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The State of Maize Flour Fortification in Uganda



April 2018

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ABOUT SPRING

The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project is a seven-year USAID-funded cooperative agreement to strengthen global and country efforts to scale up high-impact nutrition practices and policies and improve maternal and child nutrition outcomes. The project is managed by JSI Research & Training Institute, Inc., with partners Helen Keller International, The Manoff Group, Save the Children, and the International Food Policy Research Institute.

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SPRING

JSI Research & Training Institute, Inc.
1616 Fort Myer Drive, 16th Floor
Arlington, VA 22209 USA
Phone: 703-528-7474
Fax: 703-528-7480
Email: info@spring-nutrition.org
Internet: www.spring-nutrition.org

COVER PHOTO: SPRING/Uganda. Moses Byamukama pours maize flour into doser.

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Acronyms and Abbreviations

FF	fortified foods
g	gram
kg	kilogram
MOF	Ministry of Finance
MOH	Ministry of Health
MT	metric ton
MTIC	Ministry of Trade, Industry, and Cooperatives
NDA	National Drug Authority
NWGFF	National Working Group on Food Fortification
PSFU	Private Sector Foundation of Uganda
QA/QC	quality control/quality assurance
SPRING	Strengthening Partnerships, Results, and Innovations, in Nutrition Globally
UGX	Uganda shillings
UNBS	Uganda National Bureau of Standards
US\$	U.S. dollars
USAID	U.S. Agency for International Development
WFP	World Food Programme

Definitions

Food fortification: The addition of key vitamins and minerals such as iron, folic acid, iodine, vitamin A, and zinc to staple foods to improve the nutritional content and address nutritional gaps in a population.

Food vehicle: The foodstuff that is selected to carry added micronutrients—for example, maize flour, wheat flour, or cooking oil.

Fortification equipment: Machinery used to add vitamins and minerals at the factory.

Fortificant: The compound that contains the specified micronutrient intended to be added to a food vehicle.

Small-scale mill: Any maize mill with a production capacity below 10 metric tons (MT) per day.

Medium-scale mill: Any maize mill with a production capacity between 10 and 20 MT per day.

Large-scale mill: Any maize mill with a production capacity of 20 MT or more per day.

Executive Summary

Under Uganda's Food and Drug Act, producers of maize flour are required to fortify their products with a regulated blend of vitamins and minerals aimed at reducing national micronutrient deficiency. Only companies equipped to produce at a large scale are required to fortify, although maize millers of all sizes are encouraged to fortify voluntarily. From July 2016 to July 2017, Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING), USAID's flagship multi-sectoral nutrition project, conducted interviews with 33 of the largest maize-milling companies in Uganda to determine the extent to which large-scale mills were fortifying and understand barriers and enablers to fortification. We collected information on the quantity of fortified flour produced each year, the market environment for fortified flour, fortificants and technologies used, and the incremental cost for fortification for medium- and large-scale millers.

Despite fortification being a requirement for large-scale mills, of the 28 large-scale mills surveyed, only 5 fortified their flour as of November 2017. The 5 companies fortifying in 2016 produced about 16,600 metric tons (MT) of fortified maize flour, with humanitarian agencies purchasing 89 percent of the final product, followed by local markets (9 percent) and schools (2 percent). Millers reported that humanitarian agencies purchase most of the fortified flour and that some is exported to countries such as Rwanda and Congo. Millers who produced flour for export followed a different standard for vitamins and minerals to be added in maize flour than millers who produced flour for local consumption. These millers said they added one-half the amount of premix per kilogram for the humanitarian standard compared to the Uganda/East Africa standard.

Of the 12 companies with fortification equipment in 2016, 8 had installed volumetric feeders with a continuous mode of adding premixes, 2 companies had installed loss-in-weight feeders, and 2 companies had installed batch mixers, which were obtained as a donation from development partners. The study identified that a number of factors are considered before selection of a particular type of fortification technology, including cost, accuracy, and simplicity of use.

Maize millers can choose between six suppliers for the regulated blend of vitamins and minerals, also known as premix. Only one of these suppliers is local; however, the Ministry of Health and the Ministry of Finance have worked together to eliminate import duties and reduce withholding taxes on imported premix.

We found no relation between fortification and increased prices at the market. The cost of maize grains is the main cost driver across all producers of maize flour. For millers planning to fortify, the capital investment represented the greatest expense. But when considering recurring fortification costs, premix accounted for about 95 percent of the expense from fortifying. Over one year, a miller fortifying its flour will incur additional costs over a miller who does not fortify, but these costs are not high. The incremental cost of fortifying is marginally lower for millers operating on a higher scale (29.6 Uganda shillings [UGX] per kg) than for those operating on a slightly lower scale (UGX 30.6 per kg). From this study, we can conclude that maize flour fortification is still a challenge in Uganda even with the adoption of the mandatory fortification regulation.

Background

Food fortification in Uganda has been a priority since the early 1990s. In 1997, the Ministry of Health (MOH) issued *The Food and Drugs (Control of Quality) (Iodated Salt) Regulations, 1997*, mandating universal salt fortification in Uganda. The fortification program was expanded to additional food vehicles with *the Food and Drugs (Food Fortification) Regulations, 2005*, which called for industries producing wheat flour, maize flour, and edible oil and fat to voluntarily fortify their products. To promote increased production of fortified foods the MOH issued *The Food and Drugs (Food Fortification) (Amendment) Regulations, 2011* (see Figure 1), which made fortification mandatory for multiple food vehicles, including maize flour (MOH 2011). The regulation requires all mills with an installation production capacity of 20 metric tons (MT) per day or more to fortify their products with a specified premix formulation (MOH 2017).

It is estimated that about 92 percent of Ugandan households consume maize flour, with a per capita consumption of about 22 kg of maize per year (GAIN 2015). About 42 percent of households access maize flour that is fortifiable, which is defined as any food not made at home and assumed to be industrially processed. However, the recent Fortification Assessment Coverage Tool (FACT) study reported that only 6.5 percent of households consume fortified maize flour (GAIN 2015). The country has made significant progress in implementing mandatory fortification regulations for wheat flour, edible oils, and salt, but maize flour fortification remains a challenge for two reasons: (1) most millers with an installed capacity of more than 20MT per day do not fortify and (2) the milling sector is dominated by small- and medium-scale (hammer) millers. In 2016, SPRING’s mapping of the maize-milling market found that only 0.5 percent of the 780 milling units (4 maize millers out of 780) fortify and that 4 percent of millers (32 maize millers out 780) had installed capacity of 20 MT per day or more (SPRING 2017). This report is the first attempt to summarize the reasons why millers required by law to fortify do not fortify.

This paper aims to summarize maize flour fortification practices among millers who are required to fortify as of 2017—that is, those with a production capacity of 20 MT or more—also describing their primary customers, standards used, technology used, premix suppliers, and quality assurance. Findings will be used to guide future efforts in programming and scale-up of maize flour fortification in Uganda.

“FIFTH SCHEDULE

FOODSTUFF

1. Milled maize product, including maize meal and maize flour which is produced in Uganda from industrial mills of a capacity of twenty metric tonnes in twenty four continuous hours in a single or multiple mills owned by the same producer or which is imported into Uganda.
2. Edible fat and oil which is produced in Uganda from industrial mills of a capacity ten metric tonnes in twenty four continuous hours in a single or multiple mills owned by the same producer or which is imported into Uganda.
3. Wheat flour, including white and brown flour which is produced in Uganda from industrial mills or which is imported into Uganda.”

