The Millennium Mills Project:
Promoting Maize Mills as Business and Community Hubs
in Northern Mozambique’s Grain Belt

Business Plan / Feasibility Study
October 2009
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EXECUTIVE SUMMARY

Northern Mozambique’s Grain Belt: Maize and Milling

TechnoServe (TNS) has launched a broad multi-year strategic initiative to raise incomes and improve the quality of life for the rural poor in Northern Mozambique. The initiative seeks a new approach to private sector development; that is, to bring together institutions, donors and individuals to engage and observe the complex influences that shape business success, opportunities and social development and to integrate a full range of expertise and talent in the service of economic development and programmatic improvements. The Millennium Mills Project (MMP) is a key part of this vision.

Mozambique has built a post-war economy with one of the highest growth rates in Africa. From 2003-2008, the country experienced an average annual growth rate of approximately 8%, with projections for 2009 at 4% to 4.5%. Nonetheless, Mozambique continues to experience extremely high levels of poverty. In Nampula Province, for example, over half the population lives below the poverty line, only 33% have access to safe drinking water, and almost half of all children suffer from chronic malnutrition, not to mention the devastating impact of HIV/AIDS and malaria on productivity and family structures.

Still, despite these challenges, Northern Mozambique contains untapped potential to become a regional “Grain Belt,” producing high-yield grain and feed grain, creating jobs, increasing incomes, improving livelihoods and ensuring continued growth of its burgeoning poultry industry. Targeted engagement in the grain sector is based on the following assumptions: [1] grain is an integral part of the economy and culture, with grain mills occupying an important space between business enterprise and community service; [2] domestic demand for grain is high; [3] potential to source international demand and emergency food situations; [4] sustaining the poultry industry requires sourcing local maize meal for feed; and [5] local government has declared agribusiness development in maize and soy as a top priority.

The Market for Milled Maize

In 2008, demand for maize in Mozambique was about 1.6 million tons. The main driver of demand for milled maize is xima, a boiled porridge that is the country’s staple food. Most community members have incentive to buy maize grain and have it milled locally. Conservatively, it costs 11MT/kg (US$0.42) to have grain milled locally (cost of grain + milling), whereas commercial meal ranges from 15MT/kg to 25MT/kg (US$0.58 to US$0.96/kg). Given that clients prefer xima made with the finer, whiter meal that results from hulling grain prior to milling, there is also great demand for this service. Not surprisingly, rural populations rely on commercial meal only when maize grain is not locally available, implying that 100% of the community demands local milling for at least the period when local grain is available.

The price for milling is usually 1MT/kg (about US$0.04) at mills running on electricity and 1.5MT/kg (about US$0.06) at mills running on a diesel generator. The price for hulling is similar to that of milling. Pricing varies between, as well as within communities, depending on the dynamics of competition, the operating cost structure and the potential presence of external subsidies, among other factors. In some communities, there is more demand for milling than there are mills and therefore the price is quite high; in others, there is cutthroat competition with the price for milling sometimes dipping to 0.50MT/kg (about US$0.02). These fluctuations are driven largely by the milling “lifecycle” which consists of Inception,

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1 UNDP Human Development Report, 2007-2008; Banco Português de Investimento, Economic Growth in Mozambique, June 2009
3 “Mozambique produces maize surplus,” Mozambique News Agency AIM Reports, No.375, March 19, 2009
Growth, Saturation, and Shake-Out phases. Ideally there should be 1 mill per 6,000 people, and 1 mill per 6 km radius; when these ratios are off, the market dynamics in the community will self-correct, either attracting new millers or driving those who are no longer competitive to close.

Beyond demand for personal consumption, there is institutional-level demand for maize meal from schools, hospitals, food assistance programs, etc. Export Marketing, Mozambique’s largest grain trader and the primary intermediary for sourcing meal for food emergencies, buys 40,000-50,000 tons of maize per year, primarily from local smallholders (this represents less than 5% of total smallholder production). Finally, there is also demand for locally milled maize from domestic poultry producers for use as a feed component, but millers need to improve quality and reliability of meal to be able to enter this market.

About 75% of Mozambique’s smallholder farmers grow maize, and 99% of all maize producers are smallholders with an average farm plot of 1.5 hectares. In 2008, Mozambique produced over 1.677 million tons of maize, an increase of 6.7 percent on the previous year. Overall, grain production (maize and others) is predicted to grow at a rate of 9% next year.⁴

The commercial milling industry in Northern Mozambique is fairly small and relies on both local and imported maize for processing. It is dominated by CIM, Mozambique’s largest processor with over one third of the national market share.⁵ CIM processes 12,000 tons of maize per year out of Nampula, however this accounts for less than half of their total volume of grains processed. There are a few smaller players in the industry, but the relatively low volumes of commercially milled maize compared to demand reflect the tendency of rural populations in areas of high maize production to use community mills.

Nampula and Zambézia are the provinces with the ideal characteristics for new milling businesses: high population density and high agricultural production. Nampula has the highest population density (45 inhabitants/km²) of all the provinces, and Zambézia is ranked third (35 inhabitants/km²), yet the share of villages with existing mills is quite low (18% of rural villages in Nampula have mills; 33% in Zambézia).⁶ Although the milling sector is heterogeneous, there is significant unmet demand for more mills in many areas of the Grain Belt, as evidenced by the high number of new mills being established.

The Millennium Mills Project

TechnoServe has the opportunity to help current and potential Grain Belt millers grow their businesses – employing more people and providing communities with a broader set of goods, opportunities and economic choices. The overall objectives of the MMP are to:

- Promote the development of maize mills in the context of TechnoServe’s vision for long-term, sustainable transformation of the animal/human health and food systems in Northern Mozambique;
- Capitalize on a fundamental and organically occurring community service to improve income-generating opportunities for milling entrepreneurs through a “franchise” approach;
- Develop the processing component of N. Mozambique’s grains value chain, expanding the market for grain producers and meeting demand for maize meal for human consumption and animal feed;
- Establish a franchise model to provide tailor-made solutions to each community/entrepreneur
- Through partnerships with NGOs, local government and private-sector companies with stakes in the grains sector, create opportunities for improved health, nutrition, social and business outcomes using the mill as the anchor-point for these interventions.

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⁴ “Mozambique produces maize surplus,” Mozambique News Agency AIM Reports, No.375, March 19, 2009
The MMP will promote milling through a franchise concept that offers the right mix of standardization and tailored solutions. Each client will operate according to a “franchise menu” appropriate to his/her capacity and the dynamics of the target community. Franchisees will represent a recognized level of quality and follow certain common operational practices; however, just as traditional franchises must adjust their model to account for local preferences and market dynamics, so will the MMP allow for customized solutions to support Grain Belt milling enterprises in the most success-enabling way possible.

The three main models, or franchise menus, in the MMP are as follows:

1) **Simple Mill that offers milling as a service.** This model requires a mill and motor, construction of some sort of enclosure for the mill, and 1-2 employees. Minimum initial investment is US$3,100. The most significant operating cost is electricity. The primary advantages of this model are its simplicity and accessibility. An entrepreneur with basic business skills and good community connections would be capable of managing this mill. The main disadvantage is that the simple mill is highly susceptible to the seasonality of maize production. Since milling is the only service provided, profit is limited to the months when there is maize on the market; during the lean season (Nov-Jan), the mill does not turn a profit.

2) **Mill that offers Milling and Hulling.** This option takes the simple milling model and adds a hulling machine, making the mill more competitive (consumers prefer meal from hulled grain) and better-positioned to weather the lean season cash flow crisis. Adding a hulling machine essentially doubles the initial investment (US$6,000 minimum investment), however it is significantly more lucrative than milling alone (accumulated profit is 246% higher in Year 1). In fact, of all the franchise scenarios, hulling brings the highest returns. Still, this model is still greatly affected by seasonality.

3) **Mill that offers Milling and Hulling, and whose owner engages in Trading.** This scenario involves directing profit from milling/hulling operations into taking trading positions in bagged maize grain. Minimum capital required is US$7,250, the highest of all the models. Inventory is accumulated during the harvest season (Apr-Jul), stored in a warehouse, then ideally sold during the lean season when there is little maize available locally. This gives the entrepreneur a premium price for maize during a period in which regular mills have little or no profit. The key advantage of trading is that it offers two profit periods per harvest cycle. The downsides are the risk involved and the amount of working capital tied up. Trading has high profit potential; however it requires a much more skilled entrepreneur in order to be successful.

**Financial Analysis and Recommendations**

Each of the franchise scenarios has distinct advantages and disadvantages and must be considered in conjunction with the community characteristics and the milling entrepreneur’s profile. There is no cookie-cutter recommendation for all millers in the Grain Belt. That said, if the miller’s skills and the local market permit, it is generally best to evolve up from the simple mill to include the value-added hulling service and, possibly, trading to offset seasonal cash flow fluctuations.

Over a period of 5 harvests (just over 4 years), the hulling model has the highest net present value (NPV) at US$24,297, followed by the trading model at US$22,019. The simple mill has an NPV of US$10,380. From a strictly financial perspective, the best investment is usually that with the highest NPV; however, given the reality of hand-to-mouth subsistence livelihoods in the Grain Belt, the equation becomes more complex. Sometimes short-term access to cash – in particular during a time like the hunger season – can be much more valuable than long-term earning potential.

If the entrepreneur can weather the seasonal flow crisis, then hulling is likely the best model because it presents high profits, relatively low risk and is a simple operation. The hulling model is the most profitable over the long-term. (US$31,196 vs. US$29,656 for trading, and US$11,164 for milling alone).
However, there is a distinct advantage to the trading model: though less lucrative in the long-term, it offers 2 profit spikes over the year. This counter-cyclical opportunity can be critically important in a region where cash and food are frequently short in the hunger season.

Comparison of Monthly Net Profit of MMP Franchise Models over 4-Year Period (US$)
1 INTRODUCTION

1.1 Background and Context

1.1.1 Northern Mozambique’s Grain Belt: Maize and Mills

TechnoServe (TNS) has launched a broad multi-year strategic initiative to raise incomes and improve the quality of life for the rural poor in Northern Mozambique. The initiative seeks a new approach to private sector development; that is, to bring together institutions, donors and individuals to engage and observe the complex influences that shape business success, opportunities and social development and to integrate a full range of expertise and talent in the service of economic development and programmatic improvements.

Northern Mozambique contains an untapped potential to become a regional “Grain Belt,” producing high-yield grain and feed grain, creating jobs, increasing incomes, improving livelihoods and ensuring continued growth of its burgeoning poultry industry. Targeted engagement in the grain sector is based on the following assumptions: [1] grain is an integral part of the economy and culture; [2] domestic demand for grain is high; [3] potential to source international demand and emergency food situations; [4] sustaining the poultry industry requires sourcing local maize meal for feed.

Mozambique has built a post-war economy with one of the highest growth rates in Africa. From 2003-2008, the country experienced an average annual growth rate of approximately 8 percent with projections for 2009 at 4% to 4.5% In Nampula, the principal city of the Grain Belt, engaged political leaders have named agribusiness development in maize and soy, as well as infrastructure improvements, as top priorities. Mozambique currently has a maize surplus of about 75,000 tons, according to the Ministry of Agriculture. In 2008, Mozambique produced over 1.677 million tons of maize, an increase of 6.7 percent on the previous year (1.566 tons). Overall, grain production is predicted to grow at a rate of 9% next year.

1.1.1.1 “Why Maize?”

Though less profitable than other land crops such as sesame or soy, maize offers smallholders both subsistence and income as about one quarter of growers sell some portion of their maize. With two-thirds

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7 Techno Serve, [Poultry 1-pager]
9 “Mozambique produces maize surplus,” Mozambique News Agency AIM Reports, No.375, March 19, 2009
of all smallholders growing maize and virtually all consuming it in some form, maize is the most widely consumed crop in the region and an integral part of the economy and culture. The diet of most households in the Grain Belt often consists largely of a maize meal (or cassava) staple known as xima. To be sure, maize is thoroughly woven into the economic and social fabric. The demand for maize is highly inelastic, and even during the lean season, poor households will often seek other ways to cut back rather than compromise maize consumption.

Clearly grain is highly integrated into the region, and grain-related businesses are growing rapidly. During a 2008 visit to northern Mozambique, President Armando Guebuza told reporters that the most visible result of the Government’s “Local Initiative Development Fund” (LIDF) was that “[maize] flour mills [were] now appearing throughout the countryside.” According to President Guebuza, the proliferation of small maize flour mills meant that small farmers did not have to travel long distances to mill their maize, and the time they saved “could be used in other activities.”

Despite the fact that the LIDF and other sources of investment capital have helped accelerate the organic development of maize mills in rural Mozambique, it remains necessary to provide technical assistance and facilitate access to additional capital in order that mills reach a more sustainable level of operation. The current reality is that most millers have poor literacy levels and minimal business skills. While it is possible for a mill to exist solely as a ‘milling service provider’ at the community level, the most secure, adaptable and promising models involve incorporation of value-added services (such as grain hulling) and/or engaging in trading and storage to stabilize revenues throughout the year. Eventual diversification could include a series of synergetic health, social and business offerings with the grain mill as the hub.

1.1.2 The Concept: Grain Mills as Business and Community Hubs

Maize mills hold the potential to be business “hubs” within communities. Centrally located within rural villages, maize mills provide a valuable service to communities by grinding maize (and other grains/legumes/roots) into meal. The process saves women valuable time that they would otherwise spend pounding maize, and it produces a superior tasting product that consumers prefer. Maize meal also provides the highest profit margin to mill owners and rural farmers who want to sell maize meal, and is a gateway for vertical integration into larger-scale trading and storage schemes, allowing millers to hedge against certain agricultural risks and use the seasonality of maize production to their advantage.

To begin to better understand some of the complexities of milling and, in turn, develop appropriate business models and development interventions, TechnoServe conducted a field survey of local maize mill owners. Through the initial survey, it was found that the most profitable small-scale maize millers have three characteristics: [1] the mills run on electricity. The alternative to running on electricity is running on diesel generators, which is approximately twice as expensive, leading to a higher price that drives away customers; [2] the mills have hulling machines that remove the fibrous outer hull and produce finer, whiter flour. Although this process costs a fraction more per kilogram, consumers prefer this flour and will almost always choose this option if available; [3] the mill operator has the ability to incorporate technology and engage in vertical integration (i.e. trading, storage) in order to respond to consumer demands and remain competitive. Taken together, the characteristics of successful maize mills help mark a larger transition from household economy to an emergent commercialization. Shifts from diesel generation to electric power, investment in new technologies, and participation in trading signify an embryonic modernization of the mill.

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10 GoM, MINAG, Trabalho de Inquérito Agrícola (TIA), 2002 - 2007. Note that cassava is consumed in approximately equal proportion.
11 “Flour mills opening throughout countryside,” Mozambique News Agency, AIM Reports, No.360, June 10, 2008; under this fund, each district receives annually at least seven million Meticais ($290,000) from the state budget for initiatives intended to increase food production and generate jobs.
The “Millennium Mills Project” aims to create a series of “franchisees” along key transportation corridors in Nampula, Zambézia and Niassa Provinces with milling functioning as the anchor economic activity, but also including space for storage facilities (“grain banks”), meeting and training facilities and other forms of commerce, health, livelihood and social activity. Within that overall business structure, potential initiatives include a range of fortification options to improve nutrition and mitigate health risks associated with HIV/AIDS, malaria, and mycotoxins as well as the creation of a storage system to reduce post-harvest losses, increase farmers’ selling power, and improve overall maize quality. Moreover, the development of business hubs with storage infrastructures can enhance emergency response and disaster preparedness, particularly in regards to cyclical drought, by allowing “franchisees” to serve as partners and as pre-positioned operation points for interventions by agencies such as the World Food Programme and the Government of Mozambique’s Instituto Nacional de Gestão de Calamidades (INGC).

