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Business Models/Investment Case Model for Food Fortification in Uganda

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About USAID Advancing Nutrition

USAID Advancing Nutrition is the Agency's flagship multi-sectoral nutrition project, led by JSI Research & Training Institute, Inc. (JSI), and a diverse group of experienced partners. Launched in September 2018, USAID Advancing Nutrition implements nutrition interventions across sectors and disciplines for USAID and its partners. The project's multi-sectoral approach draws together global nutrition experience to design, implement, and evaluate programs that address the root causes of malnutrition. Committed to using a systems approach, USAID Advancing Nutrition strives to sustain positive outcomes by building local capacity, supporting behavior change, and strengthening the enabling environment to save lives, improve health, build resilience, increase economic productivity, and advance development.

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Photo Credit

USAID Advancing Nutrition Uganda: A production personnel at Mandela Millers Limited sealing a 25kg bag of fortified maize flour.

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Contents

Acronyms

CAPEX	Capital Expenditure
COGS	Cost of Goods Sold
DHI	District Health Inspectors
EAC	East African Community
FACT	Fortification Assessment Coverage Tool
FFI	Food Fortification Initiative
GAIN	Global Alliance for Improved Nutrition
IPO	Input-Process-Output
JSI	JSI Research & Training Institute, Inc.
KII	Key Informant Interview
MOH	Ministry of Health
MT	Metric Tons
MTIC	Ministry of Trade Industry and Cooperatives
NDA	National Drug Authority
OPEX	Operating Expenditure
PESTLE	Political, Economic, Sociological, Technological, Legal and Environmental
POME	Palm Oil Mill Effluent
PSFU	Private Sector Foundation Uganda
QA	Quality Assurance
QC	Quality Control
ROI	Return on Investment
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UGX	Uganda Shillings
UIA	Uganda Investment Authority
UIIRI	Uganda Industrial Research Institute
UMA	Uganda Manufacturer Association
UNBS	Uganda National Bureau of Standards
URA	Uganda Revenue Authority
URSBS	Uganda Registration Service Bureau
USAID	U.S. Agency for International Development
USD	U.S. Dollar
WFP	World Food Programme
WHO	World Health Organization

Acknowledgments

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Executive Summary

Micronutrient deficiencies, also known as hidden hunger, remains a public health concern in Uganda, particularly for children under five years and women of reproductive age. The Government of Uganda (GOU), through the Ministry of Health (MOH), adopted industrial food fortification as one of the high-impact and cost-effective intervention that contribute to the reduction of micronutrient deficiencies through addition of minerals and vitamins to widely consumed staple foods by the population. Uganda implements the 1997 Universal Salt Iodization legislation, mandatory food fortification of wheat flour, maize meal, and edible oils and fats as guided by the Food and Drugs (Food Fortification) (Amendment) Regulation, 2011.

Mandatory fortification levels the field because set standards and regulatory control ensure that all businesses must similarly comply and bear its costs related to technology/equipment, premix, quality assurance (QA), and quality control (QC) which are then incorporated into the sale price of the final product which costs are met by the consumers.

In an effort to attain insight on the uptake of the food fortification program by the private sector and or food industries, this report examines the range of business forms and models that aim to optimize, offer, use, and impact food fortification and are specific to the food vehicle and environment in which they operate. Taking on the Ugandan landscape, this investigation is a review and insight into the ongoing food fortification efforts across the range of business models and approaches adopted to promote uptake by the food industries. The investigation, which was conducted with support from USAID Advancing Nutrition in collaboration with the Private Sector Foundation Uganda (PSFU), also examines the supply-side perspective of food fortification in Uganda in promoting and attaining legislation requirements for wheat flour, maize flour, salt, edible oil and edible fats.

The report on business modelling for food fortification includes in-depth mapping and analysis of the value chain processes and systems, stakeholders involved, and investments in food fortification which focuses on the required organizational structure; technical personnel; capacity building; and economic incentives and financing (income and costing projects and business financing requirements), to design business models for food fortification. The business models will inform investment cases and include tools, resources on business incentives, and support services for fortified food processors.

A field study by USAID Advancing Nutrition included a business approach along the Business to Business (B2B), Business to Consumers (B2C) and Business to Business to Consumers (B2B2C) with a primary focus at the business level for a sample of businesses that fall within the mandatory food fortification regulation across the value chains of maize meal, wheat flour, and edible oil in the Uganda.

USAID Advancing Nutrition interacted with 10 processors (four maize meal, three wheat flour, two edible oils and fats, and one salt), with a varied team of managing directors and quality controllers. Additional information was obtained from the ministries, departments, agencies, and other stakeholders or institutions that influence food fortification directly and indirectly with regards to the regulatory and compliance functions, and these included: Uganda Revenue Authority (URA), National Drug Authority (NDA), and Ministry of Trade Industry and Cooperatives (MTIC). Supportive entities include: Uganda Grain Council, Private Sector Foundation Uganda (PSFU), Uganda Industrial Research Institute (UIRI), and premix suppliers.

The findings and discussion provided insights on the breakout of costs of fortification, which are aggregated into the margin (gross profit) that provides the basis for investing in fortification. Fortification provided added costs that were reflected in lower margins. We examined scenarios of moving from 1 to 100 metric tons (MTs) that capture the range of businesses, from small-scale to large-scale processors in the market. We noted that at lower capacity levels (up to 20 MTs for maize, 10 MTs for wheat, and one MT for salt), the gross margin was higher than those who avoided

fortification. The trend showed that as production increased, the margins between fortified and unfortified products did not change.