Dr. ONDOA D. J. CHRISTINE,
Minister of Health.

Figure 1: The Food and Drugs Regulations, 2011

Methodology

Survey design and methods

We interviewed the 32 maize millers with the largest capacity recorded in our mapping exercise (conducted in 2016) and one additional maize miller who later began fortification, for a total of 33 interviewees. The survey captured 28 large-scale maize millers with a daily production capacity of 20 MT or more, and five medium-scale maize millers with a production capacity of 10 MT or more per day. SPRING staff visited all the identified facilities and conducted in-depth key informant interviews with management personnel using semi-structured questionnaires (Annex 1).

To collect information on available food fortification technologies, we reviewed the *Africa Maize Fortification Strategy* (Enzama, Afidra, and Johnson 2017) and the *Uganda National Industrial Food Fortification Strategy* (MOH 2017), as well as published literature on fortification technology, and directly contacted suppliers and the Ministry of Trade, Industry and Cooperatives (MTIC) to determine prices and models available.

Survey respondents

Respondents included personnel from the 33 maize-milling companies that are knowledgeable in maize-flour processing, standards, marketing, and fortification. Depending on availability, we interviewed general managers, managing directors, production managers, quality control/quality assurance (QA/QC) officers, marketing managers, and plant managers.

Ethical considerations

All participants consented to participating in the study and all interviews respected participants' privacy; all information and data obtained were kept confidential. For any data a company did not want shared (as specified by the company representative), the researchers used anonymous identifiers both in the analysis and reporting.

Data management and analysis

We collected qualitative data from the in-depth interviews held between July 2016 and July 2017, including questions on the perceptions of fortification, the market, the challenges faced, and support needed. We examined millers' records for quantitative data, including the quantities of fortified flour produced, who it was sold to, and the pricing of flour, premixes, and equipment, and taxes paid. We visited local stores for market prices of all packaged maize flour.

To determine the incremental cost of fortification, we compared two large-scale maize mills located in different parts of the country that operated at different levels of production: one operating at 20 MT/day and the other at 60 MT/day. We evaluated the following factors: mill's installed capacity, actual mill operating level (expressed as a percentage of the manufacturer's rating), milling days per year, and total output per year calculated in metric tons. We divided costs due to fortification into two categories: (1) capital costs, which included machinery used in fortification, and (2) recurrent costs incurred annually as a result of fortification. Complete formulas and assumptions for the costing exercise are included in Annex 2.

Results

Overview of the largest maize millers in Uganda

Of the 33 millers visited, we identified 28 maize flour millers as having an installed capacity of 20 MT per day or more. By November 2017, only five of those mandated to fortify were currently fortifying, though 12 had installed fortifying equipment (see Figure 2). One finding of the mapping exercise was that some companies had installed fortification equipment that, for a number of reasons, was not being used.

Annex 3 shows the 28 milling companies with installed capacity to produce 20 MT/day or more, as of November 2017. A number of companies assumed they do not qualify for the mandatory legislation because they produce, on average, less than 20 MT per day. Installed capacity refers to the technology’s maximum capacity for maize flour. Actual production capacity may be lower, due to the miller’s current resources.

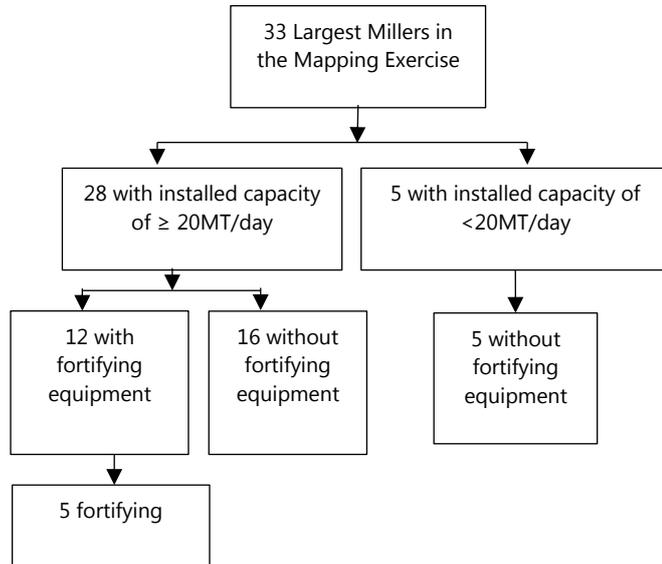


Figure 2: Surveyed millers by installed capacity and fortification equipment status

Total fortified maize flour milled in 2016

The five companies fortifying in 2016 produced about 16,600 MT of fortified maize flour (see Figure 3). Production varied among the companies, with one company producing nearly three-fourths of maize flour in 2016. Production also varied depending on season, availability and price of maize, demand by key markets, and availability and price of other food staples in the local market. Some companies only produce fortified maize flour on special orders from clients, including humanitarian agencies, while others companies fortify all their maize flour.

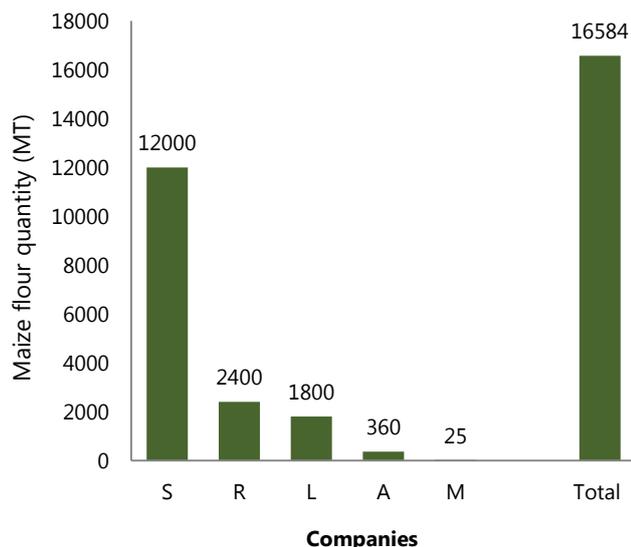


Figure 3: Absolute amount of fortified maize flour produced in 2016

Fortified maize flour customers in 2016

Millers reported that 89.4 percent of their fortified flour was purchased by humanitarian agencies, with the biggest buyer being the World Food Programme (WFP). Only 10.3 percent was consumed by the local market: 9 percent by supermarkets/shops and 0.3 percent by institutions such as schools (Figure 4).

Millers reported that schools generally do not purchase fortified flour from them for several reasons: limited awareness of the benefits and the availability of fortified maize flour, perceived high additional costs associated with fortification, and the fears about the general safety of fortified maize flour. Millers said that schools need additional education on how to store fortified maize flour, as one informant reported:

We sold about 20 MT to a school. We informed them the flour was fortified and the shelf life was six months. What happened is that they did not use all the flour before the term ended. When the [new] term started, they said it had spoilt; it developed an after-taste after four months, and they wanted us to replace it. Actually, it is because they stored it in poor conditions; so we could not [replace it]. They need to have good storage. The school never came back to buy more. We need to accompany the selling with education on use and storage, and maybe support them.