While considering all of these factors, it is important to bear in mind that at the end of the day, mills exist for utility. People grind their maize because they need to eat and because milling is a time saving, cost effective alternative to hand labor. A community’s relationship with grain and its milling is largely governed by considerations of use value rather than exchange value. And while entrepreneurs and investors might rightly identify excellent market opportunities and niches in the milling business, a dominant agrarian ethos in rural economies often means that mills function as a public service governed by collective need as much as individual pursuit of profit. Service and good business are not exclusive, of course, and, in part, the Millennium Mills Project aims to transform the very concept of a mill by incorporating social/community/health aspects into a feasible business model in a synergetic manner, and in accordance with the specific characteristics in each community.

1.2 Objectives of Business Plan / Feasibility Study

The primary goal of this Business Plan / Feasibility Study is to conduct a thorough analysis of the maize milling industry in Northern Mozambique’s Grain Belt to use as the foundation for developing a realistic and sustainable concept for the Millennium Mills Project, and to enable TechnoServe to act as an advisor to current and potential players in the grain milling value chain. Specific objectives include:

- Conduct a market analysis of the maize sector, including regional and local trends;
- Identify and analyze the strengths, weaknesses, opportunities and threats associated with operating a grain milling business in Northern Mozambique;
- Identify and describe the various stages of the “grain milling lifecycle”;  
- Understand the grain mill’s dual function of business/social services provider;
- Develop the Millennium Mills Project concept, including tailored interventions and recommendations for each milling model identified;
- Determine the capital requirements and provide a cash flow for each milling model;
- Identify potential spin-off / complementary businesses associated with grain mills;
- Explore the potential for synergy between grain mills and social/health/nutritional interventions;

1.3 Methodology

The TechnoServe Grains Team conducted extensive research using primary and secondary sources and traveled to the Grain Belt region several times to develop this document. Our methodology included:

Field Interviews and Focus Groups: The Team conducted interviews/focus groups in the field in March and May 2009, covering 3 Provinces (Southern Nampula, Northern Zambézia and Southern Niassa) and 9 towns (Nampula City, Malema, Ribauè, Cuamba, Gurúè, Íle, Lioma, Alto Molócuè and Namaita). In each
of these towns, individual interviews were conducted on-site with mill owners, managers and workers. Additionally, focus groups were conducted in Ribáuè with members of the Miller’s Association and the Ribáuè Women’s Association. Interviews with other stakeholders in the Grain Belt were ongoing and included NGOs that provide production and processing support to smallholder farmers, commercial grains processors, grain exporters, and NGOs focused on nutrition/health and emergency food supply. Finally, interviews were conducted with relevant stakeholders in Maputo city. Please see Annexes 9.3 and 9.4 for a copy of the interview guides and a full list of the interviewees.

**Literature Review:** In addition to the interviews, the Grains Team conducted a comprehensive review of secondary literature sources including: official Government of Mozambique publications and statistics, reports and papers from local and international NGOs and development institutions, internet resources and internal TechnoServe documents and studies.

### 1.3.1 Constraints to Field Work and Possible Impact on Evaluation

Researchers must be armed with a healthy dose of caution when drawing conclusions about the production and consumption patterns of the maize mill value chain. Maize mills occupy an often elusive space between commerce and social life, suggesting measured deliberation in considering investment strategies or devising a typology of consumer behavior. While attributes of quality, location and pricing have bearing on where people choose to grind their meal, the mill’s presence in the “everyday” of community life means habits, custom and pragmatism often govern decision making. As such, traditional business practices and consumer behavior are difficult to locate and measure.

Specific issues encountered in our field work which need to be considered in evaluation centered in three essential areas; data collection, inventory control and customer service:

**Data:**
- Poor record keeping. Most mills operate with limited bookkeeping and lack comprehensive records. As such, data collection is limited to short-term snap shots or point-in-time analysis;

**Weights and Measures:**
- Old and makeshift scales. Scales (or buckets based on volume) are often unreliable and it is fair to assume a small margin or error (either an under/over count) on customer weights.
- “Average”: one can assume that when mill managers and customers speak of “1 kg” that this is essential shorthand for a small basket, *capulana* or bag rather than a precise measure. Similarly, the distinction between “mean” and “medium” can be misunderstood and answered inaccurately;

**Utility of Mill and Community Service:**
- “Discounting” impacts bottom line. Virtually all mill owners or managers the TNS Grains Team interviewed indicated they offered some level of discounting to customers who otherwise could not afford to pay full price or at all.
- The role of memory: the recall of precise weekly or monthly production and processing numbers are often relayed as “ball park” estimates. In general, people produced “enough” maize to feed their family and perhaps retain some surplus. In turn, mills process what the community produces- they do not typically market services or actively look to enlarge customer base. Ultimately, units of measurement are defined in the service of subsistence not surplus production.

To the best of the TechnoServe Grains Team’s ability, these factors have been taken into consideration and accounted for to minimize the constraint on or skew of data collected for this Business Plan/Feasibility Study.
2 THE DUAL NATURE OF GRAIN MILLS: INTERSECTION OF BUSINESS AND SOCIAL SERVICES

2.1 Grain Mills as Social and Community Service Providers

Despite Mozambique’s impressive economic growth rate, GDP increases alone do not feed a family or end their poverty. In Nampula, recent growth rate is indeed impressive, yet the regional Grain Belt is marked by extremely high levels of poverty. Across the province, over half the population lives below the poverty line, job opportunities are scarce in rural communities, and subsistence agriculture represents the primary livelihood source for more than 80% of the population.

Extreme poverty and unsanitary living conditions produce and exacerbate malnutrition and disease – hampering economic growth. Only one-third of families have access to safe drinking water, leading to water-borne diseases such as diarrhea. Almost half of all children have stunted growth and development due to chronic malnutrition, limiting their ability to concentrate and attain their maximum potential in school. Finally, the devastating impact of HIV/AIDS, pneumonia, and malaria greatly reduce productivity and cost businesses money.

Specific to maize production and milling, the dynamics of poverty contain important implications for consumer purchasing power, pricing structure, a mill’s bottom line and production. Maize mills occupy an important space between business enterprise and community service. Part of what accounts for this unique position is the nuanced and multiple layers of the maize value chain. A seemingly straightforward series of transactions – production, collection and transport, storage, processing, and marketing – is ultimately confronted at every turn by locally-driven complexities and a host of subtle social and economic considerations. These nuances inevitably involve both people and systems. Millers are largely self-starters, well respected individuals, and considered servants to the community, working for a “fair allowance” established concurrently by the marketplace and custom. Consider, before maize mills became a presence in any given community, people – mostly women – exhausted considerable labor time pounding by hand. Free from these demands, however, has meant more time for diversified economic activity, better health, and increased opportunities for education. Similarly, given the choice, even the poorest members of a community typically opt to mill rather than pound, and mill owners will often facilitate this act by extending discounts or informal avenues of credit.


13 The definition of poverty can vary. The UN’s Millennium Development Goals define poverty as “living on a dollar a day per person.” No single or agreed upon indicator fully captures the condition, however, but rather a fairly fluid and wide-ranging set of experiences colored by social and economic criteria. For instance, the GoM’s “Poverty Reduction Strategy Paper” (PARPA) adopts at least two definitions. At a basic level, the PARPA defines poverty as “the inability of individuals to ensure for themselves and their dependents a set of minimum conditions necessary for survival and well-being, according to society’s standards.” Broadening the measure to include a more structural approach, however, PARPA defines poverty as “the impossibility, owing to inability and/or lack of opportunity to have access to the minimum basic conditions, according to the society’s standards.” Moreover, distinctions can be made between absolute poverty, the “lack of income necessary to satisfy basic nutritional and non-nutritional requirements” and relative poverty, “lack of sufficient income to satisfy the essential nutritional and non-nutritional needs, according to the average income in the country” (Republic of Mozambique, Action Plan for the Reduction of Absolute Poverty, 2006-2009: PARPA II, (Maputo, May 2, 2006), 8-9; United States Agency for International Development, Thematic Briefing Paper 2: Just How Poor Are ‘The Poor’? (Few Net Task Force Order 6), n.d)


15 Ibid., [Ribauè info]
These market and non-market forms of reciprocity, governed at turns by gender, kinship and class, help define the mill as a dynamic and complex social and business hub. In addition, these relationships and practices almost certainly contain important considerations as it relates to profitability, expansion, and re-investment. In short, the maize milling business and value chain occupies what historian E.P. Thompson calls a friction between the “awkward realities of commerce and consumption.”

Figure 2: Mills are an integral part of the community, serving as economic & social “hubs”

TechnoServe recognizes the unique role that milling plays in the Grain Belt communities and beyond, and is especially interested in becoming involved in milling interventions, both small- and large-scale, to capitalize on the potential mills represent in delivering essential nutrition and business opportunities to the community.

2.1.1 The Role of Women in Milling

Among a range of socio-economic benefits, expanding the milling industry contains the potential to decrease labor time and the costs associated with hand pounding and open opportunities for better education and access to health services. In particular, targeted investments in maize mill development can provide an important strategy for achieving greater gender equity.

In agricultural work a gendered division of labor often exists where women perform a disproportionate share or farm work, especially the more labor intensive tasks, without accruing the direct benefits. At that same time, across the Northern Mozambique Grain Belt, one frequently hears that milling is “man’s work.” While this claim contains a grain of truth, it is equally notable for what it fails to consider. While mill “operator” and “controller” positions are most often filled by men, characterizing the maize mill in terms of a male ethos fails to articulate the real complexities of maize processing and its attendant social relations. Rather, if we look beyond the immediate property lines and locate the mill house within a larger

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16 E.P. Thompson, *Customs in Common; Studies in Traditional Popular Culture* (New York, 1993), 193
system of locally integrated economic production, we discover a more modest interpretation of what is meant by “men’s work.”

As in most instances of social relationships, colloquial expressions and applied terminology usually contain multiple definitions; the phrase “men’s work” might mean [1] the gendered breakdown of mill ownership: in surveyed areas the ratio of male to female ownership runs roughly 3:1; [2] the composition of the workforce operating the mill: men tend to overwhelmingly occupy the standard two to three salaried positions necessary to operate a mill; [3] the customer base and utilization rates of maize mill services: first, women tend to dominate agricultural production, and, secondly, the physical act of carrying bags of maize to the mill for processing. In the latter case, these trips to the mill might be reasonably viewed as a logical extension of field labor.17

In short, men are more likely to own and operate mills while women, in turn, exert greater control over supply and end-product distribution. Within the context of the maize mill economy’s unique community of interests, this set of reciprocal relations is quite significant. Taken as a whole, the mill embodies a web of interdependent economic and social relationships that blur lines of distinction between producers, processors, traders and customers.

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**Senhora Fátima’s Story: A Woman-Owned Mill in Nampula Province**

Fátima Artur da Silva owns a mill along the main road near Marrupula, Nampula Province. Married with five children, she lives in Nampula City and makes the 100 km journey to her mill every morning starting at 5:30. On a typical day she will stay at the mill until 5:00 PM, sometimes later if there is a rush of customers.

The mill runs on generator and is open for business from 6:30 AM. Its capacity is 3 tons a day and is staffed by 2 workers plus Sra Fátima. In a pinch, her younger sister will do spot duty and run the mill when Fátima is not around. Roughly 100 customers arrive throughout the day, carrying on average 5 kg of maize. On an average day the mill will do between 800-1,200MT of business.

Fátima represents a quiet but growing number of women entrepreneurs who have entered the milling business in recent years.18 Her previous experience in small business—she owns a small shop which offers, among other items, fish, soap, sweets and oil—has served her well in the transition to mill ownership. In 2008, Fátima identified a gap in area mills and, utilizing a 100,000 mt loan from the government, bought the necessary machinery in Cuamba. From there she shipped the mill by train to Nampula City and then on to its current site by truck. After purchasing the milling machinery she used the balance of her loan to purchase land and rehabilitate an old structure on site.

The colonial era structure is the first mill in the area and has made “life easier” for residents who no longer have to pound by hand. Fátima asserts that the “community loves the mill and business is good.” And despite being the only mill in the area, Fátima welcomes competition observing that “it would be better for the community if there were more mills because [she] cannot serve everyone.” Moreover, she aims to increase volume and be in a position to lower her price through investment in an electric motor, a hulling machine and improved storage capability. While welcoming competition and lowering prices may seem counter-intuitive, Fátima’s approach to her business illustrates a kind of mutuality among mill owners and the unique community-business ethic that often defines the trade.

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18 Women’s association in Ribauè- Ribauè interview notes
3 MARKET ANALYSIS

3.1 Demand for Milled Maize

3.1.1 Regional Demand for Milled Maize

In the absence of specific statistics, one way to approximate demand for milled maize is to look at the demand for whole kernel maize (as a large percentage goes to milling). In general, regional demand for grains is not met by production. In Eastern and Southern Africa it is estimated that grain production in the year 2015 will lag behind demand by about 6.7 million tons (2.5 million tons for maize). Total demand for grains in the region is expected to grow to 36.8 million tons, and total demand for maize is expected to grow to 22.6 million tons by 2015\textsuperscript{19}.

3.1.2 Demand for Milled Maize in Mozambique

3.1.2.1 Demand for Milled Maize for Personal Consumption

In 2008, demand for maize in Mozambique was about 1.6 million tons.\textsuperscript{20} The main driver of demand for milled maize is its use in making the country’s staple food, a boiled porridge called xina. While xina can be made from a variety of bases including dried cassava and legumes, there is an undeniable national preference for maize meal. Therefore, demand for milled grains is largely a demand for milled maize. Other milled food products are viewed as substitutes when maize meal is not available, and thus demand for other grains simply reflects a lack in supply of maize grain.

Even at a very high price of maize grain of 10MT/kg (US$0.38/kg), as observed in early 2009, the incentive remains to buy grain and have it milled locally. Including the charge for milling, the end product (maize meal) would cost 11MT/kg (US$0.42) whereas the price at the market (whether sold by a local trader or packaged by a large scale commercial processor) ranges from 15MT/kg to 25MT/kg\textsuperscript{21} (US$0.58 to US$0.96/kg). Furthermore, field interviews suggest that rural populations rely on commercially processed maize meal only when maize grain is not locally available, implying that 100% of the local population relies on the hammer-mill service for at least the months of the year when local grain is available.

As mentioned above, the alternative to mechanical milling involves a time and labor intensive manual process. A back of the envelope calculation reveals the driving force of individual demand: it takes about 5 minutes to process 25 kg of maize grain into maize meal at the local mill, and costs 25MT (US$0.96). At a typical pace of hand pounding 1 kg of maize in 1 hour\textsuperscript{22}, this same volume would take 25 hours to hand pound. Using the wage of an agricultural worker of 50MT (US$1.92) per 8 to 10 hour work day, the labor cost of manual pounding is about 5MT (US$0.19) per hour, or 125MT (US$4.81) total. Thus the labor cost of hand pounding is five times that of mechanically milling. Besides the implication on demand for the milling service, this has major social implications on gender roles and income generation. Women almost always bear the responsibility of hand pounding. This tremendous duty relieved, more time becomes available to work the farm, a direct opportunity to increase income generation, and to attend school, an opportunity to increase future earning potential.

\textsuperscript{20} “Mozambique produces maize surplus,” Mozambique News Agency AIM Reports, No.375, March 19, 2009
\textsuperscript{21} Field interviews in Northern Zambézia and Southern Nampula Provinces; 2009.
\textsuperscript{22} Interview with Lídia Chiridza, conducted by Alexandra Amaro, Maputo – August 2009.
3.1.2.2 Institutional Demand for Milled Maize

Beyond demand for milled maize for personal consumption, there is institutional-level demand from schools, hospitals, the armed forces and food assistance programs. There is also unmet demand for milled maize from domestic poultry producers for use as a feed component.

Food assistance programs distribute maize meal that is processed at the large-scale, industrial level. This applies to government and non-government programs alike, as Mozambique’s National Institute for Management of Calamities (INGC) contracts the United Nations World Food Programme (WFP) for emergency food distribution. WFP buys grain exclusively from the largest maize grain trader in Mozambique, Export Marketing, and then has it milled (and sometimes fortified) by the largest processor, CIM. This is all tied to domestic demand for milled maize because Export Marketing buys most of their grain from smallholders. The big picture here is that availability of maize meal for emergency situations in Mozambique relies on smallholders and, by definition, an emergency situation will only result if production by these same smallholders is drastically lower than expected.