The business models include:

- **Product Model**, which emphasizes marketing
- **Input-Process-Out Model**, which is built on operational efficiencies
- **Economies of Scale Model**, which requires large investments

Details to be considered for each model include:

- **Strategic Context:** The compelling case for change
- **Economic Analysis:** Return on investment based on investment appraisal of options
- **Commercial Approach:** Derived from the sourcing strategy and procurement strategy
- **Financial Case**: Affordability to the organization in the time frame
- **Management Approach:** Roles, governance structure, life cycle choice, etc., that businesses can build on when taking on fortification

In conclusion: Several critical elements must be met to operationalize fortification as an effective business approach. There must be a clearly defined organizational structure with technically skilled professionals. Operational systems must be developed and implemented, and innovative economic incentives and opportunities should be sought. Success will require investments in time and resources by all stakeholders within the business. Study outcomes indicate that large manufacturers are best positioned for food fortification. That said, the market does provide opportunity for small manufacturers. Small manufacturers will be better positioned for success if they have successful strategies and implementation processes for elements such as: input costs, premix, technology, QC, and QA to ensure compliance with regulation standards.

1.0 Introduction and Background

1.1. Introduction

USAID Advancing Nutrition is USAID's flagship multi-sectoral nutrition project implemented by JSI Research & Training Institute, Inc. (JSI). The project aims to support the Government of Uganda to reduce micronutrient deficiencies by improving the quality of diet through strengthening compliance to food fortification standards, enforcement, and monitoring. USAID Advancing Nutrition works with the Nutrition Division of the Ministry of Health as the coordinating body and the Secretariat of the National Working Group on Food Fortification, the public sector (ministries, departments and agencies, regulatory bodies), the private sector (private sector institutions, food industries, corporation or associations), civil society organizations, partners, and academia and research institutions to implement and support actions to strengthen large scale food fortification (LSFF) for public health impact.

Specifically, USAID Advancing Nutrition focuses on the following objectives: 1) increase the capacity of the public sector to enforce food fortification standards and regulations; 2) strengthen the capacity of the private sector to comply with food fortification regulations and standards and increase coverage; 3) strengthen partnerships and stakeholder coordination in food fortification; and 4) raise awareness on the benefits of fortified foods.

1.2 Background

Food fortification is the practice of deliberately increasing the micronutrients (vitamins and minerals) during processing of food so as to improve the nutritional quality of the food supply and to provide a public health benefit with minimal risk to health. Food fortification achieved through industrial processing, is a high-impact intervention process used to advance nutrition efforts for the reduction of chronic malnutrition, including those that result in stunting and micronutrient deficiencies of Iron, Vitamin A, Zinc, Iodine, and Folic Acid, which lead to impaired cognitive growth and development, birth defects, morbidity, and mortality[1].

The Uganda National Panel Survey biomarker findings, registered progress in the prevention of vitamin A deficiency which is currently at five percent among children 6-59 months and 0.5 percent among women of reproductive age (WRA) were affected in 2018. Relatedly, low folate deficiency in children and in WRA was reported at 1.5 percent and 1.4 percent respectively, while iodine deficiency remains under control showing the success of salt iodization in Uganda. However, anemia prevalence still remains high at 32 percent for children 6-59 months and 17 percent for WRA, and this has been attributed to non-nutritional causes, mainly malaria and other infections, rather than iron deficiency found in 14 percent for children 6-59 months and seven percent for WRA. However, vitamin B_{12} deficiency and depletion affects five percent and 16 percent of children 6-59 months, respectively, and nine percent and 29 percent of WRA, respectively. The median urinary iodine concentration among pregnant women is adequate at 197.5 micrograms per litre (µg/L) and among non-pregnant WRA at 231.5 µg/L, which confirms the impact of salt iodization program in Uganda. The Uganda Demographic Survey 2016, reported only 15 percent coverage of children 6–23 months had a minimum acceptable diet (MAD), and only 40 percent of the children consumed iron-rich foods. Furthermore, only 34 percent of school children consumed school meals in schools[2].

To promote increased production of fortified foods the MOH issued the Food and Drugs (Food Fortification) (Amendment) Regulations, 2011, which made fortification mandatory for multiple food vehicles, including edible oils and fats, maize and wheat flour (MOH 2011). The regulation requires mandatory fortification with a specified premix formulation of all industrial mills producing a certain

[1] WHO/FAO. 2006. "Guidelines on food fortification with micronutrients." Geneva: WHO Library Cataloging-in-Publication Data
[2] Uganda Bureau of Statistics (UBOS) and ICF. 2018. Uganda Demographic and Health Survey 2016. Kampala, Uganda and Rockville, Maryland, USA: UBOS and ICF

capacity of a food vehicle (20 MTs of maize meal and flour, 10 metric tons of edible oils and fats, and all white and brown wheat flours), in twenty-four continuous hours in a single or multiple mill owned by the same producer or which is imported into Uganda (MOH 2017)[3].

