusaka provinces.
3. Select key messages, focusing on:
   - Guaranteed elimination of losses
   - Economic gains and better prices
   - Health benefits
   - Quality improvement
   - Reduction in manual labour.
4. Test, demonstrate and disseminate information widely on each brand of bag.
5. Create training materials and conduct training of trainer events in each province.
6. Recruit media names and community leaders to act as champions.
7. Target institutional buyers through personal visits and workshops.
8. Evaluate and invest in improved distribution and collection systems.
9. Create social media and online information platforms.
10. Employ field days, road shows, advertising, radio and television with consistent and repetitive messages.
ACKNOWLEDGEMENTS

This study could not have been completed without the collaboration and support of the Conservation Farming Unit (CFU). With special thanks to Collins Nkatiko for his guidance and ideas and Cephas Mkandawire for organising and taking part in the field work, and whose endless contacts ensured as many views as possible were captured.

The author would also like to recognize the AgroZ team for arranging interviews with users of the AgroZ bags in Lusaka province. These customers clearly appreciated expertise shared through regular contact with them.

Special thanks to the AgDevCo Zambia team for helping with logistics, making important introductions and giving guidance on the overall project.

Finally, to the farmers who took time from their many commitments to answer all our questions, thank you for the openness and candor.

The contents of this report are the responsibility of the lead consultant only, and any views expressed here do not necessarily represent those of AgDevCo, the Smallholder Development Unit, Mastercard Foundation or the Department for International Development.

LIST OF KEY INFORMANTS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONTACT</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRODEALER/INPUT SUPPLIER</td>
<td>Ganzani Lungu, Assistant Manager</td>
<td>Lima Agro, Kabwe</td>
</tr>
<tr>
<td></td>
<td>Stephen Piri, owner</td>
<td>MSP Farmers Shop Ltd, Chipata</td>
</tr>
<tr>
<td></td>
<td>Silvel Kapondeni, owner</td>
<td>Kapondeni Stores, Katete</td>
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<td></td>
<td>Margaret Banda, manager</td>
<td>MC Sangwani, Petauke</td>
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<td></td>
<td>Rene Lourens, Commercial Manager</td>
<td>Livestock Services Cooperative Ltd</td>
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<td></td>
<td>John Nsokoshi</td>
<td>AgroZ Zambia Ltd</td>
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<tr>
<td></td>
<td>Ganesh Teli, General Manager</td>
<td>Polythene Products Zambia Ltd</td>
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<td></td>
<td>Jordan Dey, Vice-president</td>
<td>GrainPro</td>
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<tr>
<td>GOVERNMENT</td>
<td>Sylvester Mubanga, Provincial Agriculture Information Officer</td>
<td>Ministry of Agriculture</td>
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<td></td>
<td>Robbie Musengo, District Agricultural Coordinator, Katete</td>
<td>Ministry of Agriculture</td>
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<td></td>
<td>Mwaba Lubasi, District Agricultural Coordinator, Petauke</td>
<td>Ministry of Agriculture</td>
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<td></td>
<td>Annie Lukonde, Community Development Assistant, Kabwe</td>
<td>Ministry of Community Development and Social Welfare</td>
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<td></td>
<td>Mr Sakala</td>
<td>Food Reserve Agency</td>
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<td>RESEARCH</td>
<td>Kennedy Kanenga, Research Manager, Eastern Province</td>
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</tr>
<tr>
<td></td>
<td>Stephen Kabwe, Senior Associate</td>
<td>Indaba Agricultural Policy Research Institute</td>
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<tr>
<td>FARMER ASSOCIATION</td>
<td>Malambo Virgil, Coordinator</td>
<td>Chipata District Farmers Association</td>
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<td></td>
<td>Maria Mutua, Head of Programs</td>
<td>Chipata District Farmers Association</td>
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<td>Collins Nkatiko, CEO</td>
<td>Conservation Farming Unit</td>
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<td></td>
<td>Cephas Mkandawire, Mechanisation and Business Unit Manager</td>
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<td></td>
<td>Cholwy Kagoli, Operations Manager, Central Region</td>
<td>Musika</td>
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<td>John Mundy, Coordinator, Farm to Market Alliance</td>
<td>United Nations World Food Programme</td>
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<tr>
<td>TRADERS/Buyers</td>
<td>George Liaicopoulos, MD</td>
<td>Grain Traders Association; Zdenakie Ltd</td>
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<tr>
<td></td>
<td>Carl Jensen, CEO</td>
<td>Good Nature Agro</td>
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<tr>
<td></td>
<td>Stuart Hall, General Manager</td>
<td>NWK Agri-Services</td>
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<tr>
<td></td>
<td>Raj Ganapathi, MD Fertilizers</td>
<td>Export Trading Group</td>
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<td></td>
<td>Eric Kaluba, Manager</td>
<td>Seba Foods (Z) Ltd</td>
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<tr>
<td></td>
<td>Alex Tembo, owner</td>
<td>Individual trader</td>
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<tr>
<td></td>
<td>Kenneth Linyunga, Regional manager</td>
<td>COMACO</td>
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POTENTIAL TO COMMERCIALISE HERMETIC STORAGE BAGS IN ZAMBIA

Crop being transferred to hermetic storage bags.
<table>
<thead>
<tr>
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<th>Address</th>
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