This structure is not as irrational as it may seem. For one, localized emergency food situations can be supplied with grain from non-affected regions of high production. Also, WFP may buy grain from Export Marketing for use in emergency situations in neighboring countries. Finally, WFP is also responsible for most, if not all, of the school feeding programs in the country, regardless of any emergency situations. Taking all of this into account, the demand exerted by WFP reflects the anticipated demand for localized emergency food situations (in Mozambique and neighboring countries) as well as school feeding programs, directly through Export Marketing. Export Marketing reports purchasing between 40,000 and 50,000 metric tons of maize per year, less than 5% of total production by smallholders.

There is also unmet demand for milled maize from Mozambique’s fast-growing local poultry industry. Presently, most of the maize used in poultry feed is sourced from South Africa as there are issues with quality, reliability of supply and minimum volume required to make it feasible to source from local mills. Only a few informal poultry producers use locally milled maize in their feed, although there is clear demand in the industry for a safe and cost-effective source of locally produced feed.

3.1.3 Northern Mozambique’s Grain Belt: a Hot Spot for Demand-Driven Maize Mills

Nampula and Zambézia have emerged as the provinces with the population and market characteristics most ideal for new maize milling businesses, high population density and high agricultural production. Nampula has the highest population density (45 inhabitants/km²) of all of the provinces, and Zambézia is
ranked third (35 inhabitants/km²), yet the share of villages with existing mills is quite low. In Zambézia Province, just 33% of the rural villages have mills, and in Nampula province, this drops to 18%.

Of course the demand per mill is not uniform, as some areas experiencing an over-abundance of mill while others a scarcity of them. Still, a general conclusion can be reached that in many areas of the Grain Belt there is high unmet demand for more mills, as evidenced by the notably high number of new mills being established. Furthermore, Nampula and Zambézia are characterized by fertile areas of high agricultural production; maize production from both provinces accounts for almost one third of the national volume. (A high supply of grains is required to support the customer demand for a successful mill.)

3.1.4 Demand for Other Milled Grains

It is common practice for other foods to be milled when maize supply is low. Dried cassava is the most common alternative, but sorghum, millet, dried beans, and dried peanuts are also suitable for milling into meal. Regional differences in agronomic conditions and eating customs will determine the prevalence of these supplementary foods. Field interviews conducted in the Grain Belt provinces suggest that meals from multiple food products are rarely mixed or blended. In fact it was noted by one miller that a superstition exists that even the residue of milled cassava, if blended with maize meal, can cause death. While this is an example of an extreme aversion to mixing or blending flours, it was widely observed that flours or meals from different foods were eaten separately. Nutritional campaigns by non-government and government programs alike are currently promoting this practice because of its superior nutritional quality (nutritional profiles of cereals are very well complemented by the contents of legumes). Assuming this practice is adopted, the volume of food products available for milling will increase, thus increasing the demand for the service. Please see Section 7.1 for a more in-depth discussion on blended meals.

There is virtually no demand for other milled grains from commercial processors. Other than wheat and maize, no other foods are processed by large-scale, commercial producers and this is largely due to the access to capital afforded to the large processors. During the lean season, when national maize supply is extremely low, these companies can often import maize at a lower price than at the domestic market.

3.2 Supply of Milled Maize

3.2.1 Production of Whole-Grain Maize

3.2.1.1 Regional Maize Production

In Southern Africa, maize is by far the most important crop, accounting for 80% of grain production. Despite maize’s importance, however, overall production in the region has decreased by 2.2% since 1980. This decrease was primarily due to poor yields (decrease of 1.88 to 1.82 tons/ha during this period) stemming from decreased use of farming inputs, lack of irrigation, and aberrant farming practices during times of conflict (1975-1992). Multiple initiatives, promoted by both the public and private sectors, are currently underway in the region to reverse this trend.

Within Southern Africa, South Africa is responsible for over 60% of total maize production. Yield is high relative to neighboring countries at 3 tons/ha, (e.g., yield in Mozambique is 1 ton/ha), likely the result of

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25 Interview with Export Marketing; April 2009
the dominance of commercial farms in South Africa that have access to improved inputs and employ harvest practices that result in less spoilage than those of smallholder producers. Regional production is relevant to Mozambique because, despite the fact that the country has maize surplus in certain areas, a portion of the maize used by commercial foodstuffs and poultry feed producers is imported from neighboring countries.

### 3.2.1.2 Maize Production in Mozambique

Production of whole-grain maize is the first factor to be considered in estimating the supply of milled maize in Mozambique’s Grain Belt. Within Mozambique, the yearly supply of grains for milling is highly seasonal, which is reflected in the sharp annual variations in pricing. Year over year, supply stocks are highly affected by growing conditions. The exceptional vulnerability to unexpected weather events reflects the situation for smallholder producers in Mozambique: in addition to geographical susceptibility to climatic threats (i.e., El Niño), there is low use of weather resistant cultivars (10% of holdings use improved seeds) and low availability of irrigation for dry years (13% of holdings use irrigation).

In Mozambique, over 90% of the population relies on agriculture for their livelihood. Maize is, along with cassava, one of the most important crops in the country and accounts for about 80% of the total grain production each year. About three quarters of Mozambique’s smallholder farmers grow maize, and 99% of all maize producers are smallholders with an average farm plot of 1.5 hectares. In 2007, maize production in Mozambique totaled some 1.566 million tons, of which approximately 1.133 million tons (72%) were produced by smallholders. In 2008, Mozambique produced over 1.677 million tons of maize, an increase of 6.7 percent on the previous year. Overall, grain production (maize and others) is predicted to grow at a rate of 9% next year.

Western Nampula and Zambézia provinces, along with Southern Niassa Province, provide particularly good conditions for maize and cassava production (maize accounts for about 74% of all grain production in that area). Furthermore, although Nampula and Zambézia are the provinces in Mozambique with the lowest percentage of smallholder farmers growing maize, 52% and 67% respectively are the provinces in which the highest percentage of maize production is sold, representing a surplus of maize production that is unmatched throughout the rest of the country. While there is some informal export of whole-grain maize to Malawi from the Grain Belt production areas, it is accurate to say that the bulk of the maize produced domestically is eventually milled.

### 3.2.2 Supply of Milled Maize in Mozambique

As maize is consumed in the form of flour or meal, virtually all Mozambicans rely on maize milling, be it from large-scale commercial mills or small-scale hammer mills. Commercial grain processors dominate urban settings; despite low maize production in these areas, economies of scale bring down the costs of acquiring high quality grain. This is especially evident in the South (Maputo, Gaza, and Inhambane provinces), where maize production accounts for less than 10% of the national total, and a consistent supply of high-quality grain can easily be secured from South Africa throughout the year. Even in the northern regions, the dominant commercial maize meal processor in Nampula City, Companhia Industrial

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29 “Mozambique produces maize surplus,” Mozambique News Agency AIM Reports, No.375, March 19, 2009
30 Ibid.
Societa da Matola (CIM), supplies its grain stock from South Africa because of quality and reliability problems with local producers.

In rural areas of high agricultural production, commercially processed maize meal is purchased almost exclusively in the lean season when supply from local smallholders has been depleted. The rest of the growing year, when grain is available, people take whole grain to be milled instead of buying commercially produced flour. These rural areas are dominated by small-scale hammer mills that have a capacity of processing 1 to 5 tons per day (less than one tenth of the daily capacity of commercial mills). They provide a milling service to the community in which they are located, unlike large-scale commercial mills which purchase grain and then sell the processed maize meal.

This dynamic illustrates the basic breakdown of the markets for large-scale commercial mills and small-scale hammer mills. For commercial mills the market consists of the majority of Mozambicans in urban settings (approximately 1/3 of the total population, or 7.3 million people) and nearly all Mozambicans during the lean season, while for small-scale mills the market is composed of rural populations (approximately 2/3 of the total population, or 14.1 million people). Client traffic to local mills depends on the regional supply of grains; thus, the market for milling is most attractive during the “maize campaign” that starts in March with the harvest of fresh maize, and continues with the harvest of dry maize in June and July.

3.2.3 Players in the Milled Maize Market

The commercial milling industry in Mozambique began in the mid-1990s after CIM was privatized. By 2003, four competitors entered the market; as of 2005 CIM was still the largest national producer and held over one third of the national market share. According to company representatives, CIM processes approximately 12,000 tons of maize per year, primarily using maize imported from South Africa. Based out of Maputo, CIM reports that meal processed in Nampula City accounts for less than half of their total volume of grains processed. The company claims that much of their maize meal is purchased by the government and that they are the top sellers of maize meal to commercial markets.

In the Northern region, CIM is by far the top maize grain processing company, but the 12,000 tons of processed grain amounts to less than 1% of national demand. This result demonstrates the absence of other commercial processors that are active in other regions of Mozambique and the tendency of a rural population in an area of high maize production to use local hammer mills.

Diamante Oriental, another grain processing company, is based out of Nacala (primary port in Nampula Province) and reports buying between 5,000 and 10,000 tons of grain per year – sourcing locally and regionally. V & M Grain Co. reports buying 20,000 tons of maize per year, but the proportion of imported and exported volumes is unclear. Decca, a processing company located in Central Mozambique, processes between 30,000 and 50,000 tons per year and sources grain locally and from South Africa. To use these figures in calculating total national processing of grain into maize meal is problematic, as the volumes do not match state records; nevertheless, because the market is dominated by relatively few players, and competition is low, the price is kept at approximately 25MT/kg (US$0.96), a price widely noted in interviews with millers and community mill clients as being very expensive.

3.2.4 Supply of Other Milled Grains

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33 Interview with Aly Baraza Júnior at CIM in Nampula City on March 18, 2009.
At the local level maize meal is usually the only meal for sale (rarely dried cassava can occasionally be found), and at the commercial level, supermarkets only stock wheat and maize flour (wheat flour is not used as a porridge base, only for baked goods). The main brand of commercial milled maize is Top Score, a fortified meal perceived as an expensive alternative for community-milled maize in the lean season (usually November through February). However, due to the price, many people prefer to bring other grains and/or legumes to their local mill during this period to substitute maize meal.

Although traditionally not grown in Mozambique, there is currently a strong donor-driven effort to boost soy production. Although the immediate objective is to export to foreign markets, extension workers report that they are also educating producers on consuming soy products for the increased nutritional benefits. Corn-Soy Blends (CSBs) are gaining popularity among food insecure countries, likely motivating the boost in production. These trends are likely to encourage smallholder farmers in these areas to begin milling soy for personal consumption.

3.3 Milling Industry Value Chain Analysis

Northern Mozambique’s maize milling industry value chain involves several hundreds of small-scale community mills as well as a few commercial operations. It is a relatively underdeveloped value chain and key aspects (i.e. storage, transport, distribution) still need to be developed. A basic analysis of the value chain is presented below:

Figure 4: Maize Milling Value Chain in Northern Mozambique

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34 Gates Foundation
3.3.1 Production

Maize production is dominated by smallholders who cultivate small plots of land, rarely use inputs or mechanization – thus achieving very low yields\(^{35}\) – and sell only some 15% of total crop.\(^ {36}\) For the typical maize producer, the cost of production includes only labor and seeds. The family takes on the majority of the labor duties and the seeds are almost always recycled from the previous season. Production is highly sensitive to climatic events in a given year. Because demand for grain milling depends on food production, mill businesses will be affected by the same climatic events that affect agricultural production. Government and non-government organizations are collaborating to promote access and use of inputs, which are expected to positively impact milling businesses in the future\(^ {37}\).

3.3.2 Distribution

Most maize is taken to the local mill by the smallholder by foot or bicycle. Long-distance transport to commercial mills is not readily accessible to smallholders for two reasons. First, large transport companies will only buy grain in volumes greater than one metric ton, usually from traders or farmer organizations (less than 15% of smallholders are part of organizations).\(^ {38}\) Second, transport companies charge a very high price for transport, largely the result of fast depreciation of trucks caused by poor road conditions. Projects are underway to improve road infrastructure but, because such a small proportion of smallholder-produced grain is sold (vs. own consumption), improved access to commercial grain markets for smallholders would have little effect on potential revenues for small-scale milling businesses.

3.3.3 Storage

Formal, large-scale storage facilities are used by only 15% of smallholders\(^ {39}\) (informal, short-term storage during the post-harvest drying usually occurs in or near the home). Note that this figure does not represent the proportion of farmers with access to improved storage facilities. The existing structures remain underutilized for several reasons. For all farmers and traders, spoilage of crops is a major problem - up to 30% of crops are lost due to spoilage\(^ {40}\). Also, smallholders are typically cash-constrained and cannot afford to wait to sell their grain, and thus have no need for storage. The lack of large-scale storage facilities that exercise quality control is recognized as a major constraint in the industry by the main trading and transport companies.\(^ {41}\) If concern translates to action and quality warehouses are built, the implication to millers would be a stabilization of income. Currently, the seasonality of grain production results in high revenues during the months of April-June (typically the harvest season) and very low revenues during the months of November-February (typically the hunger season with leanest grain supply). Expanding the volumes of stored grain would stabilize the grain supply throughout the year and allow millers to have two revenue peaks per season.

3.3.4 Processing

Mills are used to produce an end product (most often maize meal) and provide a service. The key difference between a business that produces maize meal for sale to the consumer and one that provides

\(^{35}\) Average yields of 1 MT/ha in Mozambique, 3 MT/ha in South Africa and 9 MT/ha in USA; FAOSTAT


\(^{37}\) Instituto de Investigação Agrária de Moçambique (IIAM); International Institute of Tropical Agriculture (IITA)

\(^{38}\) Information from CLUSA.


\(^{41}\) Interviews at Lalgy and Export Marketing.
the milling service to the consumer is the access to storage. Commercial production of maize meal requires access to sophisticated storage facilities capable of exercising quality control. The vulnerability of grain and maize meal to spoilage, and thus the need for quality control measures such as fumigation and mechanical sifting, demands a level of technological capability that is too expensive for small-scale milling businesses. The benefit of investing in expensive quality control measures is the opening of a market that has established quality standards; for example, the World Food Programme only purchases grain that passes quality tests. The state of technology – which will be used loosely to describe access to storage facilities and quality control measures, the type of motor used to drive the mill, and the availability of a hulling machine – for a given milling business, along with the specific lifecycle stage of the community-wide milling industry, will determine its profitability. Technological advancement allows businesses to minimize costs, as well as attract customers. For example, in a community that has access to electricity, all of the mills may be running on electrical motors, which is less costly than relying on a diesel-powered generator; however, the few mills that offer the service of a hulling machine will attract the most customers. As a community develops – for example, by gaining access to electrical power or hulling machines – the population will demand steady adoption of new technologies. This has obvious implications for milling businesses in that they will need to invest in new technologies to remain competitive.

Supplies needed to run a milling business are accessible, even in rural Mozambique. Large-scale industrial mills can be purchased from international manufacturing companies (provided the miller has access to capital and is able to navigate the import process), while small-scale hammer mills are mostly procured within the region. In the Grain Belt, mills are most often purchased locally (i.e. Cuamba, Gurúé), or imported from Malawi and Tanzania by truck. The motor that drives the mill is often purchased simultaneously, however if bought separately can be found in similar markets as the mill itself. Hulling machines are rarely constructed in Mozambique, but can be imported from neighboring countries with relative ease.

3.3.5 Markets

Currently, the main market for maize meal (or any alternative meal mentioned) is for human consumption. For each mill, this includes virtually the entire population within its reach, including the poorest in the community. Consumers obtain milled maize either 1) directly at the community mill – either after milling one’s own grain or if the miller offers meal for sale, 2) in a local marketplace or trading stall (barraca) – most common during the lean season when whole-grain maize is scarce, or 3) at a formal market, where the product comes packaged and branded (i.e. Top Score). Of the various end markets, the first two are by far represent the most volume.