The companies that produce the largest volume of fortified maize flour produce primarily for humanitarian agencies, particularly WFP (Figure 5). The company producing the largest volume of fortified maize flour (12,000 MT per year) exclusively produces for humanitarian agencies. Millers reported that humanitarian agencies purchase this flour for export to Rwanda or Congo.

Fortification standards used in Uganda

A standard provides a list of vitamins and minerals to be added in maize flour as well as specifies the minimum and maximum level of each vitamin and mineral. Uganda has adopted the harmonized Uganda standard/East Africa fortification standards on maize flour fortification (US: EAS 768), shown in Table 1. All fortifying companies, whether acting voluntarily or under the mandatory regulation, must follow this premix formulation.

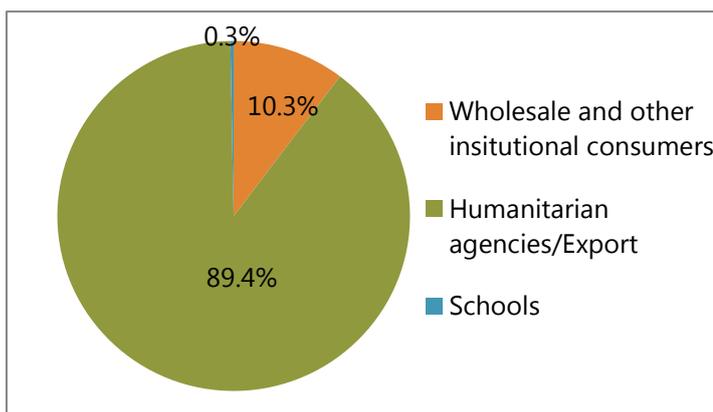


Figure 4: Proportions of fortified maize flour procured by different institution

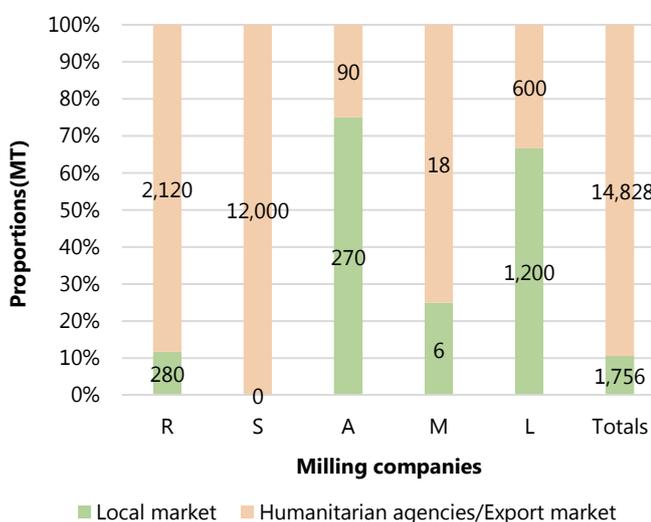


Figure 5: Proportion of fortified maize flour sold to humanitarian agencies and to the local market

Table 1: Premix Formulation According to US: EAS Standard

Nutrient	Fortificant Compound	Quantity (g/kg)
Vitamin A	Retinyl palmitate, spray-dried or equivalent, 0.075% retinol, minimum	2
Vitamin B₁	Thiamin mononitrate, 81%, minimum	9
Vitamin B₂ (riboflavin)	Riboflavin, 100%, minimum	6
Vitamin B₃ (niacin)	Niacinamide, 99%, minimum	50
Vitamin B₆ (pyridoxine)	Pyridoxine, 82%, minimum	10
Vitamin B₉ (folate)	Folic acid, 100%, minimum	2
Vitamin B₁₂	Vitamin B ₁₂ , water-soluble form, 0.1%)	0.03
Zinc	Zinc oxide, 80%, minimum	80
Iron	NaFeEDTA, 13% iron, minimum	37
Filling material (25 %)		

We found that some companies—including those that sell fortified maize flour to the local market—are using another fortification standard, provided by WFP. The two standards follow the same premix formulation, but have different quantities of premix per metric ton. While the US: EAS standard requires 500 g of the specified premix to be added to each metric ton of maize flour, the WFP standard requires only 250 g per metric ton. The WFP standard is intended for maize flour being supplied to WFP for humanitarian purposes. Further research is needed on the effects of premix concentration per metric ton.

Technologies used for fortification in Uganda

Flour fortification requires two types of technology: a premix feeder and a mixing mechanism. Premix is added either continuously or in batches. The rate that premix is added to the flour can be determined manually, using sensors and interlocking, or with automation. Volumetric premix feeders are simple and rely on a one-time weight measurement. Gravimetric premix feeders continuously weigh the premix while adding to the flour, and loss-in-weight feeders provide even greater levels of control and automation. Volumetric feeders, loss-in-weight, and gravimetric feeders are continuous feeders, which are ideal for medium- and large-scale milling. The batch-mixing method is relatively simple to use but has a number of limitations. We outline the advantages and disadvantages of the different technologies in Table 2.

Table 2: Advantages and Disadvantages of Fortifying Technologies in Use in Uganda

Technology	Advantages	Disadvantages	Cost Range
Volumetric feeder	<p>Feeders consistent in dosing the premix.</p> <p>Suitable for large-scale operations.</p> <p>Not labor-intensive as compared to batch mixers.</p>	<p>Requires routine calibration.</p>	<p>US\$1,500– US\$3,000</p>
Gravimetric/loss-in-weight feeder	<p>Most accurate system of dosing premix.</p> <p>Suitable for large-scale operations.</p>	<p>Very complex and expensive.</p> <p>Any changes to the process and/or related equipment could have a profound effect upon the operation and resulting accuracy of the loss-in-weight feeder.</p> <p>Requires calibration and consultation from the supplier for any modifications to be made.</p>	<p>US\$10,000– US\$15,000</p>
Batch blending/mixing system	<p>Can be locally fabricated or retrofitted from existing machinery</p> <p>Easy to apply premix to the maize through using hand-held scoopers</p>	<p>Not convenient to achieve consistency in final fortified product.</p> <p>Batch mixing is slower and more labor-intensive.</p>	<p>Not ascertained.</p>

Of the 12 companies in Uganda with fortification equipment in 2016, eight were using volumetric feeders with a continuous mode of adding premixes, two companies had installed loss-in-weight feeders, and two companies had installed batch mixers, which were obtained as a donation from development partners. The two companies with batch mixers were not using them; one recently acquired a volumetric feeder to produce larger volumes of maize flour. Loss-in-weight feeders and volumetric feeders are more appropriate for large-scale fortification, but the cost of the technology can be prohibitive.

Fortificants used by Ugandan millers

Fortificants are vitamins and minerals added to foods to improve their nutritional value. These fortificants are not manufactured in Uganda, but are imported from countries such as Germany, India, and South Africa, among others.

The Uganda National Drug Authority (NDA) is responsible for approval and registration of manufacturers of fortificants and fortification premixes as compliant with the good manufacturing practices (GMPs). In addition, the NDA verifies that the fortificants and fortification premixes are imported from approved manufacturers only, and evaluates the quality (physical and chemical assessment) of fortificants and fortification premixes imported into the country. Table 3 shows the NDA-approved list of premix suppliers, last inspected in 2014. It is unknown whether these suppliers' licenses are still valid.