Uganda has made considerable progress in the enforcement and compliance of food fortification regulation through support from the public and private sector, the U.S. Agency for International Development (USAID), Global Alliance for Improved Nutrition (GAIN), Food Fortification Initiative (FFI), and other stakeholders. However, compliance and uptake of the fortified products is still low. Findings from the Fortification Assessment Coverage Tool (FACT) study conducted in 2015 with support from GAIN, reported household coverage of fortified foods, with 93 percent of households consuming fortified salt of the 99.5 percent who consume salt, 54 percent consuming fortified oils of the 90 percent who consume oil, only nine percent consuming fortified wheat flour of the 11 percent consuming wheat flour, and only seven percent consuming fortified maize flour of the 92 percent that consume maize flour.

1.3 Purpose of the Activity

In an effort to attain insight on the uptake of fortification program by the private sector, and explore an inclusive business development approach to support national efforts to scale up industrial food fortification in Uganda, this report examines the range of business forms and models that aim to optimize, offer, use, and impact food fortification, and are specific to the food vehicle and environment in which they operate.

Taking on the Ugandan landscape, this investigation is a review and insight into the ongoing food fortification efforts across the range of business models and approaches adopted to promote uptake by the food industries. The investigation, which was conducted with support from USAID Advancing Nutrition in collaboration with the private sector, also examines the supply-side perspective of food fortification in Uganda in promoting and attaining legislation requirements for wheat flour, maize flour, salt, and edible oil.

Alignment of efforts and interests of private sector partners (business cases) with economic incentives will form the basis for large-scale adoption of food fortification.

The specific objectives of the assignment are to—

1. Conduct an in-depth mapping and analysis of the value chain processes and systems, stakeholders, investments/intervention in food fortification
2. Identify how fortification fits effectively into the food fortification regulation and standards, and the food industry (from a business perspective). What opportunities can be leveraged to make a whole business approach for food fortification etc.
3. Identify what it takes to operationalize fortification as an effective business approach, including but not limited to the required organizational structure, technical skills and training, economic incentives, and all financing (inclusive of income and costing projects and business financing requirements)
4. Identify and provide business models for food fortification for maize flour, wheat flour, and edible oils, fats, and salt businesses to inform investment case for food fortification. Models should include tools and resources on business incentives and business support services to fortified food processors

[3] MOH 2011. The Food and Drugs (Food Fortification) (Amendment) Regulations, 2011

2.0 Methodology and Approach

USAID Advancing Nutrition undertook a field study that entailed a business approach along: "Business to Business[4]"; "Business to Consumers[5]"; and "Business to Business to Consumer[6]", with a primary focus at the business level for a sample of businesses (food industries or processors) that are operating within the mandatory food fortification regulation[7] in the value chains of maize flour, wheat flour, and edible oil. The industries reached were within Central Uganda where most of them operate – Kampala, Mukono, and Jinja with outliers in Lira, which is the hub for the edible oil.

USAID Advancing Nutrition in collaboration with the Private Sector Foundation Uganda (PSFU) and industries identified options and provided business case models for food fortification of maize flour, wheat flour, edible oils and fats, and salt in line with the Food and Drug (Food Fortification) Regulation and Standards.

2.1 Data Collection

USAID Advancing Nutrition conducted key informant interviews (KIIs) with managing directors and quality controllers of 10 food industries including four maize, three wheat, two edible oil, and one salt, within and outside Kampala.

The information collected was to understand the whole business approach for food industries through the fortification process flow in an industry setting. Key cost parameters collected included:

- **Background Information**: Respondent information, the food vehicle, geographical location, Premix sourcing
- **Business Operation**: Business scale, legislation level, market and targeting (B2B, B2B, B2G)
- **Technology**: Premix equipment, technology (automated or semi-automated)
- **Policy**: enforcement and compliance of standards and regulations

The project obtained complementary information from key institutions that influence food fortification programs directly and/or indirectly, particularly in enforcement of standards and regulation for compliance functions. These include: Uganda National Bureau of Standards (UNBS), Uganda Revenue Authority (URA), National Drug Authority (NDA), Ministry of Trade Industry and Cooperatives (MTIC). Supportive entities include: Uganda Grain Council, PSFU, Uganda Industrial Research Institute (UIRI), and premix Suppliers. The information collected informed understanding of the regulatory monitoring (quality assurance and quality control) processes and costs incurred by industries.

Secondary information was obtained from various sources including desk reviews of commonly available information from publications of organizations engaged in Nutrition; past studies undertaken by USAID Nutrition projects; regulatory information on food fortification; reports on the value chains and business modelling across food industries; and food studies undertaken in Uganda.

4 B2B Business to Business: Transactions or interactions between two businesses or organizations
5 B2C Business to Consumers: Transactions or interactions between a business and individual consumer. B2C businesses sell products or services directly to consumers for personal use
6 Business to Business to Consumers (B2B2C): Creates a mutually beneficial relationship between suppliers of goods and services and online retailers. B2B2C extends the B2B model to include e-commerce for consumers
7 The food fortification regulation supports Mandatory fortification is Maize flour at 20 MT, Edible oil and fat 10 MT and All Wheat flour processors, and All salts.

2.2 Analysis of Information

Analysis of the information was done using several business analysis tools, including SWOT (Strengths, Weaknesses, Opportunities, and Threats), PESTLE (Political, Economic, Sociological, Technological, Legal, and Environmental), Competitive Analysis, while the Sector Mapping, Marketing, and Operations of the business provide the basis of how food fortification was undertaken. The analysis evaluated how the industry businesses performed in key areas, such as: financials; production and sales; personnel management; and the learning environment. The report describes the food vehicles, business environment, products, markets and potential markets, economic incentives, marketing strategies, value chain mapping, industry risks, financing strategy, key performance indicators, and requirements to adopt food fortification as a business.