Two distinct trends must be considered when speculating on the future of the market for locally milled food products. For one, urbanization is occurring at a high rate, especially in the North (6.5%) which will reduce the market demand for local milling services as city dwellers consume greater proportions of rice. Conversely, livestock production has grown at a rate of 20% from 1998-2007. The livestock industry is expected to continue growing, driving the expansion of market demand for the milling service that could substitute for the anticipated decrease in demand from human consumption market.

42 Interviews at the World Food Programme gave conflicting information to the validity of the claim that only fortified maize meal is distributed; April 2009 in Maputo, May 2009 in Nampula City.
43 This is the situation observed in Nampula City.
45 TNS internal calculation by Liz Walker, N. Mozambique Food and Animal Health Systems analysis (April 2009)
46 FAOSTAT
The distribution of maize production used for human vs. animal consumption is strikingly different in Mozambique than the global trend. In Mozambique, animal feed currently accounts for only 13% of maize consumption,\textsuperscript{47} whereas 65% of the total world production is used for animal feed. A likely explanation for this trend is that the majority of livestock is raised very informally and the custom is to let the animals eat what they come across naturally instead of paying for feed. Regardless, the expansion of formal livestock production will expand a market for milled food products.

3.4 Overall Market Attractiveness and Potential

Individual community dynamics are the main determinants of the market potential for a given maize mill because they affect the demand for the milling service. The profitability of a milling business depends primarily on the amount of grains milled, as well as the ability to manage costs – in particular in the face of seasonality, whereby in the lean season it can be extremely difficult to cover running costs due to the lack of maize on the market. Two factors come into play: 1) the volume of grain available to the population and 2) the number of mills available to a given population.

The ideal community for a milling business is one where the number of potential clients per mill is high, and the agronomic conditions typically allow for high grain production. Competition in this hypothetical community is very low, and the most basic mills (i.e., operate on a generator, do not offer separating machine) can still be profitable. Even though the operating costs are high (i.e., diesel powered generator is more costly than electricity) and potential revenues are lower (i.e. if a mill does not offer hulling service), the mills will have a dominant share of a large market.

On the other extreme is a hypothetical mill located in a community of low grain production and a low number of potential clients per mill. Low grain supply can be a cause of low client numbers, but a high number of mills in the community will also negatively affect the number of clients demanding the milling service. As profits drop, mills must operate on electricity, as the alternative of operating on a diesel generator is much too costly to make profit. Competition for customers is a natural outcome as the community evolves. A variety of methods are used to attract customers: hulling machines are purchased, offering customers the service of separating the fibrous outer hull from the starchy center that will mill into very fine flour; and prices may be lowered below the municipally set price to undercut competitors.\textsuperscript{48} Conditions in some communities are such that mills cannot be profitable. However, because the service is so essential for the community, the more successful, diversified business owners seem to cover the cost of running their milling business with a profitable side business.\textsuperscript{49}

Because grain supply varies to such a high degree within a given year, every mill will experience a significant drop in market potential (as measured by customers per day) from the period of high grain supply to the period of lowest grain supply. It is in this lean season that operating advantages (i.e., reduced cost by running on electricity, offering the service of the hulling machine, supporting mill with a side business) are most beneficial.

3.4.1.1 Buyer Power

In the context of small-scale milling businesses, consumers have some pricing leverage. The majority of these businesses rely entirely on the clients of the milling service to generate revenue. This dependence,

\textsuperscript{47}Average proportion of national maize grain stock (production + import – export) used for animal feed from 1993-2003; FAOSTAT
\textsuperscript{48}Field interviews in Gurúê, Íle, and Lioma (June 2009).
\textsuperscript{49}Observed side businesses include grain trading, mechanic business, and an aviary.
compounded by the fact that there is a very high buyer-to-milling enterprise concentration ratio, gives consumers the power to set the price. On the other hand, small-scale milling businesses are the only distribution channel for the service. It is widely reported that the milling service is accessible to even the poorest in the community, reflecting a balance between business and social objectives that is struck by the consumer, who ensures that the price be accessible to the population, but high enough for the miller to make a profit. Millers will allow customers regular discounts, and even allow those in dire situations to mill for free. Nevertheless, the average set price is accepted as reasonable.

3.4.1.2 Supplier Power

Grain mills are technologically simple machines, and thus require little technical expertise during manufacturing. In fact, they are often constructed and repaired by individuals with metal-working experience who operate in the social or familial networks of those involved in the milling business. However, there is also the option of sourcing mills and repair parts regionally. Suppliers do not seem to exert much pressure, if any, on small-scale milling businesses.

Hulling machines are in lower supply locally, but they can be found regionally. For example, in the Grain Belt it is common to source hulling machines in neighboring countries of Tanzania and Malawi. Because these machines are cannot be constructed or repaired locally, suppliers have all of the pricing leverage. Conversely, small-scale milling businesses are likely the only buyers of the small-capacity hulling machines so suppliers must price the machines so that they are affordable to the buyers.

3.4.1.3 Barriers to Entry

Availability of investment capital is the dominant barrier to entering the milling industry. Because community context will determine the demand for the milling service, it will also dictate which business model will maximize profits and thus the level of capital expenditure required for operation. This can vary quite dramatically depending on the simplicity or complexity of the business. The details of the capital requirements for each milling model are discussed at length in Section 6.

3.4.1.4 Threat of Substitute Products

Because the demand for the milling service relies on a desire for an end product (most often maize meal), commercially produced maize meal is the only threat as a substitute product. It is unlikely that commercially produced maize meal will ever wholly substitute the service provided by community mills because of the large difference in costs for acquiring each end product (commercial meal costs between two and three times more than buying grain and milling it locally). Also, until farmers transition to commercial production where 100% of their production is sold, there will be some demand for the subsistence milling service. There are seasonal alternatives to maize meal, however as previously mentioned these other grains are seen as a foodstuffs to be consumed when there is a lack of maize; they are not a highly desired option in and of themselves.

3.4.1.5 Competition in the Industry

Small-scale hammer mills have several competitive advantages over industrial mills. The main advantage is price. While the hammer mills provide a service and commercial mills a product, the milling service allows the customers to acquire the end product at a cheaper overall price: the cost of producing or buying maize grain plus the cost of milling is lower than the market price of commercially produced maize flour. Additionally, mill businesses do not incur additional costs of advertising, research and development, or quality control. Customers are attracted based on the quality of maize meal produced – mainly judged by whiteness and fineness of the flour – which is divulged by word of mouth. Commercial mills invest in
research and development and quality assurance measures. Small-scale hammer mills do not incur the cost of this investment, but may lose a competitive advantage over quality. This is not to say that vertical integration of storage and trading, which are the first steps a small-scale miller takes toward expansion that may eventually include an industrial-size mill and quality control measures, are not recommended for business growth; in fact these steps can be important in the sustainability of small-scale mills because they offer stability and the chance to turn a profit outside of the harvest season. Instead, it means that small-scale hammer mills, especially in highly populated communities with high agricultural production, provide a channel for acquiring an end product that is more cost-effective than the alternative, filling a social role that commercial processors do not, or cannot, compete with.

Within any community context, certain characteristics will give small-scale mill businesses a competitive advantage and ensure success. Firstly, adopting new technologies can help to maximize revenues and minimize costs. For example, a mill operating on an electrically-powered motor attracts customers because it charges a lower price than a mill relying on a diesel-powered generator. Similarly, a hulking machine requires significant investment, however, it not only provides extra revenue for each customer, it also attracts more customers as it is widely recognized that the typical charged price of 1MT/kg (0.04 USD/kg) is worth the savings in labor cost to hand pound grain. A final argument for a technology upgrade involves construction methods and materials. Mill business owners that invest in structurally sound housing can maintain normal operations during thunderstorms and avoid paying for costly repairs that are needed when lightning damages electrical motors, a risk that motivates most mill owners to stop operations until storms pass.

Secondly, geographic location plays an important role in profitability. Most obviously, mills that are highly visible and easily accessible will receive more clients than mills that are difficult to find and require traveling long distances to reach. Finally, clients need food to mill; mills located in areas with optimal agronomic conditions for growing grains are likely to receive more clients than those located in areas with low grain production.
4 THE GRAIN MILL

4.1 Operational Structure of a Grain Mill

A grain mill is a relatively simple operation, adaptable to both basic community-level and more sophisticated commercial contexts. Most common in the rural areas of Northern Mozambique, and of particular interest to TechnoServe in the context of the Millennium Mills Project, are small-scale hammer mills, as illustrated in the figure below.

Figure 5: Operational Flow of a Small-Scale Hammer Mill

Typically at these community mills, people bring their grains in fabric-contained bundles or recycled rice sacks and wait in line for their turn to mill. Both men and women bring grain to the mills, about 50/50 in terms of gender distribution according to interviews.\(^5\)

The first step is to weigh the grain, after which it is deposited into an input funnel (1) that controls the flow into the mill. A motor drives rotating blades (2) that grind the kernels into a fine-grained flour, which is then pushed upward through an output funnel by a fan (3). The flour then passes through the funnel and a sieve (4) into a catch container. There are typically two to three employees at a simple community mill: one to weigh the grain, one to operate the mill, and one to act as a guard and keep crowds orderly.

The main investment in technology for a basic mill is to include a hulling machine that pounds the grain prior to milling so that the outer hull is removed. Hulling results in finer, whiter flour, which is generally preferred by clients as it is said to make tastier xima (porridge). In the absence of a hulling machine,

\(^5\) Interviews conducted by Andrew Raymer in Nampula Province, March 2009.
clients will use an oversized mortar and pestle to pound the grain by hand prior to bringing it to the mill, a lengthy and tiring process. If given the option, and assuming they have the available cash, clients will almost always prefer to hull their maize mechanically, even if it means cutting back on spending somewhere else. As such, having a hulling machine quickly becomes a differential for success for the community-level mill.

4.2 Milling Volumes and Pricing

At a typical small-scale mill in the Grain Belt, clients bring between 5 kg and 20 kg\textsuperscript{51} of maize to be milled each visit, returning 2 to 3 times per week to obtain meal for the family’s \textit{xima}. The quantity per client can vary drastically; however, the volume of grains milled drops across the board during the hunger season. To make up for the lack of maize during the lean period, clients will typically bring between 1 kg and 10 kg of cassava, sorghum or other foodstuffs per visit, again varying significantly from person to person.

The price for milling is usually 1\textit{MT}/kg (about US$0.04) at mills running on electricity and 1.5\textit{MT}/kg (about US$0.06) at mills running on a diesel generator. In many locations, this is a fixed price that has been agreed upon and implemented by an Association of Millers with support from the local government. The standard price for hulling is similar to that of milling, usually 1\textit{MT}/kg (about US$0.04).

The price for milling/hulling varies between, as well as within communities, depending on the dynamics of competition, the operating cost structure and the potential presence of external subsidies, among other factors. In some communities, there is more demand for milling than there are mills and therefore the price is quite high; in others, there is cutthroat competition that leads to price wars, with the price for milling sometimes dipping to 0.50\textit{MT}/kg (about US$0.02). In other communities, the operating cost is high – mostly due to elevated electricity costs\textsuperscript{52} – and the market can become distorted due to subsidies\textsuperscript{53}, thus forcing other millers in the area to charge a similarly low price in order to compete.

These fluctuations in pricing are driven largely by the milling “lifecycle”, explained further below.

4.3 The Lifecycle of Grain Mills

The dynamics of the milling industry are rather complex – particularly considering that small-scale hammer mills are a straightforward business – and vary from one community to the next according to a milling “lifecycle” (shown in the diagram on the next page).

\textsuperscript{51} Clients bring varying volumes per visit, starting at 1kg and going through 50 kg as reported in interviews. However, the range between 5 kg and 20 kg is representative of the average client at most mills.

\textsuperscript{52} For reasons unclear to the Grains Team, the electricity cost for mills in Gurûé is disproportionately high as compared to other communities in the region. The high cost might be attributed to geography – Gurûé is located in a mountainous region – or, possibly, to price skewing by the people responsible for determining electricity charges (according to interviews, the “owner” (\textit{dono}) of Gurûé’s electricity company also owns and operates several mills).

\textsuperscript{53} The presence of Father Hilário’s Catholic Mission has significantly impacted the local milling sector, as the Mission offers reduced-cost milling and hulling.
4.3.1.1 Inception Phase

Communities in the inception phase of the milling lifecycle typically have very few mills (or even none) and high unmet demand for milling services. Many clients travel long distances (sometimes upwards of 25km) to reach the mill and face long lines once there, in particular during the harvest season. These communities tend to have less than the recommended 1 mill per 6 km radius, and less than 1 mill per 6,000 people. The mill(s) in existence are new – likely operating for no more than 9 months – and are generator-powered. If the community has electricity, it is a recent development. Due to the scarcity of mills and the high costs of running on a generator, the price charged for milling is 1.5MT/kg (US$0.06). Both millers and customers perceive a clear need for more mills in the community.

Mills established in inception phase communities will experience heavy traffic and healthy revenues, in particular if the location is favorable (i.e. near a road or market). In this stage, generator-powered mills are able to flourish without offering any value-added services; however, in order to survive as competition increases and the community moves through the lifecycle, it will be necessary to invest in technology (electric motor, hulling machine, etc.) and have a sound business strategy (cash flow and cost management, quality control, etc.).
Inception Phase Case Study: Namaita

Namaita, a town of some 34,000 inhabitants about 30km outside Nampula City, is an example of a community in the inception phase. Namaita only has one mill, in operation for under a month as of May 2009. The mill serves some 200 people per day in the harvest season and always has large crowds of people waiting to mill. Several people interviewed at this mill came from over 25km away, as there are several communities in the surrounding area with no mills at all. As one man observed, “Tem falta de moagem,” (There aren’t enough mills).

The Namaita mill charges 1.5MT/kg (US$0.06) for the milling service despite the fact that it runs on electricity (Namaita was put on the grid a few days before the mill began operating; this was a factor in the owner’s decision to start a mill). This is the highest price observed by the Grains Team, and is indicative of the massive unmet demand for milling in the area. The fact that Namaita, located just a short distance from Nampula City where there are several dozens of mills and a fixed price of 1MT/kg (US$0.04), has a scarcity of mills and charges a premium for the service illustrates the homogenous nature of the milling industry in Northern Mozambique.

An interesting final note is the fact that the Namaita mill is the only one the Grains Team encountered that has a fixed policy for “charity milling”, that is, the discounted or free milling services extended to the poorest members of the community. While other millers tend to allow those without enough money to mill whatever grain they’ve brought for whatever money they have, the Namaita mill pro-rates people’s maize (i.e. if a person has 0.75MT (US$0.03), they are allowed to mill 0.5kg). Perhaps this is indicative of the fact that this mill can, in effect, name its price due to the massive demand for milling services in the community.

4.3.1.2 Growth Phase

Communities in the growth phase of the milling lifecycle usually are connected to the electrical grid and have, as a result of the reduced barriers to entry (lower start-up and running costs), an increasing number of mills. These communities are likely approaching the ideal ratio of 1 mill per 6 km radius, and 1 mill per 6,000 people. As a result of supply nearing demand, pricing for milling services stabilizes, usually around 1MT/kg (US$0.04). A few mills may offer separating – thus drawing a larger client base – and some forward-thinking millers may engage in trading. It is common for Millers’ Associations to form in this stage to start self-regulating the industry and ensuring that millers obtain sufficient revenue to cover their costs (while keeping services affordable for the community). Most of the mills in a growth phase community are flourishing, and it is rare for a mill to close its doors. However, the situation must be carefully analyzed to determine whether or not there are attractive opportunities for additional mills.

Growth Phase Case Study: Ribáuè

Roughly 100 km west of Nampula City is the District of Ribáuè. With a population of 186,000 it is home to a regional climate ideally suited for grain and overall agricultural production.