Table 3: NDA-Approved List of Fortificant Suppliers

Company Name	Country of Origin	In-country Local Supplier
Muhlenchemie	Germany	No
Prime merchantiles¹	Uganda	Yes
DSM	South Africa	No
BSFA	German	No
Fortitech	Denmark	No
Hexagon Nutrition (Export) Pvt.	India	No

In November 2017, we collected prices of premix from different suppliers. We found that premix sourced domestically cost US\$15 per kilogram, and premix sourced internationally cost US\$7–US\$18 per kilogram.

Maize millers reported struggling with financing and upfront purchase of premix. They also must balance the risk of stock-out with premix expiration. Industries felt that local suppliers are easier to work with than international suppliers, because they are able to avoid importation challenges and the need to obtain clearances. However, there is not necessarily a price advantage to sourcing premix domestically versus internally because the Uganda Revenue Authority waives import duties on premix.

Importers of fortificants are required to pay the taxes shown in Table 4. Taxes on imported premix have been reduced, thanks to collaboration between the MOH and the Ministry of Finance (MOF). The import duty on premix has been removed, and millers can also apply for value-added tax (VAT) exemption on imported materials.

Two of the five companies supplying fortified maize to humanitarian populations indicated that they were exempted from the withholding tax and import tax. However, they had to get clear documentation for the MOF explaining why they needed a waiver and the country of origin for the materials in their premix (including the harmonized system codes for each of their products). These new tax reductions on imported premix provide an ideal opportunity for costing savings on one of the significant ongoing expenditures of fortification.

Table 4: Taxes Levied on Premix

Tax	Percentage Levied
Value-added tax	18%
Withholding tax	6%
Import duty	0%

Quality assurance and enforcement of the fortification legislation

During interviews and site visits with the maize millers, we observed that quality assurance and quality control (QA/QC) pose a challenge when fortifying maize flour. We found issues related to non-compliance of industries to the national standards, such as examples poor product labeling, failure to use the fortification logo, and poor hygiene practice, especially in grain handling and storage. These QA/QC issues need to be addressed before additional millers are encouraged to fortify.

¹ Prime Merchantiles International, Ltd., is the local supplier of Muhlenchemie.

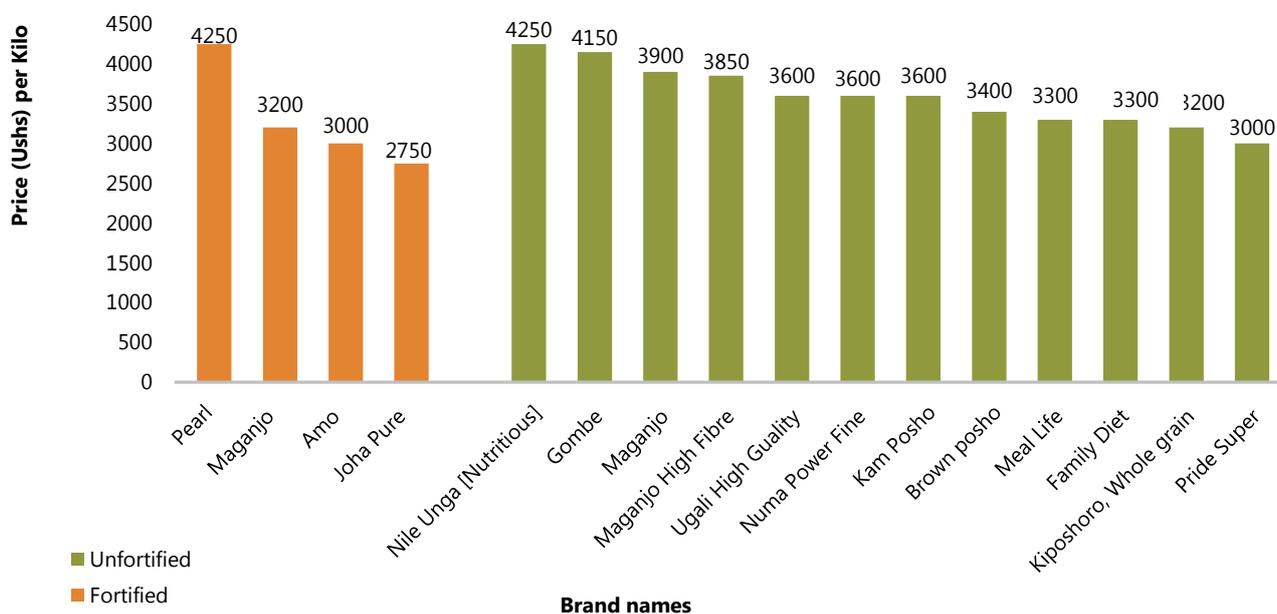
Prices of maize flour on the market

As indicated in Figure 6, we found no relation between fortification and increased prices at the market. Surveyed millers indicated that they sell a kilogram of fortified maize flour at a price of UGX 2,300–2,500. However, on checking prices of individual brands on market, we found that prices ranged from UGX 1,950—3,000. Annex 4 contains a list of fortification products available on the market and a photo of their packaging.

The company offering the lowest price per kilogram of fortified maize flour does not sell products on the local market. Some companies sell fortified and unfortified maize flour at the same price. One company sold fortified maize flour at a price much higher than the rest of the companies. They attributed this to the investment the company had made in QA along the entire production chain such as building and equipping their own laboratory, ensuring they provided extension services, procuring high-quality seeds from their contracted farmers, and training the farmers on post-harvest handling of grains.

The cost of maize grains was identified to be the main cost driver across all producers of maize flour. For millers planning to fortify, the capital investment represents the greatest expense. But when considering recurring fortification costs, premix accounts for about 93 percent of the expense from fortifying. Other recurring costs for fortification include quality assurance (2 percent) and quality control (1 percent) as well as incremental production costs (4 percent). In addition to considering the cost of purchasing fortification technology, millers will need to budget for ongoing expenses such as premix.

Figure 6: Price per kg of fortified and unfortified maize flour by company name in Uganda, November 2017



Incremental cost of fortification in large-scale maize flour fortification

Engaging in fortification requires one-time costs, such as machines, dosers, and mixers, and recurrent costs, such as QA/QC, purchase of premix, and labor/production costs. Over one year, a miller fortifying their flour will incur additional costs over a miller who does not fortify, but these costs are not high. The annual incremental cost by weight shows the added costs of fortifying over not fortifying, and informs millers how to price their product. In Tables 5 and 6, we see the incremental cost by weight for large-scale millers operating at different capacities; the incremental cost of fortifying is marginally lower for large-scale millers operating on

higher scale than for those operating at a slightly lower production scale. The inputs for the costing exercise are included in Annex 5.

Table 5: Incremental Costs for Fortification: Large-Scale Mill Operating at 20 MT/Day

Annual Incremental Cost per MT of Fortified Maize Flour (Including Capital)	UGX
Cost per MT	30,632
Cost per kg	30.6

Table 6: Incremental Costs for Fortification: Large-Scale Mill Operating at 60 MT/Day

Annual Incremental Cost per Ton of Fortified Maize Flour (Including Capital)	UGX
Cost per MT	29,553
Cost per kg	29.6

Recommendations on the Way Forward

Of the 33 maize millers we visited, 23 millers were not fortifying their flour, including seven who already owned fortification equipment. Further, maize millers who fortify their flour are selling their product to WFP and other humanitarian organizations, the majority of which is subsequently exported. Increasing the availability of locally-produced fortified flour will require a dual approach: to increase demand for fortified maize flour domestically, and to encourage and support millers who are not currently fortifying to do so. Stakeholders, including industry members, government representatives, development partners, and the research community, must work together to increase access to fortified maize flour in Uganda, by Ugandans, through changes in policy, programs, and practices.