3.0 Analysis of the Business Models

3.1 What is a Business Model?

A business model is "*a specific combination of resources which through transactions generate value for customers and the organization*" used to deliver the expected fortification results (Lalani, B., Ndegwa, M., & Bennett, B. 2020). Combining the Business Model and Food Fortification is the basis of investigation on dynamics and cost drivers that frame what it takes to build a business case in the adoption of food fortification which determine: production scale; technology; incentives; governance, enforcement; and compliance of the regulation and standards; business level of operation; supply of inputs; demand for finished products; and form of intervention (e.g., output vs. process) to foster fortification.

On the demand side, Lalani et al., 2019, in a review of the efficacy of the different models used in fortification, highlighted three different types: (i) public-led, (ii) private-led, and (iii) multi-sector partnerships.

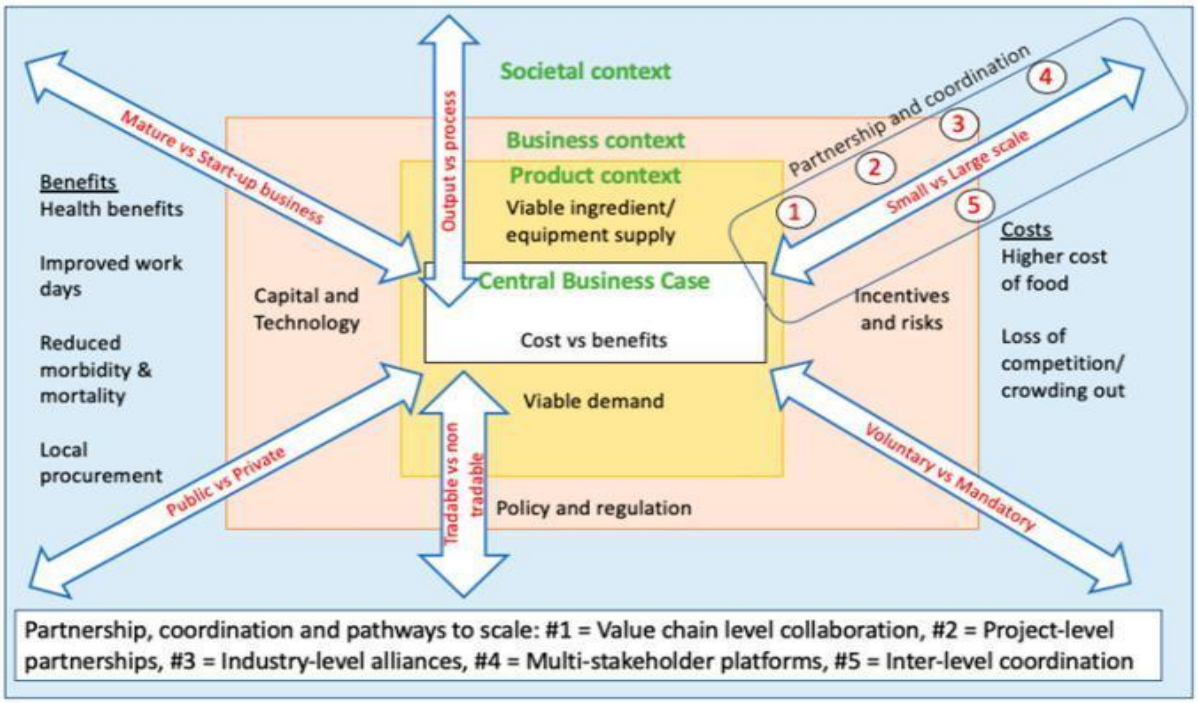
- Public sector led models are national fortification strategies which typically include mandatory fortification (legislation), enforceable regulation, and strong quality assurance (QA) and compliance.
- Private sector led models of fortification follow voluntary fortification and are based on the commercial market development of their products. They may, however, benefit from input from the public sector in the form of incentives (e.g., tax-related or equipment/training, etc.).
- Multi-sector partnerships are those which consist of a variety of stakeholders, e.g., public sector bodies, the private sector, and civil society organizations.

In Uganda, the public sector enforces the mandatory food fortification regulation and standards or legislation, which are implemented by government agencies who regulate and ensure compliance by industries of all wheat flour and salt processors. The regulation also mandates Maize flour processors of 20 MT or more per day, and edible oil and fats processors of 10 MT or more per day. The food fortification intervention is a high impact intervention in the reduction of micronutrient deficiencies in the country and is coordinated by the Ministry of Health through a multi-sectoral approach with engagements of ministries, departments and agencies, private sector institutions, including food industries, academia and research institutions, civil society organizations, and partners.

Central Business Case[8] is at the heart of all food fortification efforts. Viability can be assured in many ways, ranging from a full subsidy from the state or another actor to a completely market-based approach with costs being subsumed by non-state actors such as farmers, processors, retailers, and/or consumers. Driving the model is the interplay of the product, business environment, and consumer preference, taking note of the costs and benefits of fortification, as shown in figure 1 below:

[8] Central business case is based on five elements: 1) Strategic context: The compelling case for change. 2) Economic analysis: Return on investment based on investment appraisal of options. 3) Commercial approach: Derived from the sourcing strategy and procurement strategy. 4) Financial case: Affordability to the organization in the time frame. 5) Management approach: Roles, governance structure, life cycle choice, etc.