The district currently hosts 31 officially-licensed milling operations distributed among 20 individual owners, cooperatives and associations. A typical community in the growth phase of the lifecycle, milling in Ribáuè is perceived to be a “bom negócio” (good business) and supply of milling services has yet to exceed demand. The local Association of Millers passed a fixed price for milling of 1MT/kg (US$0.04) that is widely accepted and respected by millers and clients alike. With basic business management skills, the consensus is that it is possible to cover costs and make a modest profit with milling. Increasingly, it
will be important for millers to respond to consumer demand for hulling services in order to remain competitive as Ribáue moves through the milling lifecycle.

Women millers represent approximately one-third of the mill owners in the District, and groups such as the Ribáue Women’s Association are interested in expanding into milling. Currently, this member-driven and profit-sharing association invests in various small-scale enterprises like seamstress services, vegetable and fruit vending and small shop-keeping.

Among Ribáue’s mill owners a community of interest and mutuality exists. Millers largely run their individual enterprises through an economy of association, whereby the setting of prices, conducting repairs, and procurement of spare parts are often pursued collectively. Furthermore, a mill’s target market is almost always locally concentrated and responsive to a particular customer base and village social structure. Moreover, paying customers represent only one group that patronizes a mill. Mills also serve as centralized social hubs, a post for information sharing and trading and as a host site to informal business transactions.

Accounting for these cultural and social caveats, the investment climate remains promising. Ribáue’s District Government enthusiastically supports the expansion of new mills to underserved areas, and its multi-year strategic plan for agriculture calls for, among other features, an expansion of grain production and an increased investment in soy. Fortified blending and soy production, in particular, seemingly represents a ripe opportunity for public-private partnerships. In addition to local government’s support of soy production, the international NGO Save the Children is currently supporting the District Health Office to manage cases of malnutrition. The health centers’ stock of corn-soy blend (CSB), however, is non-existent. Expanding local capacity to produce and process soy contains the promise of not only saving lives, but also ensuring a more profitable and efficient grain value chain.

4.3.1.3 Saturation Phase

A community in the saturation phase has multiple mills operating and has reached or exceeded the ideal ration for mills per capita and/or mills per geographic area and growth stagnates. The positive side of this is that customers travel shorter distances to the mill and wait less time for milling; the negative side (for the miller) is that some mills have low traffic and may even be idle. In the saturation phase, diverse pricing strategies may emerge, even in the face of a municipally-fixed price. In an attempt to undercut the competition, some millers will drop their prices, often to below 1MT/kg.

With pricing wars, many millers may be unable to cover basic running costs. No longer is milling perceived to be a guaranteed “good business”; to make it, a mill must have some sort of differentiating factor, be it the quality of the meal produced (i.e. fine, white flour made with a hulling machine), excellent customer service (i.e. fair weights, organized waiting lines), location of the mill or the ability of the mill owner to efficiently manage his business. In other cases, mills are able to remain open because the owners have a successful side business that permits them to take a loss on milling for part of the year.

Saturation Phase Case Study: Alto Molócuè

The consensus among millers in Alto Molócuè, an administrative post in Zambézia Province with a population of 162,236, is that there are too many mills in town. An example of a community in the saturation phase, many millers complained that milling isn’t profitable anymore, citing low traffic and price wars. Officially there is a fixed price of 1MT/kg (US$0.04) in Alto Molócuè, however for over a year people have been undercutting this; most mills now charge 0.50MT/kg (US$0.02) for the basic
milling service, although a few people interviewed charge 0.75MT/kg (US$0.03). The millers agree that it’s nearly impossible to cover costs on 0.50MT/kg, however they also acknowledge that they can’t attract clients without dropping the price to that level.

Regardless of the hard times millers are facing, they continue to play a charitable role in the community and look out for the poorest citizens of Alto Molócuè. Every miller interviewed said they allow people to mill for a reduced price or for free, even though their businesses are struggling. The sense of social obligation is strong, and as one miller said, “Não pode deixar a pessoa chegar em casa e não ter o que comer,” (You can’t let someone go home and not have anything to eat).

Interestingly, most of the mills the Grains Team visited in Alto Molócuè did not have hulling machines. Millers seemed stuck in the difficult position of needing to invest in their businesses to survive (i.e. purchase a hulling machine to attract customers and increase revenues) but, with price wars and difficulties turning a profit, they have no capital available.

4.3.1.4 Shake-Out Phase

In communities in the shake-out phase, it is common for mills that struggled in the saturation phase to close their doors. Only the mills that are able to cover costs and cope with the seasonality effect on the cash flow will remain open. In some cases, this is due to a sound business strategy that includes investment in technology (hulling machine) and focus on providing a consistent, quality end product. In other cases, it is because millers are engaging in storage and trading schemes, thus making it easier to survive the lean season (due to two profit peaks in the same year). Finally, some millers are able to cover their costs using funds from a successful side business. With the weeding-out of struggling mills, the ratio of mills per population and geographic area will come close to ideal levels. Traffic per mill will increase, and prices will tend to stabilize (even if different from one community to the next).

Shake-Out Phase Case Study: Gurúè

Gurúè is a town with 121,564 people located in a mountainous area of Zambézia Province, quite near the border with Malawi. In terms of the milling industry lifecycle, Gurúè represents a community in the shake-out phase; however, it is also influenced by the presence of a Catholic mission and technical-vocational complex, commonly known as “Padre Hilário” (the name of the Italian Father who runs the mission), where 5 large-scale maize mills are in operation. Padre Hilário’s mills offer services at the significantly reduced price of 0.40MT/kg (US$0.015), the result of subsidies made possible by donations to the Church. This is the price Padre Hilário believes is fair, and that allows even the poorest members of the community to mill their staple foodstuff.

In effect, all of the other mills in Gurúè are forced to match the Father’s price of 0.40MT/kg if they want to attract any customers, even though this is notably below the market price in the region (even in communities in the height of price wars). As a result, an already difficult business in terms of covering costs is made even more so, leading many local mills to close their doors because they can’t compete with Padre Hilário. It is particularly ironic that a charity-oriented operation is putting some community mills out of business given the traditional role that millers play in looking out for the poor.

The mills in Gurúè that are still in operation seem to be either 1) seriously struggling and unsustainable given the current situation, or 2) owned by entrepreneurs that have diversified side businesses (from which they take revenues to cover their milling expenses). Two of the millers interviewed by the Grains Team stated that if it weren’t for their side businesses (an aviary and a mechanic’s shop, respectively)
they would have closed their mills long ago; they have kept the mills open, even though they aren’t profitable, out of a sense of social obligation. They recognize that mills are a fundamental part of the community’s fabric, and they seem proud to be involved in providing an essential service. Notably, the woman miller (who runs the aviary) is very interested in taking her milling operations to an industrial level. She sees going to scale as the only way to compete with Padre Hilário, however she currently lacks access to capital to pursue that vision.

4.4 SWOT Analysis of Millennium Mills Project

Based on TechnoServe’s thorough investigation of the maize milling sector, a SWOT analysis of the Millennium Mills Project is presented below.

Figure 7: SWOT Analysis of Millennium Mills Project

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Franchise structure of Millennium Mills Project (MMP) allows for flexibility to create tailor-made interventions for each community and/or client.</td>
<td>• Challenge to understand a heterogeneous milling sector: each community presents a different scenario, and none of the scenarios are static.</td>
</tr>
<tr>
<td>• Highly qualified TechnoServe team understands grains sector and dynamics of N. Mozambique.</td>
<td>• Seasonality of maize production means a lack of grain on the market for several months each year, making it difficult for simple mills to cover costs in the hunger season.</td>
</tr>
<tr>
<td>• MMP easily allows for partnerships with other organizations.</td>
<td>• Implicit price ceiling</td>
</tr>
<tr>
<td>• Organic existence of maize mills in communities – mills have a recognized/established value.</td>
<td>• Difficult for entrepreneurs to access credit on favorable terms, even with mill as collateral.</td>
</tr>
<tr>
<td>• Potential for vertical integration and diversification.</td>
<td>• Limited industry data; poor quality (or lack of) records kept by current millers.</td>
</tr>
<tr>
<td>• Milling is a relatively simple business that depends on basic technology, doesn’t require specialized skills.</td>
<td>• Poor literacy and business skills among millers.</td>
</tr>
<tr>
<td>• Local government keen to support milling.</td>
<td>• No current model for successful grain bank in Mozambique.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Strong interest from donors in food/nutrition.</td>
<td>• Calamities and agricultural shocks (flood, drought, cyclones, plagues, etc.)</td>
</tr>
<tr>
<td>• Community development catalyzed by maize mill as a business/social hub – mill acts as anchor point for business development.</td>
<td>• Presence of subsidized mills/projects can hamper private sector-driven efforts to develop milling.</td>
</tr>
<tr>
<td>• Potential for creating spin-off businesses (e.g. chicken feed, corn-soy blends).</td>
<td>• N. Mozambique strongly affected by subsidy/aid situation in Malawi – determinant for how (and if) grain is sold in-country or exported.</td>
</tr>
<tr>
<td>• Potential for complementary health/nutrition interventions, including sales to food aid agencies.</td>
<td>• Poor storage and quality control methods (aflatoxin, spoilage) could compromise results.</td>
</tr>
<tr>
<td>• N. Mozambique has favorable climate for maize production, surplus maize in harvest season.</td>
<td>• Fluctuating commodity prices.</td>
</tr>
<tr>
<td>• Potential to expand market for grains producers by developing maize milling value chain.</td>
<td>• Poor transportation infrastructure.</td>
</tr>
<tr>
<td>• Strong demand from millers for access to financing to help expand/grow their businesses.</td>
<td></td>
</tr>
</tbody>
</table>
5 THE MILLENNIUM MILLS PROJECT

5.1 Millennium Mills Project Concept

By providing technical knowledge, business training, and small-scale financing, TechnoServe can help mill owners and operators grow their businesses and expand their reach – employing more people and providing communities with a broader set of goods, opportunities and economic choices. The Millennium Mills Project (MMP) will promote maize milling in Northern Mozambique’s Grain Belt through a “franchise” concept that offers the right mix of standardization and tailored solutions for milling entrepreneurs to grow their businesses and increase their income. The MMP aims to create a series of “franchisees” along key transportation corridors with milling functioning as the anchor economic activity, but also including space other forms of commerce, health, livelihood and social activity.

5.1.1 Millennium Mills Project Objectives

The overall objectives of the MMP are to:

- Promote the development of maize mills in the context of TechnoServe’s vision for long-term, sustainable transformation of the animal/human health and food systems in Northern Mozambique;
- Capitalize on a fundamental and organically occurring community service to improve income-generating opportunities for milling entrepreneurs through a “franchise” approach;
- Develop the processing component of Northern Mozambique’s grains value chain, thereby expanding the market for grain producers in the region and meeting demand for maize meal for human consumption and animal feed;
- Establish a franchise model to provide tailor-made solutions to each community/entrepreneur;
- Through partnerships with NGOs, local government and private-sector companies with stakes in the grains sector, create opportunities for improved health, nutrition, social and business outcomes using the mill as the anchor-point for these interventions.

In order to reach these objectives, TechnoServe will identify established and emerging milling entrepreneurs; evaluate the characteristics of the miller and his/her community in order to determine growth opportunities and identify potential constraints to success; provide technical assistance and support to Millennium Mills clients through business plan development, capital raising assistance and consultancies with local and international grains/milling experts; market linkage facilitation (i.e. with poultry producers); and promotion of partnerships with organizations involved in health and nutrition.

5.1.2 “Franchise Menus” – the Right Mix of Standardization and Customization

The franchise concept is based on TechnoServe’s understanding of the industry dynamics as well as the individual workings of the grain mill as a business. Each milling client in the MMP will receive a tailored milling package or “franchise menu” appropriate to his/her capacity and the dynamics of the target community. Drawing on the model of traditional franchise operations (i.e. fast food, clothing retailers), Millennium Mills franchisees will represent a recognized level of quality and follow certain common operational practices; however, just as traditional franchise businesses must adjust their model to account for local preferences and market dynamics, so will the MMP allow for customized solutions to promote Grain Belt milling enterprises in the most appropriate and success-enabling manner possible.

The Millennium Mills franchise menus will contain standardized elements – for example, promotion of key success factors for milling that TechnoServe has identified that are valid across the board – as well as individualized intervention components – for example, where a community is in the milling lifecycle, the
mill owner’s access to capital and previous entrepreneurial experience. In this manner, it will be possible for the MMP to work with multiple different mills; franchisees could range from a very simple mill that only offers milling as a service, all the way through a larger-capacity mill that engages in trading and eventually provides storage options for the community. Furthermore, the MMP is not limited to current players in the milling sector. The Project can also involve supporting/coaching entrepreneurs from other areas who have the appropriate skills profile and access to capital to enter the milling business.

Figure 8: Critical Success Factors for Milling Enterprises

<table>
<thead>
<tr>
<th>Characteristics of Milling Entrepreneur</th>
<th>Characteristics of Target Community</th>
<th>Operational Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic business skills (costing, pricing, accounting)</td>
<td>High population density</td>
<td>Mill is run on electricity, not diesel generator</td>
</tr>
<tr>
<td>Entrepreneurial experience</td>
<td>High grain production, especially maize</td>
<td>Incorporation of a hulling machine as soon as possible</td>
</tr>
<tr>
<td>Basic technical/mechanical skills</td>
<td>Ideally 1 mill per 6,000 population</td>
<td>In certain cases, vertical integration (trading) and incorporation of storage to offset seasonality effect on cash flow</td>
</tr>
<tr>
<td>Access to minimum capital required to cover investment in mill and running costs</td>
<td>Not more than 1 mill per 6 km radius</td>
<td>Quality control measures in place</td>
</tr>
<tr>
<td>Basic understanding of local/regional grain market dynamics and seasonality</td>
<td>Connection to electrical grid</td>
<td></td>
</tr>
<tr>
<td>Respected role in community and broad social/familial network</td>
<td>Access to road infrastructure</td>
<td></td>
</tr>
</tbody>
</table>

### 5.2 Implementing the Millennium Mills Project

#### 5.2.1 Evaluation of Target Community and Miller

Since the milling industry in Northern Mozambique is heterogeneous, the necessary first step in implementing the MMP will be to evaluate the target community and current/prospective millers. Such an evaluation can be tailored to suit the local conditions; however the following steps will remain constant:

**Step 1: Survey the Target Community**

This survey should be carried out on-the-ground and include millers and other stakeholders familiar with the target area in order to:

- Identify number of mills in operation and their basic operating characteristics;
- Determine total population of target community (ideal ratio is 1 mill per 6,000 people);\(^{54}\)
- Determine population density (ideally at least 35 – 45 people per km2);
- Evaluate geographic distribution of mills (ideal ratio is 1 mill per 6km radius);
- Ensure there is sufficient supply of whole grain to support mills;
- Determine access to and condition of road infrastructure in the area;
- Identify potential markets for milled maize and other grains.

**Step 2: Identify Stage of Milling Lifecycle**

Using the criteria above, the community’s stage in the milling lifecycle should be identified. To do this, it is also necessary to take into account:

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\(^{54}\) Ideal geographic radius and population per mill provided by João de Deus from Oikos during interview with Andrew Raymer, July 2009.
• Current price for milling services;
• Existence (and enforcement) of fixed price for milling;
• Presence of hulling machines in community;
• Presence of millers engaged in storage and/or trading;

Step 3: Understand Miller’s Profile
It is critical to understand the milling entrepreneur’s strengths and weaknesses in order to determine the most appropriate course of action. The miller’s profile should take into consideration:
• Level of business skills and entrepreneurship;
• Previous experience in milling sector;
• Access to capital;
• Role in community and network of relationships;
• Reasons for wanting to enter the milling industry.

Step 4: Determine Best Intervention Strategy
After analyzing the community characteristics, milling lifecycle stage, miller’s profile and the market opportunities and challenges, an intervention strategy should be developed based on the MMP Franchise Menu Models (discussed in detail in Sections 6.2, 6.3 and 6.4). These milling models are:

1) Simple Mill that offers milling as a service;
2) Mill that offers Milling and Hulling; and
3) Mill that offers Milling and Hulling, and whose owner engages in grain trading.