Policy considerations

The Government of Uganda can assist in supporting maize millers by developing a platform for public and private sector collaboration. Ongoing dialogue will allow for sharing progress, discussing challenges in maize flour fortification, and understanding national standards and legislation on fortification.

There is a need for further clarification of national standards on food fortification, given the confusion around the national policy: some millers assumed fortification is mandatory for those who *actually produce* 20 MT or more per day; however, the standard applies to millers with the *capacity to produce* 20 MT or more per day. Additionally, millers are currently using two different standards for fortification, one according to US:EAS standards for national consumption of fortified foods, and one for export for humanitarian purposes. Although the markets for the two products are different, having two premix standards is difficult for millers in terms of enforcement and quality assurance. A lower concentration of premix per kilogram also affects the micronutrient levels of the flour. Millers must be educated on fortification standards to increase compliance with mandatory fortification standards as well as QA/QC measures.

Enforcement of national policies on food fortification needs to be improved. The majority of maize millers that are required to fortify by law are not currently fortifying, yet they face no consequence, so there is no incentive to change. Increasing monitoring and enforcement is key to motivating maize millers to adopt fortification. SPRING has assisted the government in recognizing an additional four laboratories to certify fortified products; the list of laboratories must be shared with millers and testing of samples must be expedited. The government should also research outside resources to support enforcement of fortification standards at the local level.

There is a need to increase millers' access to the inputs for fortification, including premix and technology. To increase the availability of premix for millers, the NDA can work to certify additional suppliers of premix, which could also drive the price down for locally-produced premix. Food control agencies, such as the Uganda National Bureau of Standards (UNBS), can also build the capacity of maize millers on the installation and use of available technologies—for example, on the calibration of the machines.

Finally, we must strengthen the feedback system for fortifying industries. In the event industries fail to produce compliant fortified food samples, there should be an effective information system to enable industries to take action before these samples are taken to the market. Currently, collected data do not affect day-to-day fortification activities; this is a significant missed opportunity.

Programmatic considerations

Private sector

Currently in local supermarkets, fortified maize flour is sold at the same or lower price than unfortified maize flour, partly due to lack of consumer awareness of the benefits of fortified flour. The private sector should

incorporate fortification into their routine marketing and communication campaigns to increase public awareness on the availability, benefits, and identification of fortified foods. The fortification logo should represent an added value to the consumer, describing not only the addition of vitamins and minerals, but the knowledge that the product has passed a QA/QC check and is of higher quality than its unfortified counterpart.

Mobilizing and clustering maize millers into associations can increase their access to resources, trainings, and advocacy efforts. As a unified group, maize millers can more competitively propose amendments to national legislation on food fortification and lobby for tax incentives. They are also better positioned to write proposals and request funding from private foundations. A group of maize millers is also better positioned to buy premix and fortification inputs at competitive rates compared to a single miller.

Development partners

The National Working Group on Food Fortification (NWGFF) and the government have previously led awareness efforts on creating demand for fortified foods. But development partners and organizations can reinvigorate mass media campaigns to raise awareness of fortified foods. In 2016, public sensitization campaigns informed the public about products with the big blue “F,” but maize flour fortification was not included in the campaign. The next communications campaign can feature fortified maize flour in addition to fortified oil and wheat flour, and inform consumers through television advertisements, radio spots, and point-of-purchase marketing about what fortified food means and why added vitamins and minerals are beneficial. This initiative goes hand in hand with encouraging the private sector to market their fortified products as being of higher quality, thus mutually reinforcing this key message.

Outside partners can also support dialogue between the public and private sectors through the creation of a communications platform for maize millers. Through a website or another mass communication platform, maize millers could access information about fortification, learn about the standards, contact suppliers, and learn about funding opportunities.

We found that 28 maize millers have sufficient production capacity to fall under mandatory fortification standards in Uganda, however, only five of these millers fortified their flour as of November 2017. Development partners should work with this “low-hanging fruit,” and rectify the situation by helping them understand standards and regulations, secure premix, learn where there are laboratories, and certify samples of fortified foods. This same approach was successfully adopted for wheat flour fortification.

Research community

Universities and research institutions can also be engaged to develop innovations in fortification technology and adapt existing technology to the local context. The SANKU fortification equipment, currently used in Tanzania, was developed by a university team, and has served as an interesting model for Uganda to consider adapting. The research community has the potential to innovate cheaper, local technologies that can serve Ugandan maize millers.

Next steps

The next step is to further engage ministries, millers, and outside institutions to promote fortification of maize flour. The public sector should encourage procurement of fortified maize flour for vulnerable/captive populations, including schoolchildren, hospital patients, armed services, and prison populations. The MTIC has led the way by offering to support fortification efforts. Ongoing dialogue between millers and government will facilitate fortification efforts and help resolve barriers on the road to maize flour fortification.

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Annex 1: Questionnaire for Study Participants

Section A: Identification Information

A01	District:	A02	Subcounty:
A03	Town/village:	A04	Company name:
A05	GPS coordinates Lat: ___ ___ Long: ___ ___	A06	Date of interview: ___ / ___ /2017 (dd/mm)

Section B: Applicable to All Companies

B01	Which different product do you mill?																		
B02	What was your production capacity of your mill for maize flour the last year? (2016) -----MT																		
B03	Who were your main customers?																		
B04	Did you fortify all the maize flour produced by your company? 1 Yes 2 No																		
B05	If NO, probe to identify why not all the flour is fortified.																		
B06	Who among your customers bought the largest amounts in 2016? <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">a. Customer</th> <th style="text-align: center;">b. Amount purchased (MT)</th> <th style="text-align: center;">c. Amount fortified (MT)</th> </tr> </thead> <tbody> <tr><td>1.</td><td></td><td></td></tr> <tr><td>2.</td><td></td><td></td></tr> <tr><td>3.</td><td></td><td></td></tr> <tr><td>4.</td><td></td><td></td></tr> <tr><td>5.</td><td></td><td></td></tr> </tbody> </table>	a. Customer	b. Amount purchased (MT)	c. Amount fortified (MT)	1.			2.			3.			4.			5.		
a. Customer	b. Amount purchased (MT)	c. Amount fortified (MT)																	
1.																			
2.																			
3.																			
4.																			
5.																			
B07	For how much on average does your company sell a kilogram of A. Unfortified maize flour _____shs.																		