Figure 1: Framework Model for Food Fortification



Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7730650/figure/ijerph-17-08862-f001/

At the business level, Baqir Lalani, Michael Ndegwa, and Ben Bennett argue that a successful business model for industrial fortification initiatives invariably consists of: (1) the involvement of larger-sized firms that have the advantage of benefiting from mass production, (2) the availability and application of agreed standards by the food industry, (3) high-quality assurance/control for compliance monitoring (including post-mix testing where relevant), and (4) the ability to procure premix in a timely/cost-effective manner.

3.2 What is Known About Effective Business Models for Food Fortification?

What fortification models have worked where? How were the successful models designed? Who led them, and who was engaged?

Mandatory fortification programs are common around the world over and most especially - fortified wheat flour, with currently 85 countries who have mandated its use, and iodized salt in over 130 countries. Edible oils are an increasingly common vehicle for fortification, and thus far 27 countries have mandated oil fortification with Vitamin A. Currently, over 140 countries globally have guidance or regulations in place for fortification programs, the majority of which are mandatory. Also, about 85 countries mandate at least one kind of cereal grain (maize, rice, or wheat) be fortified with iron and folic acid (Olson, R et.al, 2021).

There is strong evidence from developed countries that food fortification is highly effective in addressing micronutrient deficiencies, especially in the case of mandatory programs. Mandatory or large-scale fortification entails the addition of one or more micronutrients to foods commonly consumed by the general population such as grains, salt and condiments or edible oil. It is usually mandated and regulated by the government sector, in response to evidenced micronutrient deficiencies or where a population, or sub-population, may benefit. These efforts are typically concentrated on the organized food processing sector and large- and medium-size industries.

One of the specific features of all types of food fortification is the important and required link between the public and private sectors as well as engagement from consumers, civil society,

academia, and the NGO/donor community. Regulation on paper is not enough to ensure fortification compliance without real incentives and strong and consistent consequences, which drive under-fortified foods out of markets.

An effective regulatory system and enforcement mechanism need to ensure that all producers are on a level playing field, i.e., none has the possibility to cheat, and producers integrate fortification in their business model, particularly in a context of limited public awareness and demand. Consumer demand is an important factor driving sustained private sector support for adequate fortification but will likely require time to create; price and taste are the most important factors driving demand.

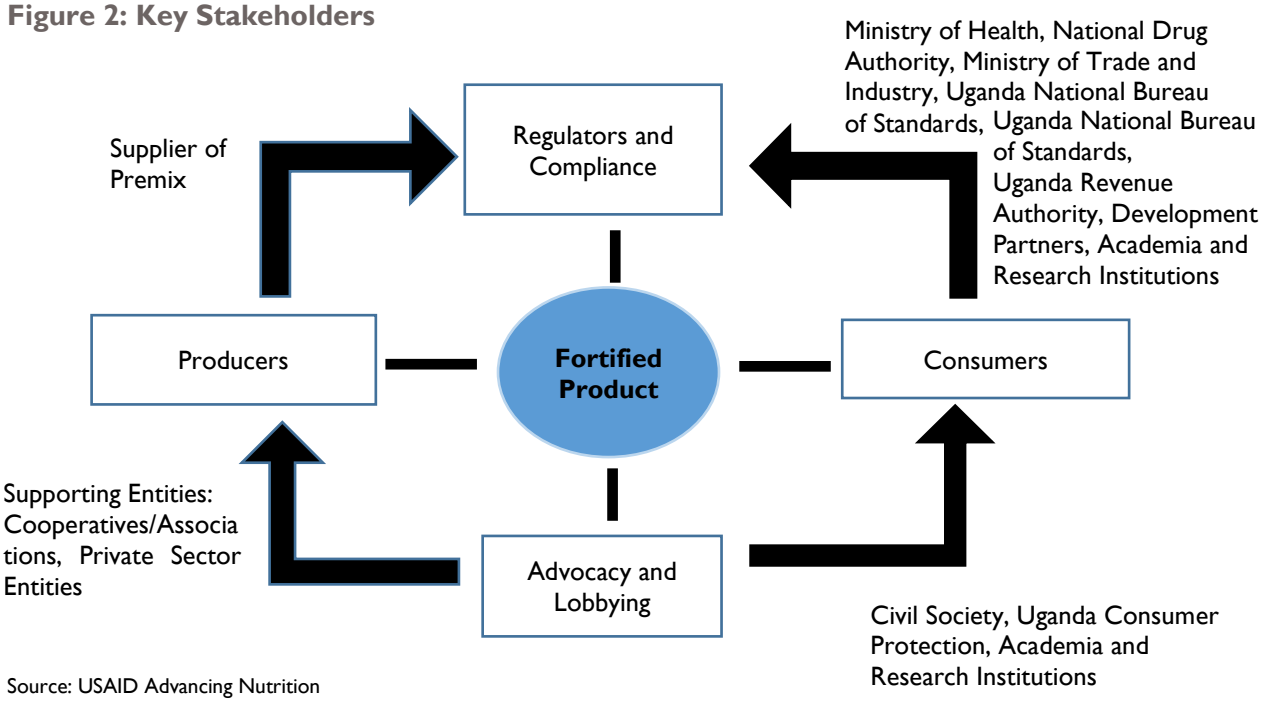
In many countries, one mechanism for addressing the multi-sectoral nature of food fortification is through the establishment of National Fortification Alliances (NFAs). These groups comprise stakeholders from a wide variety of sectors and help to coordinate and harmonise activities towards a common goal. Success factors for NFAs include shared leadership and decision-making, available budget to conduct coordination activities, and the formation of results-based short-term goals achieved through active sub-committees (Rehman, H et al. 2016).