Several evaluation perspectives should be used when determining the best intervention strategy. For example, the matrix below classifies opportunities based on the miller’s access to capital and the target community’s stage in the milling lifecycle.

Figure 9: Evaluation Matrix (Access to Capital x Milling Lifecycle Stage)
5.2.2 Millennium Mills Project Team

The Millennium Mills Project implementation team will consist of two Business Advisors in the field working in conjunction with the Poultry Program personnel. One Business Advisor will provide technical assistance to millers, helping them to run their mills in the most efficient and profitable manner possible. He/she will help both current and prospective milling entrepreneurs to analyze the opportunities present and develop appropriate strategies to pursue them. The Technical Assistance Business Advisor will be familiar with the milling sector and will be known and respected in the target communities.

The Technical Assistance specialist will work together with a Market Linkages Business Advisor to help millers connect with markets (i.e. food assistance, commercial producers of blended meal, poultry feed producers) and understand the requirements to work with them (i.e. quality, traceability, minimum volume). The Market Linkages Business Advisor will have a business background and will have experience with the poultry and food/nutrition sectors in Mozambique.

The Millennium Mills Project team will work under the guidance of the Poultry Program Director, Higino Marrule. Milling clients will receive support in fundraising (debt, equity and grants) from Tricia Wallace, the Director of Client Services and Capital Raising. Jake Walter, Chief of Party of TechnoServe Mozambique, will be responsible for high-level strategic direction of the MMP.

Figure 10: Millennium Mills Project Team
## 6 FINANCIAL ANALYSIS OF MILLENNIUM MILLS MODELS

### 6.1 Assumptions

The TechnoServe Grains Team built financial models for the maize mill models presented in this document: 1) Milling, 2) Milling and Hulling, 3) Milling, Hulling and Trading. Inputs and assumptions are based on primary research conducted with millers and confirmed wherever possible by stakeholders who are experts in the milling industry in Mozambique. The table below summarizes the key assumptions made in the financial models.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Assumptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum daily capacity of mill</td>
<td>2,000 kg</td>
<td>Based on interviews, confirmed by multiplying maximum milling capacity of 5 kg/min (as stated by industry veterans) by operating time of 7 hours/day (1 hour rest) = 2,100 kg/day.</td>
</tr>
<tr>
<td>Number of employees</td>
<td>2</td>
<td>Most commonly observed. One employee weighs grains and receives payment, other employee regulates grain flow at input funnel (customer regulates outflow into their own catch basin).</td>
</tr>
<tr>
<td>Minimum wage</td>
<td>3,300MT (US$127)</td>
<td>Model assumes monthly legal minimum wage for agricultural workers, however in practice salaries are between 30% and 60% lower.</td>
</tr>
<tr>
<td>Working days</td>
<td>25 per month</td>
<td>Sunday is a day of rest at most mills.</td>
</tr>
<tr>
<td>Established price for milling</td>
<td>1 MT/kg</td>
<td>Assuming a mill that runs on electricity in a typical community in inception/growth phase.</td>
</tr>
<tr>
<td>Actual price for milling</td>
<td>0.9 MT/kg</td>
<td>Takes into account informal discount extended to poorest members of community. Because volume per customer was typically stated as 10-20 kg, and a typical discount of 1-2MT, a discount of 10% per kg is observed in the model.</td>
</tr>
<tr>
<td>Revenue Assumptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td># customers/day:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak season</td>
<td>10</td>
<td>Customer volume varies according to seasonal grain supply. Considering volume of 15kg per client, peak season correlates to 70% of maximum capacity, med is 30% capacity and lean season is 15% capacity.</td>
</tr>
<tr>
<td>Mid season</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Lean season</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Volume milled per customer</td>
<td>15 kg</td>
<td>This is the mid-point of the most frequently quoted range of 10-20 kg per person per visit. The average of all data points was 15.6 kg and the mean was 17.5 kg, being fairly consistent throughout the season.</td>
</tr>
<tr>
<td>Volume hulled per month</td>
<td>75%</td>
<td>According to interviews, “most” people that pay to mill maize also pay for hulling. Hulling isn’t required to make maize meal, but is preferred. Thus, a conservative estimate of 75% was made.</td>
</tr>
<tr>
<td>Trading Assumptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume purchased per month</td>
<td>1/3 of total grain purchased</td>
<td>Purchase is spread over 3 months because in rural areas it’s difficult to buy 20 tons of maize at one time, and most small/medium-scale traders could not afford it. 3 months selected reflect period of highest supply and lowest price.</td>
</tr>
<tr>
<td>Volume sold per month</td>
<td>1/3 of total grain sold</td>
<td>If trader managed to maintain high quality, selling 20 tons of grain to a large scale trader is feasible. Typically, some spoilage occurs and quality reduction eliminates potential for sale to large-scale buyers. Thus is difficult to sell 20 tons of maize at once. 3 months chosen for sale are those with lowest supply, highest price.</td>
</tr>
</tbody>
</table>
### Grain Losses

<table>
<thead>
<tr>
<th>Grain Losses</th>
<th>15%</th>
<th>Typical smallholder losses are 20% of purchased volume, but it is assumed that trader will employ basic quality control practices (manual exclusion of spoiled grain to minimize spreading of mold).</th>
</tr>
</thead>
</table>

### Grain prices

<table>
<thead>
<tr>
<th>Grain prices</th>
<th>Avg. prices Nampula</th>
<th>Based on average nominal maize prices from 2004-2008, published by SIMA.</th>
</tr>
</thead>
</table>

### Investment Assumptions

All investment assumptions were derived from interviews, either with millers, organizations involved in trading, or industry veterans. Data points used to estimate cost of the warehouse depend on assumed trading volume. If trading below 50 tons – by default the model assumes trading of 20 tons – data points come from field interviews with traders. If trading above 50 tons, it is recommended to use data points suggested in justification section of assumptions tab.

### Running Cost Assumptions

<table>
<thead>
<tr>
<th>Energy costs (per month)</th>
<th>4,500 – 7,200MT (US$173-$277)</th>
<th>Conservative estimates based on interviews, may vary per municipality. In some areas, fee is charged for using electric motor, explaining lack of proportionality in energy cost to volume milled. No information was available to estimate additional cost of running a hulling machine; however, interviews suggest that energy requirement is much lower than that of the mill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance and repairs (per month)</td>
<td>300MT (US$12)</td>
<td>Estimated from interview data. Repairs include replacement of elastic band connecting motor to mill turbine, and replacement of hammers inside mill. Maintenance involves cleaning residual flour out of mill and applying lubricant to moving parts.</td>
</tr>
</tbody>
</table>

### Financial Assumptions

<table>
<thead>
<tr>
<th>Taxes</th>
<th>1.5% 1st year, 3% thereafter</th>
<th>Cash flow estimates earnings before interest and taxes. Simplified Tax for Small Taxpayers (ISPC) requires businesses whose annual turnover is equal to or less than 2,500,000 MT (US$ 90,000) pay 1.5% first year, 3% every following year. Payment is quarterly.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate</td>
<td>26MT:1 US$</td>
<td>Current rate as of interviews with millers.</td>
</tr>
<tr>
<td>Inflation</td>
<td>n/a</td>
<td>Not taken into account in this model.</td>
</tr>
<tr>
<td>Depreciation</td>
<td>n/a</td>
<td>Not taken into account in this model.</td>
</tr>
</tbody>
</table>

### Loan Assumptions

<table>
<thead>
<tr>
<th>Loan amount</th>
<th>US$3,100 US$6,000 US$7,250</th>
<th>Milling Model Milling + Hulling Model Milling + Hulling + Trading Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>5%</td>
<td>Typical monthly interest rate offered to small-scale entrepreneurs by commercial banks and microcredit institutions in Mozambique for loans secured by collateral (i.e. mill/motor, mill house, warehouse).</td>
</tr>
<tr>
<td>Payback period</td>
<td>24 months</td>
<td>Typical repayment period offered to small-scale entrepreneurs by financial institutions in Mozambique.</td>
</tr>
<tr>
<td>Monthly risk-free rate</td>
<td>1%</td>
<td>Based on typical APY that can be earned in a savings account in Mozambique.</td>
</tr>
</tbody>
</table>

### 6.1.1 Limitations of the Financial Models

While the data used to build these financial models is as accurate as possible, these models should be verified, updated and fine-tuned prior to being used in the roll-out of the Millennium Mills Project. Please see Annex 8.4 for further discussion of the limitations of these financial models.
6.2 Scenario 1: Simple Mill

6.2.1 Description of Model

The first and most straightforward MMP franchise menu option is a basic hammer mill that only provides milling as a service. This model requires investment in a mill and motor, construction of some sort of enclosure for the mill, scale, and the licenses and other paperwork required to run a milling business. This mill requires 1-2 employees depending on customer volume, and the most significant operating cost is electricity. This model is most appropriate for communities in the Inception and Growth phases and requires an initial investment of at least US$3,100 (based on the assumptions described in Section 6.1).

The primary advantages of this model are its simplicity and accessibility. An entrepreneur with basic business skills and good community connections would be capable of managing this type of mill. The main disadvantage is that the simple mill is highly susceptible to the seasonality of maize production. Since milling is the only service provided, profit is limited to the months when there is maize on the market; during the lean season, the mill does not turn a profit. This can make it difficult for the mill owner not only to cover running costs during the lean season, but to have extra money available for the family.

A final advantage to this franchise option is that the mill can easily become a business and social hub for the community. Seeing that there are usually long lines for milling in the harvest season, in particular in communities in the Inception and Growth phases (due to lower number of mills per capita), there is a captive audience for consumer goods like personal care items, cell phone credit and beverages. Mill customers are also an ideal target group for social/health interventions, for example distribution of information about HIV/AIDS or nutritional supplements.

6.2.2 Cash Flow Analysis

A summarized cash flow for the first 4 years of operation of the simple mill is presented below:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain milling service</td>
<td>8,048</td>
<td>8,308</td>
<td>8,308</td>
<td>8,308</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>8,048</td>
<td>8,308</td>
<td>8,308</td>
<td>8,308</td>
</tr>
<tr>
<td><strong>RUNNING COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>2,396</td>
<td>2,569</td>
<td>2,569</td>
<td>2,569</td>
</tr>
<tr>
<td>Maintenance &amp; repairs</td>
<td>127</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>Payroll</td>
<td>1,396</td>
<td>1,523</td>
<td>1,523</td>
<td>1,523</td>
</tr>
<tr>
<td>Total running costs</td>
<td>3,919</td>
<td>4,231</td>
<td>4,231</td>
<td>4,231</td>
</tr>
<tr>
<td><strong>INVESTMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mill (+motor)</td>
<td>2,596</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Housing</td>
<td>385</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>License</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Total Investment</td>
<td>3,050</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td><strong>FINANCING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own capital</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bank Loan</td>
<td>3,100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Loan Repayment</td>
<td>(2,771)</td>
<td>(2,131)</td>
<td>(136)</td>
<td>0</td>
</tr>
<tr>
<td>Total Financing</td>
<td>329</td>
<td>(2,131)</td>
<td>(136)</td>
<td>0</td>
</tr>
<tr>
<td><strong>PROFIT/LOSS</strong></td>
<td>1,408</td>
<td>1,876</td>
<td>3,872</td>
<td>4,008</td>
</tr>
<tr>
<td><strong>ACCUMULATED PROFIT</strong></td>
<td>1,408</td>
<td>3,285</td>
<td>7,157</td>
<td>11,164</td>
</tr>
</tbody>
</table>
The accumulated profit for a simple mill after 4 calendar years of operation, assuming the bank loan was granted in March (1 month prior to the harvest), is US$11,164. The net present value (NPV) over 5 harvest seasons (just over 4 calendar years) is US$10,381 and the average profit margin is 16.2%. For full details of the cash flow, please see the Millennium Mills Financial Models that accompany this document.

**Figure 12: Profit Trend for Simple Milling Business, Year 1 (US$)**

The chart above demonstrates the strong influence that seasonal grain production has on downstream businesses. Decreased supply means decrease in customer flow, and thus a decrease in profit. This effect is especially dramatic for a milling business that is paying off debt. In Year 1 of operations, the simple mill only turns a profit during the height of the harvest season; from Year 2 onwards, there is profit during the harvest and “mid” seasons. Investing in a hulling machine is one clear way the simple mill can soften the seasonality impact, as hulling provides significant additional profit during the harvest season that can be saved and used to tide over the business and the miller’s family during the hunger period.

### 6.3 Scenario 2: Milling and Hulling

#### 6.3.1 Description of Model

This franchise menu option essentially takes the simple mill model and adds a hulling machine. With a hulling machine, the mill becomes more competitive (consumers have a clear preference for the finer, whiter meal that comes from removing the maize husk prior to milling) and is better-positioned to weather the lean season cash flow crisis. Adding a hulling machine essentially doubles the initial investment (US$6,000 minimum investment), however future profits more than justify the expenditure.

The principal advantage of this model is high returns while still being a relatively simple operation. For example, accumulated profit is 246% higher in the hulling model as compared to the simple mill in Year
1, a trend that continues throughout the years. Milling plus hulling is significantly more lucrative than milling alone (US$31,196 vs. US$11,164 accumulated profit over the 4-year calendar period). In fact, of all the Millennium Mills franchise scenarios, hulling brings the highest returns. The primary disadvantage of this model is that it is still greatly affected by seasonality; in the first 2 years of operation, the mill does not turn a profit during the 4-month lean season.

The milling plus hulling model also provides opportunities for complementary business and/or social interventions with milling clients who are a captive audience. In particular, it is worth pursuing nutritional information campaigns at these mills because, despite the consumer preference for hulled grain, the removal of the husk means that people aren’t consuming whole grains. There may be opportunities to educate people on ways to compensate for the decreased nutritional value of hulled maize by blending different meals or supplementing their diet with whole grains in other areas.

### 6.3.2 Cash Flow Analysis

A summarized cash flow for the first 4 years of operation of the milling + hulling model is shown below:

**Figure 13: Summary Cash Flow for Milling + Hulling (US$)**

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REVENUE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grain milling service</td>
<td>8,048</td>
<td>8,308</td>
<td>8,308</td>
<td>8,308</td>
</tr>
<tr>
<td>Maize hulling service</td>
<td>6,036</td>
<td>6,231</td>
<td>6,231</td>
<td>6,231</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>14,084</td>
<td>14,538</td>
<td>14,538</td>
<td>14,538</td>
</tr>
<tr>
<td><strong>RUNNING COSTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>2,396</td>
<td>2,569</td>
<td>2,569</td>
<td>2,569</td>
</tr>
<tr>
<td>Maintenance &amp; repairs</td>
<td>127</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>Payroll</td>
<td>1,396</td>
<td>1,523</td>
<td>1,523</td>
<td>1,523</td>
</tr>
<tr>
<td>Total running costs</td>
<td>3,919</td>
<td>4,231</td>
<td>4,231</td>
<td>4,231</td>
</tr>
<tr>
<td><strong>INVESTMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mill (+motor)</td>
<td>2,596</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hulling Machine</td>
<td>2,885</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Housing</td>
<td>385</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>License</td>
<td>69</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Total Investment</td>
<td>5,935</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td><strong>FINANCING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own capital</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bank Loan</td>
<td>6,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Loan Repayment</td>
<td>(5,363)</td>
<td>(4,125)</td>
<td>(263)</td>
<td>0</td>
</tr>
<tr>
<td>Total Financing</td>
<td>638</td>
<td>(4,125)</td>
<td>(263)</td>
<td>0</td>
</tr>
<tr>
<td><strong>PROFIT/LOSS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit/loss</td>
<td>4,868</td>
<td>6,113</td>
<td>9,976</td>
<td>10,238</td>
</tr>
<tr>
<td>Accumulated profit</td>
<td>4,868</td>
<td>10,981</td>
<td>20,957</td>
<td>31,196</td>
</tr>
</tbody>
</table>

The NPV for the milling and hulling business over 5 harvest seasons (just over 4 calendar years) is US$24,297 and the average profit margin is just over 36%. For the complete cash flow, please see the Millennium Mills Financial Models that accompany this document.
6.4 Scenario 3: Milling, Hulling and Trading

6.4.1 Description of Model

This franchise menu scenario is focused on directing profit from milling/hulling operations into taking trading positions in bagged maize grain. The suppliers of the maize will be local smallholders that sell their grain at the farm-gate along an established route or bring it directly to the mill. This business requires all the assets of milling/hulling model in addition to a 30-ton warehouse to store the grain, as well as use of a truck to pick up grain sold along the trading route. In general it is most profitable to accumulate as much inventory of maize as possible during the harvest season (April – July), store from during the mid-season (August – October), and sell everything during the lean season (November – January) when there is little maize available on the local market. This strategy allows the entrepreneur to obtain a premium price for whole-grain maize during a period in which regular (non-trading) mills have little profit. The mill owner has the choice of selling bags of maize directly to the market, or of charging an additional 1MT/kg over the established price to mill the grain and sell it as meal55.