	B. Fortified maize flour _____shs.
B08	<p>What factors influence the prices per kilogram of fortified flour?</p> <p>Probe—What proportion of the different factors contribute to the prices of the final product?</p>
B09	<p>Have you received any concern regarding the prices of fortified and unfortified maize flour?</p> <p>1 Yes</p> <p>2 No → B12</p>
B10	<p>If YES, what were some of those concerns raised by your customers on fortified flour produced by your company?</p>
B11	<p>How do you think we can address some of these concerns?</p>
B12	<p>Are there any schools currently procuring maize flour from your company?</p> <p>1 Yes</p> <p>2 No → B14</p>
B13	<p>If Yes, which are the top three schools?</p> <p>1.</p> <p>2.</p> <p>3.</p>
B14	<p>If No, has your company tried to explore any opportunity of selling maize flour to schools?</p> <p>Probe—What were some of your concerns in supplying to schools?</p> <p>1 Yes</p> <p>2 No → B16</p>
B15	<p>If Yes, what were the concerns of the schools contacted?</p>
B16	<p>How can we address some of these concerns?</p>

Section C: Fortification technologies installed (applicable to fortifying companies and those that have installed the equipment but are not yet fortifying)

<p>C01</p>	<p>Which type of fortification equipment is installed at your company? Probe—For how long, if currently fortify?</p>
<p>C02</p>	<p>What were considerations to procure the type of fortification equipment owned by your company?</p>
<p>C03</p>	<p>Who are the suppliers of the type of fortification technology owned by your company? (Contact details)</p>
<p>C04</p>	<p>What is the total cost of installing the type of fortification equipment owned by your company?</p>
<p>C05</p>	<p>Would you recommend a company of the same size as yours to procure the type of fortification technology owned by your company? (Probe for reasons in any case.)</p>
<p>C06</p>	<p>Are there any specific concerns related to the type of fortification technology owned by your company? (E.g., <i>need to replace every after a given time, calibration requirements, availability of spare parts, specific training requirements</i>)</p>
<p>C07</p>	<p>ONLY for those NOT using the installed fortification equipment; otherwise, go to Section D In your opinion, what could be the reasons for not using the fortification equipment installed by your company? (Probe for more responses...)</p>
<p>C08</p>	<p>At the moment, is there any plan for your company to start using the fortification equipment installed? (Probe for details on implementation of the plan.)</p>
<p>C09</p>	<p>Assuming that there was any possibility to provide support to your company, what specific things would your company prioritize to be supported in order to start fortification?</p>

Section D: Premixes/fortificants (only applicable to fortifying companies)

D01	<p>Who is your current supplier(s) of premix?</p> <ol style="list-style-type: none"> 1. 2. 3.
D02	<p>What do you consider to determine the supplier(s) of premix used by your company?</p>
D03	<p>How much was a kilogram of premix distributed by your current supplier in 2016?</p> <p>_____ shs.</p>
D04	<p>Which fortification standards are followed by your company to fortify maize flour?</p>
D05	<p>Which taxes are incurred on the procurement of premix by your company?</p>
D06	<p>Do you have any concerns regarding the premix supplied your company?</p>
D07	<p>Have you had any contacts with the UNBS or NDA?</p> <p>Probe—For purposes of visits/interactions</p>
D08	<p>What concerns do you have on the visits of the regulatory bodies?</p>

Section E: Milling technologies installed (applicable to all maize mills)

E01	<p>Which type of mill is owned by company?</p> <ol style="list-style-type: none"> 1. Roller mill 2. Hammer mill 3. Both roller and hammer
E02	<p>How did you determine the milling technology currently owned by your company? (Probe.)</p>
E03	<p>In your opinion, would you recommend a starting company opt for the same type of mill owned by your company or not? (Give reasons in any case.)</p>
E04	<p>Are there any specific concerns related to the type of mill owned by your company? E.g., <i>repair and maintenance, availability of spare parts, requirements for operation</i>)</p>
E05	<p>Is there any way in which milling technology owned by your company influences the fortification practices? If Yes, probe for details.</p>

Section F: Support provided to maize millers (applicable to all maize mills)

F01	<p>What support is currently provided to your company? (In terms of equipment, training, fortification)</p> <ol style="list-style-type: none"> 1. 2. 3.
F02	<p>Who provides the required support to your company?</p>
F03	<p>Which support would be required by your industry?</p>
F04	<p>Is there any cost associated with the support received by your company?</p>

Annex 2: Calculations and Formulae Used in Costing Exercise

*Total milling days per year*² = (average number of milling days per month × number of months operated in year)

Total maize flour output per year = actual mill operating level × milling days per year

Capital costs

These are fixed costs of fortification incurred by the mill once at the start-up of the program. They include machinery such as mixers and blenders. To ascertain the annual capital costs, we considered both the purchase/installation costs of the fortification equipment and the life span of the machine.

Annual capital costs = total purchase and installation costs ÷ lifespan of the machine

Annual recurrent costs

These costs are incurred routinely for a period when a mill is involved in food fortification. The costs were calculated basing on the following factors: premix, internal quality control/quality assurance operations, external quality control operations, and incremental production costs.

Premix costs

Annual premix used per metric ton = (500/1,000)³ × number of months operated per year

Annual freight/transport charges of premix to the mill = (annual premix used per metric ton × estimated transport⁴ costs per kg of premix)

Total cost of premix supplied by local agent in Uganda = (annual premix used per metric ton × annual freight /transport charges of premix to the mill [twice a year])

Total annual premix costs by the mill = total cost of premix supplied by local agent in Uganda⁵ + annual freight charges/transport of premix to the factory (twice year)

Total annual premix costs per MT = total annual premix costs by the mill ÷ total maize flour output per year

Internal QA /QC testing costs

Internal quality assurance and quality control procedures are part of the recurrent costs incurred by a fortifying maize mill. Two co-stable units were identified, and these include an iron spot test and the personnel assigned to perform the test.

Total annual cost of iron spot test = no. of tests performed in a given period of a single day × no. of days operated in a month × no. of months operated in a year × estimated cost incurred to perform a single test

Annual total costs charged by the QC personnel = (estimated percentage time required to perform iron spot tests × no. of months operated in a year × monthly payment of the personnel)/100

Total annual in-plant costs on quality assurance = (total annual cost on iron spot tests + annual total costs charged by the QC personnel at the mill)

² The assumption made was that each mill operated on average 26 days per month for eight months per year.

³ A target addition rate of 500 g/MT was considered as specified in the harmonized East African fortification standard (US:EAS-768).

⁴ Transportation of premix to the mill is done twice a year.

⁵ *Premix cost per kilogram was ascertained from a local supplier in Uganda (Prime Merchantiles); this was inclusive of all charges a mill would incur if they imported premix directly.

External quality control

For regulatory monitoring of fortified foods, it is expected that at least one composite sample is sent out for quantitative analysis from an external laboratory usually on a monthly basis. The study methodology considered the cost of testing at least two marker nutrients (vitamin A and iron) in fortified maize flour.

Total annual cost per nutrient = cost per test of a particular nutrient × no. of tests performed per year

In addition to the costs incurred by a mill on testing of samples from an external laboratory, the process involves transportations of samples to and from the factory. Therefore, the study methodology included transportation fees calculated as follows:

Total annual transportation costs of samples = local transport costs from a particular mill to the external laboratory × no. of times samples are transported for external testing per year

Total annual external quality control costs = total annual cost per nutrient tested + total annual transportation costs of samples

Incremental production costs

The costs captured here include the following; power costs of operating the blender, average annual maintenance costs of the machine, production personnel and machine operators.