In addition to the need for clear legislation and a legal basis for fortification, fortified-food producers face critical challenges and capacity gaps in ensuring their products meet standards through their own quality assurance and quality control systems, and national governments face challenges in identifying and holding producers accountable to this end. This is evidenced by industry data from 15 national mandatory fortification programs, which indicate that less than half (47 percent) of collected samples were compliant against relevant standards (Luthringer et al. 2015).

3.3 Who Are the Key Stakeholders to Consult on Issues Related to Business Models?

Key stakeholders to consult on issues related to business models for food fortification are shown in figure 2 below.

Figure 2: Key Stakeholders



Source: USAID Advancing Nutrition

Producers: The Food and Drug (Food Fortification) Regulations (amendment), 2011 mandates maize flour processors producing 20 MT or more in a 24-hour cycle, all wheat flour and salt processors, and edible oil processors of 10 MT or more in a 24-hour cycle to fortify. All ten

processors visited during this activity were producing fortified food products. They all maintained fortification as value addition in food processing and integrated QC and QA processes in the overall production.

Regulation and Compliance: The Government of Uganda through UNBS conducts regulatory monitoring of fortified foods for compliance of standards. Uganda's fortification program follows a system of regulatory monitoring that begins at the border and tracks the quality of raw materials and food products to the retail store level. The mandate for inspection and testing primarily rests with the UNBS, with the assistance of the URA at border points or ports of entry, and the NDA is responsible for regulating the import, transport, and storage of premix by food producers and importers. Specifically, the certifications scheme and quality assurance inspections are done annually and biannually respectively, where fortified food samples are collected from production facilities and are tested for a number of standard requirements including fortification, packaging, and labelling. The certification scheme is intended for attainment of a license known as 'the Quality Mark' as part of the certification scheme whose costs are met by the industries, and these have also been included in the business model.

Advocacy and Lobbying: Private sector institutions such as Private Sector Foundation Uganda and other entities, ensure that regulations and compliance benefit producers of fortified foods by advocating and negotiating for incentives that promote fortification.

Consumers: On the demand side, the final consumers must be made aware of the benefits, how to identify and or recognize fortified food brands, especially where there are exists both fortified and unfortified foods with support from entities like civil societies, Uganda Consumer Protection, and academia and research institutions. Demand creation and marketing of fortified foods entails the value proposition with the labelling and content of the required nutrition status and packaging of fortified foods.

3.4 What Skill Sets and Resources Should Be Identified to Improve Business

Looking at the entire value chain (maize flour, wheat flour, and edible oil, what are the critical areas of consideration at each stage in the development of a successful business model?

The critical areas for consideration in the value chain start with the business unit and support services that will help the business scale, attain technology, seek incentives, practice governance, advocate policy, and adhere to regulations. As the business nurtures to maturity, by fostering a steady supply of inputs at stable prices, and responds to the market demand for finished products, it has to deal with all items that tackle inputs, processes, and outputs to foster fortification. Developing a business checklist that identifies areas of support will help the business address the opportunities and challenges in its value chain.

Institutions that support businesses achieve their potential include: Uganda Investment Authority (UIA), PSFU, Uganda Manufacturer Association (UMA), National Chamber of Commerce, Ministry of Trade and Industry and Cooperatives, and the Uganda Registration Service Bureau (URSB). These institutions need to support these entities to approach food fortification away from a compliance lens and have a customer service approach.

The general business ecosystem, needs business planning, access to finance, operation efficiencies, compliance with food quality and safety standards, and marketing to attain a food processing sector that is economically viable and resilient, in addition to improving diets. Supporting the growth of large-scale food fortification creates an infrastructure that can improve other aspects of the food system, such as food safety, trade, regulation, and multi-stakeholder collaboration.

Specific to Food Fortification Regulation and Compliance, it is critical to ensure: 1) consumer demand for fortified foods; 2) installed advanced technology that supports fortification; 3) support incentives for food fortification: 4) quality affordable and accessible premix; and 5) quality and safe fortified foods.

4.0 Business Models and its Application in Food Fortification

The fortification process takes place at the end of production line, before packaging.