The key advantage of the trading model is that it offers two profit periods per harvest cycle. Having a reliable source of income during the lean season can make a massive difference in the life of a Grain Belt entrepreneur and the nuclear and extended family he/she supports. The trading model also has a high profit potential in the long-term, however as compared to the other models it requires a much more skilled entrepreneur in order to be successful. The main disadvantages to the trading scenario are the level of risk involved and the relatively high amount of working capital tied up in the business. Important risk factors to consider include crop failure, loss of inventory (fire, flood, spoilage due to lack of or improper quality control methods), and demand for food aid.56

While simple storage is required to engage in grain trading, this franchise menu option does not take into consideration the establishment of a larger “grain bank” scheme in which storage is offered to the community as a service. Storage services are certainly an interesting – and much-needed option – in the Grain Bank, and should be considered either as an opportunity for a complementary intervention or for vertical integration (for the right milling entrepreneur). Grain bank/storage models are further discussed in Section 7.6.

6.4.2 Cash Flow Analysis

A summarized cash flow for the first 4 years of operation of the milling/hulling/trading model is shown on the following page:

---

55 In this model, no “own milling” of grain for resale during the lean season was considered. However, the model can easily be modified to include this factor if required in analyzing a potential business opportunity.

56 Most maize for emergency food aid is purchased by Export Marketing (on behalf of INGC and WFP) from local smallholders, then sent to CIM for processing. Depending on the dynamics, this could either mean increased or decreased opportunity for small-scale millers and traders.
The minimum capital required to pursue this franchise option is US$7,250, the highest of all the models. The largest incremental investment cost in the trading model is for the warehouse (US$680). Running costs are higher mostly due to the need for capital to purchase grain (US$3,692). The other associated incremental costs are negligible. The accumulated profit for a simple mill after 4 calendar years of operation, assuming the bank loan was granted in March (1 month prior to the harvest), is US$29,656. This is slightly lower than the milling/hulling model, but significantly higher than milling alone. The NPV over 5 harvest seasons (just over 4 calendar years) is US$22,019 and the average profit margin is 27%. For the full cash flow, please see the MMP Financial Models that accompany this document.

6.5 Comparison of MMP Franchise Models

Each of the 3 franchise options presented above has distinct advantages and disadvantages and must be considered in conjunction with the community characteristics and the milling entrepreneur’s profile. There is no cookie-cutter recommendation for all millers in the Grain Belt to follow. That said, if the miller’s skills and the local market permit, it is generally best to evolve up from the simple mill to include the value-added hulling service and, possibly, trading to offset seasonal cash flow fluctuations.

From a strictly financial perspective, a potential investment is analyzed by its net present value. The best option is usually that with the highest NPV. However, given the reality of hand-to-mouth subsistence
livelihoods in the Grain Belt, the equation becomes more complex. Sometimes short-term access to cash is much more valuable than long-term earning potential.

Figure 15: Comparison of Net Present Value of MMP Franchise Models

![Comparison of NPV of Franchise Models over 4 Years](image)

In the case of the Millennium Mills franchise scenarios, the one with the highest NPV is milling plus hulling. If the entrepreneur has the ability to weather the lean season cash flow crisis, perhaps this is the most interesting model to follow because it presents relatively low risk and is a simple model (meaning the mill owner can hire a manager, if desired, and be free to pursue other income-generating opportunities). As shown below, the accumulated monthly net profit of the milling + hulling model is the highest over time.

Figure 16: Comparison of Accumulated Monthly Net Profit of MMP Franchise Models (US$)
However, there is a distinct advantage to the trading model: it offers two profit spikes in the same maize season. This counter-cyclical revenue opportunity can be extremely attractive in a region where cash and food are frequently short in the lean season. The monthly net profits of the three scenarios are illustrated in the chart below.

**Figure 17: Comparison of Monthly Net Profit of MMP Franchise Models (US$)**

Overall, potential Millennium Mills Project entrepreneurs must carefully analyze which is the most appropriate scenario given access to capital and the need for lean season income vs. long-term profits.
7 POTENTIAL FOR COMPLEMENTARY BUSINESSES

Within the concept of the grain mill as a potential business and social hub for the community, there are multiple opportunities for incorporation of complementary initiatives to capitalize on market demand as well as a captive audience at the grain mills. Some of these side interventions are presented below.

7.1 Opportunities in Production of Blended/Fortified Meals

A paradox exists in the Grain Belt. The region enjoys fertile land and abundant production of maize and other crops, yet it is also characterized by persistent malnutrition. A strategy of increased production of key crops (i.e. legumes, soy) coupled with local processing and the promotion of fortified and blended meals, however, present opportunities to address this challenge.

7.1.1 Fortified Meal

In the future, small-scale hammer mills that produce fortified flours (or offer the option of adding micronutrients) could have a competitive advantage over other mills, as this practice does not currently exist in Mozambique at the local level. An aggressive marketing campaign by the largest commercial producer of fortified maize meal promoting the benefits of the fortified product has helped raise awareness of the added value\(^\text{57}\). It is anticipated that this marketing campaign, along with nutritional campaigns by the MOH, will promote the perception of the added value of this service. The price of the commercially produced maize meal is at least 10 MT/kg (US$0.4) higher than non-fortified, locally produced flour costing 13 or 14 MT/kg (US$0.5-0.54/kg). This represents a large price range that could accommodate the extra cost for local maize mill producers of adding micronutrients.

\(^{57}\) Interview at CIM, May 2009.
Interviews suggest that demand for a locally produced, fortified product (or a locally supplied fortification mix that could be added to the maize meal) is currently low, but there is potential. The WFP is lobbying for national standards to require fortification of meals in Mozambique; if this occurs, 100% of market demand will be for fortified flour.

Supply of micronutrient packets that could be used to fortify maize meal can be found regionally, but not nationally. DSM, a South African company, is engaged in other nutrient fortification programs and is familiar with constraints for small businesses. Distribution of these nutrients to small-scale mills and regulation of processing is not feasible at this point without substantial financial assistance.

**7.1.2 Blended Meal**

Small-scale hammer mills that produce blended meals could also have a competitive advantage over other mills. At present, mill clients do not regularly engage in blending and the availability of blended meals is not used as a marketing tactic to attract customers. Only one commercial producer of blended flours, Joint Aid Management International, exists in Mozambique and is located in the central city of Beira. Interviews suggest that demand for blended meals at the local level is low, but there is potential. Regionally produced flour blends are increasingly common. Also, the practice is being promoted by government and non-government nutrition programs. So, similar to fortification, the perceived added value of this product is being promoted and is anticipated to create a demand for a blending service in the near future.

**A Nutritional Center in Cuamba Provides “Multi-Mistura” Porridge to Malnourished Children**

In Cuamba, mothers are learning how to prepare blended meal consisting of maize, sorghum, millet, soy, beans, sunflower seeds, peanuts, pumpkin seeds, dried cassava leaves and ground egg shells for calcium. All of these ingredients are mixed and sent to mills, where they are processed. Any mill in the community can blend this mixture.

The “multi-mistura” (literally multi-blend in Portuguese) has been very successful in helping malnourished children recover their health and gain weight. The “multi-mistura” is meant to be given 3 times per day while the children are recovering, for a period of about 2 weeks. The blended meal costs 15mt/kg and is distributed generally in small cups and whatever container is available.

It is often difficult to get communities to accept blended meals. Traditionally, each grain is milled and prepared as its own distinct flour, and made into “xima” (the local staple). People find it strange to mix these grains, and can be resistant. They also prefer the fine, white flour as opposed to whole grain meal. However, gradually many mothers and children have developed a taste for the blended meal; particularly once they learn more about the nutritional benefits. Of the women who learn about the nutritional benefits of “multi-mistura” at the center in Cuamba, Sister Raimunda estimates that some 30% continue to make the blended meal when they are back in their communities. She encourages the communities to pool the production of individual families so that all (or at least some) of the ingredients in the blend are available (i.e. one family provides millet, one family provides soy, one family provides sunflower seeds). The different grains and seeds are mixed and blended at the community level, then redistributed among the beneficiaries.

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58 Interview with Billy Mwinga at WFP. April 2009  
60 JAM International  
61 JAM International opened a factory in 2004; TNS supported factory in Tanzania is meant to open mid-2009  
62 Interview with Director of Department of Nutrition at Ministry of Health, June 2009; Interview with Brazilian nun in Gurê  
63 Interview with Sister Raimunda, Gurue, May 27, 2009
Supply of food suitable for blending can be found locally. It is generally accepted that the nutritional profiles of legumes complement the profile of maize. Mozambique produces approximately 117,000 tons of beans each year, and campaigns to promote soy production are beginning to make way; estimated production for the 2008/2009 season is 7,000 tons and the goal is to have 30,000 tons of soy produced in the 2012/2013 season.

With increased soy production, Corn-soy blend (CSB) becomes a significant opportunity for the Grain Belt. CSB is a fortified, blended food that has been used to manage cases of moderate malnutrition and to increase the nutritional value of the daily diet. In Mozambique, CSB is included in the national protocol for managing moderate acute malnutrition, but in reality CSB is not widely available to the majority of health centers nationwide. This means that a majority of cases are left untreated and are at serious risk of deteriorating to severe acute malnutrition and death within a short period of time. The Ministry of Health (MOH) is searching for ways to ensure that all health centers have CSB, particularly in places where HIV treatment also exists. Save the Children and the Provincial Health Office have already established three learning centers in Nampula where the national protocols have been introduced and lessons are being used to guide implementation in the rest of the country. However, to date, CSB has not been introduced in the program because of the lack of availability within the MOH system.

### 7.2 Quality Control Opportunities

As is the case with many other areas of agricultural production and processing in Mozambique, the small-scale milling sector suffers from a general lack of appropriate quality control methods, thus making it impossible to take advantage of certain market opportunities. Quality control is an area where technical assistance from NGOs or commercial players is needed.

#### 7.2.1 Quality Control and Phyto-sanitary Issues

The quality of the end product (maize meal), as defined by the chemical make-up and resulting nutritional value, depends largely on phytosanitation measures taken during grain production, distribution, and storage. Pest invasion and mold growth are the two main causes of compromised quality. The vulnerability of foods to pest and mold infestation is dictated by the stress experienced along the value chain. Of particular concern is mold growth. The two most common molds both produce mycotoxins, which research suggests have a significant negative impact on human health.

During production, pre- and post-harvest practices and agronomic conditions will determine the vulnerability of the grain to pest infestation and mold growth. Quality control measures at this stage include: maximizing agronomic conditions by expanding the use of farming inputs (e.g., improved seeds, fertilizer, and pesticides), improving pre-harvest practices (e.g., clearing plant debris from fields, carefully timing planting and harvesting periods, and allowing cobs of maize to dry sufficiently in the field), and improving post-harvest practices (e.g., dry the cobs and kernels sufficiently, winnow the grains in a way that minimizes damage, and store in a pest resistant environment). Ensuring minimal stress to the maize grain at the production stage will minimize decrease in quality further along the value chain.

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64 GoM, MINAG, Trabalho de Inquérito Agrícola (TIA), 2002 - 2007. ; includes cow pea and common bean production, does not include black-eyed peas.
65 CLUSA
66 FAO: Training manual on mycotoxin control in food and feed grain.
Decrease in quality during transport and distribution can be avoided by minimizing damage to the structural integrity of the grain. At the small-scale level, grain is typically bagged and carried to the mill by foot or bicycle. Little damage occurs in this process. Large-scale container transport is not considered in the scope of this document.

Storage conditions may promote or inhibit decreases in quality, and offer the capability of exercising quality control measures. High humidity and warm temperatures will promote mold growth, while airtight storage in cool, dry conditions will inhibit. Large-scale commercial warehouses use sifters (mechanically powered or manually run) to remove debris and mold. Infestation by large pests can be prevented by constructing a facility that does not leave space for animals to enter. Properly drying the grain is recommended to prevent infestation by small pests. To mitigate further losses after a pest infestation, fumigation with pesticides is recommended, but often prohibitively expensive for smallholders. Because the grain and meal spend a short time at the mill, there is little opportunity for any decrease in quality; however, basic cleaning, which is often considered as part of the general maintenance of the mill and housing, will avoid spreading any mold and decrease the likelihood of pests entering the mill house.

The mill business should be considered as a point where quality control measures can be facilitated. Farm inputs can minimize the stress that occurs during production, so a business including a point of sale for these products would be useful for producers that can afford the cost of inputs and would have a positive impact further along the value chain. Once mold growth has occurred, the only way to evaluate the level of mycotoxins is to test chemically. Currently, the cost of this process is logistically and economically prohibitive to smallholders. Thus, separating grain with mycotoxins from grain without is not possible; the only feasible measure to be taken, and the recommended policy by FAO, is discarding all grain on which mold has grown. There is potential that a specific type of clay selectively binds aflatoxin, one of the mycotoxins, preventing ingestion after consumption. This appears to be an effective, cheap, and safe solution to the problem, and mills seem to be ideal places to distribute this product and exercise quality control in mixing the clay with the flour, but further research is needed to evaluate the feasibility in the Mozambican context. Finally, the hulling machine that is often included in milling businesses can help reduce the ingestion of the other common mycotoxin, fumonisin. In affected maize grain, fumonisin is concentrated in the germ and outer hull, which are removed by the hulling machine (however at the expense of greater nutritional benefit from consuming whole grains).

**7.2.2 Production of Clay-Added Meals for Aflatoxin Control**

Clay is currently used as an anti-caking agent in the animal feed industry but is not currently used for human consumption. However, there appears to be potential for using bentonite clay to limit the ingestion of toxins produced by mold that grows on grains. This product appears to be a safe, cheap, and effective solution to a serious health concern in Mozambique.

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68 Testing may become more economically feasible in the near future. Testing services currently charge approximately 600 USD per test, however IKURU is developing a test that is predicted will cost approximately 30 USD per test. Information from interview with ITS in Nacala and informal interview with CLUSA.  
69 FAO: Training manual on mycotoxin control in food and feed grain.  
70 Specifically, Novasil, a bentonite clay. Williams, Tim. “Presentation: Community-based Management of Acute Malnutrition, RUTF Production, and Aflatoxin.” 2008  
71 Main issues include: possible government approval required, transport costs may be prohibitive, and there may not be a market willing to pay for the product.  
Demand for these meals mixed with tiny amounts of clay does not exist, but there is potential. If national standards are established, they are likely to include a maximum level of aflatoxins; because clays selectively bind aflatoxins, their integration with the maize meal may allow the product to meet standards (and there is great social benefit of removing damaging content from maize meals). Currently, the World Food Programme only purchases food products that meet quality standards. For maize products, the aflatoxin levels of smallholder-produced grain are often above the maximum allowed by the WFP, thus closing a market opportunity for selling grain. Additionally, if the mill business includes chicken feed production, the clay adds value by acting as an anti-caking agent.

Large international feed producers will manufacture commercial grade clay. Including shipping costs to Maputo, but excluding other costs incurred for a small-scale miller, it would cost 0.15 MT/kg, or US$0.0055/kg of maize.