Average annual power cost on operating a mixer/blender = estimated monthly costs for operating a mixer × no. of months operated in a year

Average annual maintenance costs of machinery = estimated percentage of annual depreciation × total installed cost of the machinery

Total annual costs incurred on the production personnel = estimated percentage of time devoted to fortification per person × monthly payment of a person × no. of months operated in year × no. of production persons employed on fortification

Total annual incremental cost of fortification = total premix costs + quality assurance (in-plant testing) + quality control (External testing) + incremental production costs + annualized capital costs

Annual incremental cost per ton of fortified maize flour (including capital costs) = total annual Incremental cost of fortification (including capital costs) ÷ total maize flour output per year expressed in metric tons

Annual incremental cost per kilogram of fortified maize flour (including capital costs) = annual incremental cost per ton of fortified maize flour (including capital costs) ÷ 1,000

Annex 3: Factories with Installed Capacity of 20 MT/Day and Above

Company	Milling Technology	Location	Installed Capacity (MT)/Day	Fortifying?
1. Pan Afric Impex	Roller mill	Kampala	216	Yes ⁶
2. Sunrise Commodities, Ltd.	Roller mill	Kampala	85	Yes
3. RECO Industries	Roller mill	Kampala	75	Yes
4. AK Oils-Mukwano	Roller mill	Lira	75	Yes
5. Maganjo Grain Millers	Hammer mill**	Wakiso	35	Yes
6. Aaron Foods Industries, Ltd.	Both roller and hammer** ⁷	Kampala	30	Yes
7. Savannah Commodities	Hammer mill**	Mukono	75	Equip ⁸
8. Sanyu Agro Harvest	Hammer mill**	Mukono	60	Equip
9. Aponye (U), Ltd.	Hammer mill**	Kampala	45	Equip
10. Talian Company, Ltd.	Roller mill	Mukono	30	Equip
11. Afro Kai, Ltd.	Roller and Hammer**	Wakiso	20	Equip
12. Haree Maize Mill	Roller mill	Gulu	30	Int ⁹
13. Namunkekera Agro Processing Industries, Ltd. (NAPIL)	Roller mill	Nakaseke	100	No
14. Twezimbe Area Cooperative Enterprise	Hammer mill**	Kyankwanzi	32	No
15. MMACKS Investment	Roller and hammer mill**	Wakiso	30	No
16. Mugwanya Grain Millers	Hammer mill	Luweero	24	No
17. Nutri-mix Maize millers	Hammer mill**	Gulu	24	No
18. Aminco Maize Mills	Hammer mill**	Bombo	24	No
19. Buwama Maize Millers	Hammer mill*	Mpigi	20	No

⁶ Pan Afric Impex began fortifying in October 2017.

⁷ **Modern hammer mill.

⁸ Equip signifies companies with installed fortification equipment and already in the process to start fortification.

⁹ Int signifies the company does not have fortification equipment installed yet but engaged consultants to support the fortification process.

20. Nantamali Maize Millers	Hammer mill ^{*10}	Jinja	20	No
21. OPIT and Sons Investment	Hammer mill*	Mukono	20	No
22. Kigata Grain Millers	Hammer mill*	Mukono	20	No
23. ASB Enterprises	Hammer mill*	Wakiso	20	No
24. DMK Maize Millers	Hammer mill	Mayuge	20	No
25. Soka Millers	Hammer mill	Lira	20	No
26. Kasawo Grain Millers	Hammer mill**	Kampala	18	No
27. Nuuma Feed, Ltd.	Hammer mill**	Sheema	10	No
28. Unga 2000	Hammer Mill	Mbarara		No

¹⁰ * Locally fabricated hammer mill.

Annex 4: Fortified Maize Flour Products Available for Purchase in Uganda

Company Name	Brand Name of Fortified Product	Product's External Appearance
RECO Industries	Pearl Fortified Maize Flour	
Sunrise¹¹	N/A	N/A
Pan Afric Impex	Joha Fortified Maize Flour	
Aaron Foods	Amo Fortified Maize Flour	

¹¹ Branding is done in accordance to the specifications of WFP and varies among different consignments.

<p>AK Oils</p>	<p>SHIBE Fortified Maize Flour</p>	
<p>Maganjo Grain Millers</p>	<p>Maganjo Fortified Maize Flour</p>	

Annex 5: Inputs for Added Costs for Fortification among Large-Scale Maize Millers

Costing fortification in a large-scale maize mill in Uganda operating at 60 MT/day	
	Mill size
Mill capacity/production	Large
1. Manufacturer rated capacity	60%
2. Actual operating level as a percentage of manufacturer's rating	136%
3. Average actual operating level	60%
4. Milling days per year (26 days per month for 8 months)	208
5. Total output per year in MT	12,480
CAPITAL COSTS	
	UGX
Start-up costs	
Feeder and installation costs for one mill = hi-tech Buhler type with installation	36,000,000
Annualized capital cost over 20 years	1,800,000
Subtotal of equipment-related annual incremental costs	4,760,000
Annualized capital costs and capital-related incremental costs	6,560,000
ANNUAL RECURRENT COSTS	
	UGX
1. Premix costs	
Annual premix used at target addition rate of 5,000 g/MT <i>expressed in kg</i>	6,240
Annual amount of maize flour produced <i>expressed in MT</i>	12,480
Premix cost per kg supplied to Uganda by Prime Machentile (<i>inclusive of freight clearance and license fees, VAT</i>)	55,460
*Annual transport to the factory (<i>twice a year</i>) @ at 1,500,000 per 3 MT	3,120,000
Total cost of fortificant <i>supplied by local agent in Uganda Prime Machentile</i>	346,070,400
Total annual premix costs with in-country transportation	349,190,400
Total annual premix costs per MT	27,980

2. Internal QA /QC testing costs	
Iron spot test for fortified maize flour (every 2 hours, 4 times a day) each test is UGX 1,000	832,000
Two stores officers handle premix @UGX 500,000, one per shift assumed only 20% time related to fortification	1,600,000
In-plant quality control—personnel costs estimated at 20%	
One laboratory supervisor UGX 800,000 per month	1,280,000
One laboratory technician UGX 600,000 per month	960,000
Total annual in-plant QA costs <i>These costs include other benefits such as taxes, social security, medical and food, and constitute 30%</i>	4,672,000
3. External quality control (one composite sample per month)	
(It is expected that one composite sample per month will be necessary.)	
Vitamin A analysis (UGX 50,000 per test, 12 tests per year)	400,000
Iron analysis (UGX 50,000 per test, 12 tests per year)	400,000
Transportation of samples per month	800,000
Average total cost per plant—Year 1	1,600,000
4. Incremental production	
Personnel costs estimated at 10% FF per annum	
Production (one chief miller), UGX 150,0000 per month	1,200,000
Two supervisors, UGX 1,500,000 per month	2,400,000
Four machine operators two per shift, UGX 1,000,000 per month	3,200,000
Average annual operating costs	2,240,000
Average annual maintenance costs at 7% estimates	2,520,000
Total annual in-plant QA costs <i>These costs include other benefits such as taxes, NSSF, medical, and food, and constitute 30%</i>	11,560,000