4.1 Assembly Line

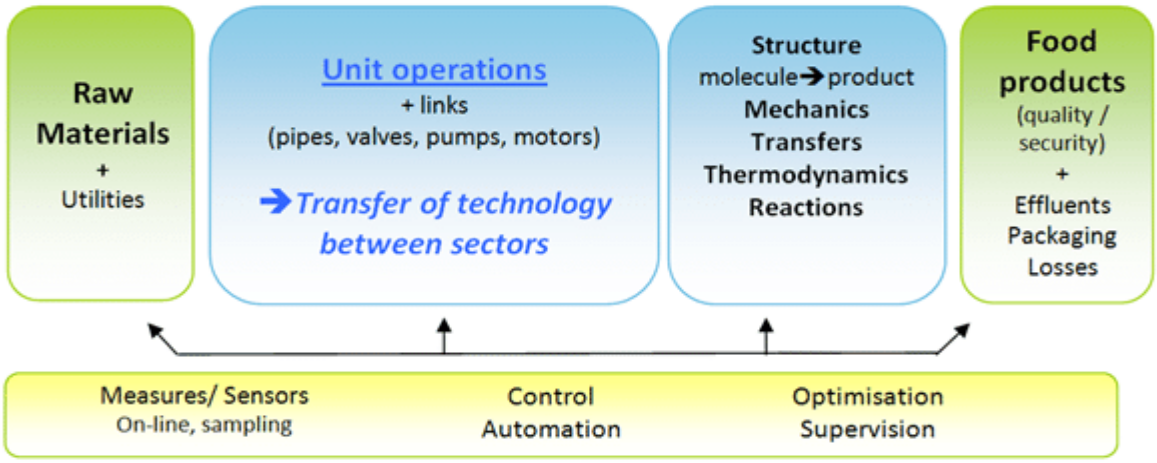
Assembly line is a production process that breaks the manufacture of a product/good into steps completed in a pre-defined sequence. Assembly lines are the most used method in the mass production of products. They reduce labour costs because unskilled workers are trained to perform specific tasks.

In the visited manufacturing industries/plants of maize flour, wheat flour, edible oils, and salt, assembly line production involved mechanised and automated lines that were geared towards:

- *Batch production*: where groups of items are made together in a shift or round of operation.
- *Flow production*: where identical, standardized items are produced on a continuous line.

The assembly line based on fortification utilizes only imported premix as guided by the food fortification regulation. The assembly line model is depicted in figure 3 below:

Figure 3: Assembly Line Food Production Layout



Source: https://www.researchgate.net/figure/Scheme-of-food-production-line_fig1_271122405 [accessed 22 Sep, 2022]

Food processors rely on input raw materials such as local domestic maize grains and sunflower, as well as imported products like palm oil crude, rock salt, and wheat grains. They use utilities like electricity and water to produce food products using assembly line operations and various technologies, such as using a roller and hammer for maize processing. The detailed structure of the food processing is based on molecular structure the product undergoes, with grain differing from edible oils and salt. Mechanics and thermodynamic reactions separate the main product (flour, oil, salt) from by-products (grain-bran wheat pollard, maize germ, and salt dust), which are sold for a price to avoid wastage and minimize losses. Premix are added at the end of the process before packaging and distribution.

Across all levels of manufacturing/processing taking place in Uganda for food and its fortification, the assembly line is highly customized to location setting and manufacturer's/industry level installation capacity, from fully automated to partially automated lines. The packaging at the end of the line is the most flexible, where batch sizes need to meet consumer orders based on optimization. Some

manufacturers have opted to use manual packaging instead of automated packaging, using women's labour to meet their Corporate Social Responsibility requirements.

The application of the dosifier on the assembly line has to meet the set capacity level of production and consider the packaging of the final material. Food product quality then has to adhere to the packaging ingredients (fortificants and affluents) in a consistent manner with minimal losses. The QC and QA mechanisms are set at this point based on legislation that gives items of inclusion as guided in the Food Regulations 2005 and amendment 2011.

4.2 Business Models for Food Fortification

This activity identified business models applicable in the context of Uganda where implementing mandatory food fortification is detailed across the four models as highlighted below:

4.2.1 Product-Centric Business Model

Each business format or model is located within a product environment. Product-centric delivery is less about products and more about the value that is delivered. In product-centric delivery, capabilities and services are delivered by a line of business or multiple lines of business together, which are often grouped around an end-to-end customer journey.

The main feature of the product-centric model is that supply is higher than demand. The product is produced without proof of consumer demand. The business evaluates the following:

- Is it a viable option as a business?
- Is it technically possible to produce?

Case Example 1

Mandela Millers experience on use of product-centric business model by Marketing of Fortified Maize and Wheat

Mandela Millers does not have the maize and wheat products differentiated along fortification as an exclusive marketing strategy. This is because the Food Fortification Regulations determines how fortified food should be promoted.

However, the company uses: different colored packaging, the fortification logo, and provides specifications. Mandela Millers markets fortified flour as a "popular Supreme Premium Quality Flour brand."

In Uganda, fortification is driven by the mandatory fortification regulation and standards set by the government for compliance by food industries. However, few maize industries fortify due to the unique value chain of maize as it is decentralized with majority of the millers being micro-small scale, and milling less than the 20 MT threshold, bringing high competition for the large-scale maize fortifying industries. For maize flour, this meant that industries created and differentiated maize flour in a market that did not yet know what fortification was since both unfortified and fortified products exist within the market. They provided a product that customers do not yet know they need, thus the focus is on marketing and selling the fortified foods. An example is the experience from Mandela Millers detailed in case example 1 above.

The Product-Centric Business model focuses on the following:

- **Human Focused:** Creating tangible value and superior quality/experience for the consumer/user is essential.
- **Business and User Value:** Governance and leadership of the company shifts from "time-budget-features" to business value.
- **Budgeting and Costing:** Product costs are captured as direct operational costs along each product with different return on investment (ROI).