7.3 Opportunities in Poultry Feed Production

There is unmet demand for quality, cost-effective, locally produced poultry feed in Mozambique. The feed market can be divided into those growing chickens for their own consumption and small commercial growers selling at local markets or sale posts (large commercial producers would not be in the market for small quantities of feed produced at local hammer mills). Some small growers will use the “waste” (hull and germ) that is left after pounding/separating; this waste (farelo) is often left at the mill site, leaving the miller with the opportunity to produce a marketable chicken feed – the alternatives are to discard it or use it to make grain alcohol.

Poultry feed is usually made from a pre-blend of fish/meat meal, vitamins, minerals, bran, and groundnut/sunflower cake, along with a maize and soy component. Both the soy and pre-blend are prohibitively costly for small-scale consumers, presumably because transport costs are high and there is a lack of economies of scale for bringing these components to Northern Mozambique’s markets (usually from South Africa). Further research needs to be conducted, but the opportunity to source the pre-blend and soy components from regionally based, commercial producers of chicken feed may be an effective solution for both parties (reduce production costs for the large commercial producer, reduce the price for the mill owner, and thus allowing the mill owner to produce a “branded” chicken feed to sell locally).

7.4 Opportunities for Sale of Consumer Goods

Mills offer an interesting opportunity for the sale of fast-moving consumer goods (FMCGs) and other essential items. Companies such as mCel, VodaCom, Coca-Cola, Pepsi, Unilever and many others could have increased market access by partnering with Millennium Mills entrepreneurs. By establishing fixed sale points or using a network of mobile vendors, the private sector can reach Grain Belt communities that may otherwise be difficult to access. The Women First program (promoted by IRD – International Relief and Development), for example, would be an ideal candidate for a partnership with MMP clients.

7.5 Partnerships with Social/Health Interventions

The captive audience waiting in line at grain mills, in addition to the mills’ natural role as a meeting place for the community, makes mills ideal venues for social and health interventions. Possibilities abound for collaborations with local and international NGOs, grassroots organizations and even commercial partners to bring important messages to people at the MMP franchisee mills. Interventions could include:

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74 This assumes the application of 5g of clay per kg of maize meal (0.5%). NovaSil Plus is produced by Nutreco.
75 TechnoServe internal document.
HIV/AIDS, malaria and tuberculosis awareness campaigns; distribution of condoms, bed nets, rehydration solutions; education and literacy; gender equality; promotion of improved nutrition; crafts training; etc.

7.6 Grain Bank/Storage Opportunities

There is a clear need for improved and increased storage opportunities for small-scale producers in Northern Mozambique. MMP millers engaging in trading may eventually become providers of storage services to their communities. Improved storage systems, when properly managed, provide an important benefit to the community by reducing post-harvest losses and the prevalence of aflatoxins in the food supply. A successful trader could easily establish a large warehouse with part of the space used for his own trading, and part used to serve third parties.

In general terms, a “grain bank” model would operate as follows: When the customer delivers the grain it must be inspected for mold and pests. If the product is clean, it will be re-bagged and stored. The customer will be given a receipt of exactly what they delivered for storage and the product’s location in the warehouse. When the customer returns they will be charged a rate of, for example, 5% of the lean season price per kg. If they cannot produce cash sufficient to retrieve their grain, they immediately receive the harvest season price for the grain that was stored in cash.

Finally, if food aid is deployed in the area these warehouses can serve a vital logistical role by providing storage, linking the Millennium Mills franchise concept with food security and disaster mitigation.
8 ANNEXES

Annex 9.1 – Map of Mozambique

Annex 9.2 – PESTLE Analysis of Northern Mozambique

Annex 9.3 – Interview Guides

Annex 9.4 – Sources Consulted
8.1 Map of Mozambique
8.2 PESTLE Analysis

Following is a macro-level analysis of the Political, Economic, Social, Technological, Legal and Environmental factors that are pertinent to any business or project operating in Northern Mozambique. For each factor identified, a brief description is provided along with the projected impact on the Millennium Mills Project, and the impact period and relevance of said factor.

### POLITICAL FACTORS

<table>
<thead>
<tr>
<th>Description</th>
<th>Potential Impact on MMP</th>
<th>Impact period</th>
<th>Importance/Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Elections 2009</td>
<td>Stable and democratic government attracts new investment</td>
<td>Short-term</td>
<td>Medium</td>
</tr>
<tr>
<td>Corruption</td>
<td>Delays, fines and other problems</td>
<td>Long-term</td>
<td>Medium</td>
</tr>
<tr>
<td>Foreign Investment Environment</td>
<td>New projects provide clients and investment opportunities</td>
<td>Long-term</td>
<td>Medium</td>
</tr>
<tr>
<td>Tax Policy</td>
<td></td>
<td>Long-term</td>
<td>Low</td>
</tr>
<tr>
<td>Local Initiative Development Fund</td>
<td>Maize mill growth is key element of GoM’s rural development strategy</td>
<td>Medium-term</td>
<td>Medium to High</td>
</tr>
</tbody>
</table>

Grain-related businesses are growing rapidly. During a 2008 visit to northern Mozambique, President Armando Guebuza told reporters that the most visible result of the Government’s “Local Initiative Development Fund” was that “[maize] flour mills [were] now appearing throughout the countryside.” According to President Guebuza, the proliferation of small maize flour mills meant that small farmers did not have to travel long distances to mill their maize, and the time they saved “could be used in other activities.”

### ECONOMIC FACTORS

<table>
<thead>
<tr>
<th>Description</th>
<th>Potential Impact on MMP</th>
<th>Impact period</th>
<th>Importance/Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth</td>
<td>Signifier of overall macro-economic health</td>
<td>Long-term</td>
<td>Low to Medium</td>
</tr>
<tr>
<td>Labor Costs and Supply</td>
<td>Modest labor costs as percentage of total operating expenses</td>
<td>Long-term</td>
<td>Low to Medium</td>
</tr>
<tr>
<td>Currency Fluctuations</td>
<td>Increased revenue with stronger Metical</td>
<td>Medium-long-term</td>
<td>Medium</td>
</tr>
<tr>
<td>Commodity Prices</td>
<td></td>
<td>Long-term</td>
<td>Medium to High</td>
</tr>
<tr>
<td>World Financial Crisis</td>
<td></td>
<td>Short-term</td>
<td>Low</td>
</tr>
<tr>
<td>Grain exports to Malawi</td>
<td>Less maize available for milling locally</td>
<td>Short-term</td>
<td>Low</td>
</tr>
<tr>
<td>Maize+ Production</td>
<td>Increased production</td>
<td>Decreased production</td>
<td>Long-term</td>
</tr>
</tbody>
</table>

76 “Flour mills opening throughout countryside,” Mozambique News Agency, AIM Reports, No.360, June 10, 2008; under this fund, each district receives annually at least seven million meticais ($290,000) from the state budget for initiatives intended to increase food production and generate jobs.
Mozambique has built a post-war economy with one of the highest growth rates in Africa. In Nampula, engaged political leaders have named agribusiness development in maize and soy, as well as infrastructure improvements, as top priorities. Mozambique currently has a maize surplus of about 75,000 tons, according to the Ministry of Agriculture. In 2008, Mozambique produced over 1.677 million tons of maize, an increase of 7.9 percent on the previous year (1.566 tons). Overall, grain production is predicted to grow at a rate of nine percent next year.\textsuperscript{77} As a community service and staple form of production and consumption, however, maize milling operates somewhat in isolation from external or macro-economic influences. Production and consumption take place largely at the local level and pricing is governed by a unique collision of economic and social forces. As a result, production, processing and consumption tend to be fairly inelastic.

<table>
<thead>
<tr>
<th>SOCIAL FACTORS</th>
<th>Potential Impact on MMP</th>
<th>Impact period</th>
<th>Importance/Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Community Service</td>
<td>Greater health outcomes and market access to poor communities; Built in ceiling on price.</td>
<td>Built-in ceiling on price.</td>
<td>Long-term</td>
</tr>
<tr>
<td>Gender</td>
<td>Opportunities for woman-owned businesses and significant reduction of labor time</td>
<td></td>
<td>Long-term</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Poor community health impacts production</td>
<td></td>
<td>Long-term</td>
</tr>
<tr>
<td>Malaria</td>
<td>Poor community health impacts production</td>
<td></td>
<td>Long-term</td>
</tr>
<tr>
<td>Consumer preference for maize versus blending</td>
<td>Blending provides excellent opportunities for improved nutrition</td>
<td></td>
<td>Long-term</td>
</tr>
</tbody>
</table>

The absence of maize mills in a community typically means that people mostly women-exhaust considerable labor time pounding by hand. Free from these demands, however, results in more time for diversified economic activity, better health, and increased opportunities for education. Similarly, given the choice, even the poorest members of a community typically opt to mill rather than pound, and mill owners will often facilitate this act by extending discounts or informal avenues of credit.

\textsuperscript{77} “Mozambique produces maize surplus,” Mozambique News Agency AIM Reports, No.375, March 19, 2009
A grain mill is a relatively simple operation, adaptable to both basic community-level and more sophisticated commercial contexts.

### TECHNOLOGICAL FACTORS

<table>
<thead>
<tr>
<th>Description</th>
<th>Potential Impact on MMP</th>
<th>Impact period</th>
<th>Importance/Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Lack of Electricity</td>
<td></td>
<td>Increased operating</td>
<td>Medium to Long-term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>costs</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Hulling Machine</td>
<td>Greater efficiency;</td>
<td></td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td>consumer preference</td>
<td></td>
<td>Low to Medium</td>
</tr>
<tr>
<td>Rudimentary Machine technology</td>
<td>Makeshift repairs</td>
<td></td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td>require little mechanical knowledge</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Quality Control</td>
<td></td>
<td>Mold, particularly Aflatoxins</td>
<td>Long-term</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High</td>
</tr>
</tbody>
</table>

### LEGAL FACTORS

<table>
<thead>
<tr>
<th>Description</th>
<th>Potential Impact on MMP</th>
<th>Impact period</th>
<th>Importance/Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Ownership</td>
<td>Neutral, not dealing</td>
<td>Long-term</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>with production;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ownership is over</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>mill/storage</td>
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<td></td>
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<tr>
<td></td>
<td>infrastructure and</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Law</td>
<td>Ex-pat labor law could</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>limit the availability of technical advisors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ENVIRONMENTAL FACTORS

<table>
<thead>
<tr>
<th>Description</th>
<th>Potential Impact on MMP</th>
<th>Impact period</th>
<th>Importance/Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonality</td>
<td>“Hunger season” severely limits revenues</td>
<td>Long-term</td>
<td>High</td>
</tr>
<tr>
<td>Climatic events</td>
<td>Tropical storms, floods and drought affect agricultural production, community infrastructure and business operations</td>
<td>Long-term</td>
<td>High</td>
</tr>
</tbody>
</table>

The seasonality of grain production results in high revenues during the months of April through June (typically the time range of peak grain availability) and very low revenues during the months of November through February (typically the hunger season with leanest grain supply). Expanding the volumes of stored grain would stabilize the grain supply throughout the year and stabilize the revenues for millers.
8.3 Interview Guide

QUESTIONS FOR MILLERS

Operations

Capacity (kg/hr or day):

Customers per day for maize milling
   April – July:
   August – November:
   December – March:

Customers per day for cassava milling
   April – July:
   August – November:
   December – March:

Average volume of maize milled per customer:

Average volume of cassava milled per customer:

Number of days worked per month
   April – July:
   August – November:
   December – March:

Price charged for milling (and separating):

Revenue from milling
   April – July:
   August – November:
   December – March:

Profit from milling
   April – July:
   August – November:
   December – March:

Are you currently saving up any money for expanding the business?
   What would you do with 1,000 Mts? 5,000 Mts? 10,000 Mts? Etc…

Costs

Number of employees:

Wage:

Does wage vary depending on the flow of customers?
   (do employees work less during the lean season vs. peak season vs. medium season? If so, do they get a lower wage?)

Energy cost (note diesel fuel or electricity)
   April – July:
   August – November:
December – March:

Cost of mill:
  Where does it come from?

Cost of mill motor (if sold separately):

Cost of generator:

Cost of maintenance (oil for generator, lubricant for mill parts):

Cost of separator:

**If trading**

Cost of bags:

Cost of transport:

What is average distance traveled to go buy grain?
  What is maximum distance?
  Do you pay anyone to transport bags for you?
  How much?
  How far do they have to walk?

**Blending/fortifying**

Do people by Top Score when available?
  At what price?

Does anyone blend maize meal with cassava or beans?

**Reach**

How many mills are in the community?

Does everyone use the mill?
  Do the poorest use the mill? Or pound by hand?

How many times per week do people visit the mill?

**Customer Profile**

How many times per week does the average customer visit?

Why would one choose one mill over another (distance not a factor)?

Are there any women millers in the town?

What do male millers think about women millers?

Do you know of any millers that have failed?
  What is required to succeed as a miller?
8.4 Limitations of Financial Models

While the Grains Team used the best data available to construct the MMP financial models, there are limitations that must be taken into consideration, as follows:

- **Flaws in data collected during interviews with millers:** Data collected directly from millers also differed greatly from one interviewee to the next, a reflection of 1) the heterogeneous nature of milling, driven by community characteristics (milling lifecycle, market) as well as the entrepreneur’s profile; 2) insufficient record-keeping on the part of millers (sometimes driven by poor literacy/numeracy, other times due to poor business practices); and 3) lack of understanding of the basic business concepts behind the data being collected (i.e. profit vs. revenue). To the best of the team’s ability, figures reported by millers were cross-checked, for example comparing stated operating costs with an electrical bill. Furthermore, the team posed questions in different ways to try and resolve conceptual difficulties when it was apparent that the interviewee didn’t understand what was being asked.

- **Necessary compensation to account for flaws in interview data:** In instances where data reported by a miller didn’t “add up”, the team analyzed the issue at hand and made the most rational decision possible on how to compensate for the discrepancies. In certain cases, outliers with no explanation were not considered when building the model, as the team believed they reflected poor comprehension/record-keeping on the part of the miller, and not a real variance in data. A particular challenge for the team was that the monthly revenue reported by mill owners was not consistent with the monthly revenue calculated by the team using reported volume x price charged. In these cases, the most reasonable of the figures was used.

- **Need for more objective method of data collection:** These financial models would be greatly improved if revenue and costs could be objectively measured instead of relying solely on polling results. As such, these models should be verified, updated and fine-tuned prior to being used in the roll-out of the Millennium Mills Project.
8.5 Sources Consulted

Government of Mozambique


Mozambique News Agency AIM Reports
__________“Mozambique produces maize surplus,” No.375, March 19, 2009
__________“Flour mills opening throughout countryside,” No.360, June 10


Monographs and Reports:

UNDP Human Development Report, 2007-2008;

United States Agency for International Development, Thematic Briefing Paper 2: Just How Poor Are ‘The Poor’? (Few Net Task Force Order 6), n.d)


Banco Português de Investimento, Economic Growth in Mozambique, June 2009


Save the Children-US, “Nampula Province Details, District Characteristics”

Macro International, Mozambique: Standard Demographic and Health Survey, 2003


Williams, Tim. “Presentation: Community-based Management of Acute Malnutrition, RUTF Production, and Aflatoxin.” 2008


**Interviews with Millers and Other Stakeholders:**

Maria Pinto Veloso, Alto Molócuè, May 27, 2009;  
Sra. Juleca, Gurúè, May 26, 2009;  
Sr. Texas, Gurúè, May 26, 2009;  
Sra. Virgina, Gurúè, May 26, 2009  
Sr. Lino, Íle, May 27, 2009;  
Sister Raimunda, Gurúè, May 27, 2009  
Moagem Mumai, Alto Molócuè, May 28, 2009;  
Moagem Nicotope, Alto Molócuè, May 28, 2009;  
Hortencia Miguel, Gurúè, May 26, 2009;  
Workers at the mill of Sr. Basilio, Íle, May 27, 2009;  
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[Ribauè Interviews]