Total Annual Incremental Costs of Fortification	
1. Premix	349,190,400
2. Quality assurance / in-plant lab testing	4,672,000
3. Quality control / external lab testing	1,600,000
4. Incremental production costs	11,560,000
TOTAL WITHOUT ANNUALIZED CAPITAL COSTS	367,022,400
Annualized capital cost spread over 20 years	1,800,000
TOTAL WITH ANNUALIZED CAPITAL COSTS (20-year lifespan assumed)	368,822,400
Annual incremental cost per ton of fortified maize flour (excluding capital)	
Cost per MT	29,408.8
Cost per kg	29.4
Annual incremental cost per ton of fortified maize flour (including capital)	
Cost per MT	29,553
Cost per kg	29.6

Costing fortification in a large-scale maize mill in Uganda operating at 20 MT/day	
	Mill size
Mill capacity/production	Large
1. Manufacturer rated capacity	20%
2. Actual operating level as a percentage of manufacturer's rating	100%
3. Average actual operating level	20%
4. Milling days per year 26 days per month for 8 months	208
5. Total output per year, in MT	4,160
CAPITAL COSTS	UGX
Start-up costs	
Blender and installation costs (batch)= high-tech Buehler type	15,680,000
Annualized capital costs (lifespan of 20 years)	784,000
ANNUAL RECURRENT COSTS	UGX
1. Premix costs	
Annual premix used at target addition rate of 500 g/MT (<i>expressed in kg</i>)	2,080
Annual amount of maize flour produced (<i>expressed in MT</i>)	4,160
Premix cost per kg supplied to Uganda by Prime Machentile (<i>inclusive of freight clearance and license fees, VAT</i>)	55,460
*Annual freight charges and transport to the factory (<i>twice per year</i>), transporting 1 MT per trip estimated at UGX 1,500 UGX/kg	3,120,000
Annual clearance for imports (<i>annually</i>)	250,000
Import license/NDA certification fee for each importation batch, with 2 batches per year at UGX 100,000 each	200,000
Total cost of fortificant supplied by local agent in Uganda Prime Machentile	115,356,800
Total annual premix costs by the mill	118,476,800
Total Annual Premix Costs per MT	28,480

2. Internal QA /QC testing costs	
Iron spot test for fortified maize flour (every 2 hours, 4 times a day), with each test costing UGX 1,000	832,000
One quality control person at 10% UGX 400,000	320,000
Total annual in-plant QA costs	1,152,000
3. External quality control	
(It is expected that one composite sample per month will be necessary.)	
Vitamin A analysis (UGX 50,000 per test, 8 tests per year)	400,000
Iron analysis UGX (UGX 50,000 per test, 8 tests per year)	400,000
Transportation of samples per month	800,000
Average total cost per plant per year	1,600,000
4. Incremental production	
Average annual fortification-related operating costs (power for the blender) assumed at UGX 100,000 per month	800,000
Average annual maintenance costs (estimated at 7%)	1,097,600
Additional personnel who are estimated to devote 20% of full-time employment on fortification-related activities.	
Two production personnel, UGX 700,000 per month	2,240,000
Two machine operators, two per shift UGX 400,000 per month	1,280,000
Total annual in-plant QA costs	5,417,600
<i>These costs include other benefits such as taxes, NSSF, medical and food, and constitute 30%.</i>	
Total annual incremental costs of fortification	
1. Premix	118,476,800
2. Quality assurance / in-plant lab testing	1,152,000
3. Quality control / external lab testing	1,600,000
4. Incremental production	5,417,600
TOTAL WITHOUT ANNUALIZED CAPITAL COSTS	126,646,400
Annualized capital cost spread over 20 years	784,000
TOTAL WITH ANNUALIZED CAPITAL COSTS (20-year lifespan assumed)	127,430,400

Annual incremental cost per ton of fortified maize flour (excluding capital)	
Cost per MT	30,443.8
Cost per kg	30.4
Annual incremental cost per MT of fortified maize flour (including capital)	
Cost per MT	30,632
Cost per kg	30.6

NOTES

1. Exchange rate of US\$1.00 = UGX 3,600 as of November 2017
2. Social marketing costs are to be carried by MOH.

Annex 6: Companies Producing Fortification Technology for Uganda

S/N	Company Name	Location	Contact Person	Contact Details
01	China Huangpai Food Machines (U.) Ltd.	Lugogo Show Grounds, Reco Building, Uganda, Kampala	Ojwiya Nelson, manager	Mobile: 0772621223; 0705110000 Telephone: 0312261682 Email: huangpai@utlonline.co.ug ojwiyanelson@gmail.com
		*Branches in other parts of Uganda, e.g., Gulu town	Hao Qi, sales manager	Mobile: 0786222623 Telephone: 0312261682 Email: huangpai@utlonline.co.ug Haoqi2323@gmail.com
02	Cimbria East Africa, Ltd.	Nairobi, Kenya	J. T. Nielson/Losey M. Wamutitu	P.O. Box 24580, 00502, Nairobi, Kenya Email: info@cimbria.co.ke Telephone: +2540518006354/5/7
				Telephone: 0086-537-4165999 Mobile: 0086-18462102999 (chat)
03	Shandong Xingfeng Flour Machinery Co., Ltd.	Shangdong province, China	Zhou, manager	Mobile: 0086-15854746699
			Lian Lueng, marketing manager	Telephone: +256414699138 Mobile: +256782556879 Email: fnyekoo@gmail.com , talian@gmail.com
		*Local agents in Seeta Mukono, Uganda	Francis Nyeko, managing director, Talian Co., Ltd.	125 Cambridge Park Drive Suite 301 Cambridge, MA 02140, USA Telephone: +44 510-898-6013 Email: info@sanku.com
04	SANKU	125 Cambridge Park Drive	Felix Brooks Church	7th Floor, Amani Place Ohio Street, Office Park Dar es Salaam, Tanzania Telephone: +255 764 765 976
		Tanzania Field office	Felix Brooks Church	Email: info@indopol.com Telephone: +91 129 2276162 / 2276161 / 2275823 / 2274756
05	Indopol Food Processing Machinery Pvt., Ltd.	India	Vivek Gupta	P.O. Box 31 30100 Eldoret, Kenya Email: kibet@agce.co.ke Mobile: 0722623657

06	Africa Grain Care Equipment, Ltd.	Nairobi, Kenya	Michael Kibet Kebenei, managing director	CH-9240 Uzwil, Switzerland Telephone: + 41 (0) 71 955 12 55 Mobile: <u>+ 41 (0) 79 524 86 27</u>
07	Buehler (WUXI) Commercial Co., Ltd.	Jiangsu province, China	Walter von Reding, Leader Grain Milling Flour Service	Email: patrick.mwitia@buhlergroup.com
		*Nairobi	Patrick Mwitia, head of customer service at Buehler Nairobi	Telephone: +27 12 803 0036 Fax: +27 (0)12 803 0065 Email: info@abchansenafrica.co.za P.O. Box 25354, Monument Park 0105, Pretoria, South Africa
08	ABC Hansen	South Africa		Telephone: +903642549560PBX Fax: +903642549290 Telephone: +902124656040PBX Fax: +902124656042 Website: www.alapala.com . www.alapalaworld.com Email: info@alapala.com
09	Gruppo Alapala	Italy		

SPRING

JSI Research & Training Institute, Inc.
1616 Fort Myer Drive, 16th Floor
Arlington, VA 22209 USA

Tel: 703-528-7474
Fax: 703-528-7480

Email: info@spring-nutrition.org
Web: www.spring-nutrition.org