4.2.2 Mass Economies of Scale Business Model

Economies of scale are cost savings that a business (and, by default, its customers) can reap as a result of efficient production processes. Generally, these cost savings are achieved because the

average cost of producing something falls as the volume being produced increases. At this point, the cost of production (including fixed and variable costs) is spread over more units of production.

To fully achieve economies of scale, the business must reap technical, procurement, and financial economies of scale. For food fortification, economies of scale has the food fortification process fragmented into:

1. **Technical** means you can manage the QC at high volumes.
2. **Procurement** can independently procure premix, store them securely to ensure compliance.
3. **Financially**, the operation is run at high volumes to have continuous uninterrupted production.

Case Example 2

BIDCO Uganda Limited leveraging on Mass Economies of Scale Business Model by Producing fortified palm oil for six edible oil brands

Utilizing a volume capacity level of 1,700 MT per batch, the industry has a dedicated QC team with advanced technology/equipment and skills required to monitor the fortification process before packaging the final product.

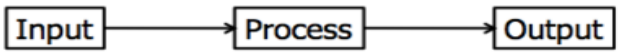
The Economies of Scale business model focuses on the following:

- **Scalability:** Creating mass production on large-scale manufacturing capacity.
- **Total Quality Management:** Governance and management structure to build systems that meet the highest level of compliance.
- **Product Portfolio:** Offer the same product in differentiated market segments to maximize pricing and packaging and attain maximum revenues.

4.2.3 Input-Output Process Model

The Input-Process-Output (IPO) analysis model assumes that business entities (such as firms, offices, and plants) use inputs, perform processes, and produce outputs to sustain themselves and to expand.

- Inputs include non-labour resources, manpower, data, and money.
- Processes, which transform inputs into output, include functions, actions, and operations.
- Outputs, which are the results of processes, include products, information, and reports.



Case Example 3

The Mukwano Group of Companies' experience in the use of IPO model using Sunseed Sunflower Premium Cooking Oil

To manage the inputs, Mukwano initiated the growing of Pan 7351, a hybrid sunflower variety that increases oil production by 10%, and distributed the seed to farmers in Masindi and Lango regions.

The company set up the initial process level for crude sunflower oil mill at the source in Lira and final refining in Kampala to efficiently manage production costs.

The end game is that fortification becomes an embedded part of the process with minimal costs.

For food fortification, inputs are the food vehicle (maize, wheat, edible oil, and salt) that needs to be processed with the fortificant to attain the output of the desired level of fortified wheat and maize flour, oil, or salt for human consumption.

The IPO model analyzes the interrelationships of all the activities in a business. For a successful business, the input's cost and/or quality is the basis for enabling the process to attain the required margin to meet the desired price. It all begins with the source of the major ingredient to build processes upon.

The IPO business model focuses on the following:

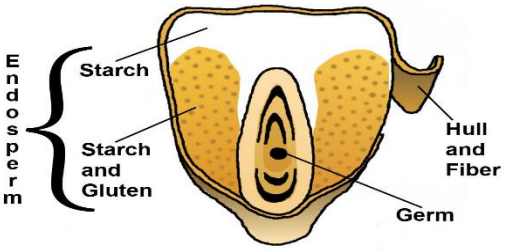
- **Resource-Driven:** Creating utility on available inputs.
- **Attain Efficiency:** Governance- and management-structured build systems that attain operational capacity.
- **Costing:** Apportion costs along the production line to attain profitability.

5.0 Analysis of the Food Vehicles

5.1 Maize

The maize milling industry plays a central role in the grain value chain, turning safe and quality grain into a range of products for further processing and human consumption. The maize kernel is composed of four primary structures from a processing perspective: endosperm, germ, pericarp, and tip cap.

Figure 4: The Maize Grain component



1. **Endosperm 83%** (starch)
2. **Germ 11%** (oil)
3. **Pericarp 5%** (hull and fibre for bran)
4. **Tip cap 1%**

Process: Milling maize grain includes particle size reduction of clean whole maize with or without screening separation, retaining all or some of the original maize germ and fibre. De-germination of maize involves mechanical separation and processing, resulting in dry shelf-stable products with a majority of both germ and fibre removed. Much of the particle size reduction and separation is accomplished with equipment similar to that employed in wheat flour milling, including hammer mills, stone mills, roller mills, screeners, sifters, specific gravity separators, and aspirators.

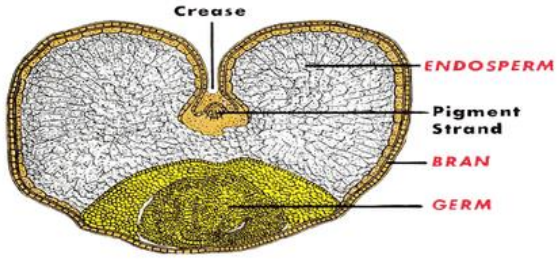
Products: The products of maize dry milling include flaking grits; coarse, medium, and fine grits; coarse or granulated meal; fine meal; and maize flour. In the study, we noted that maize milling has three main products at extraction:

- **Maize flour (58 percent):** The vitreous endosperm is the most starch-rich part of the kernel. After several milling, separation, and blending phases, a wide range of products, from semolina to flour and grits, is packaged in 2 kg, 5 kg, 10 kg, 50 kg, and 100 kg as Super Grade 1 flour.
- **Bran (27 percent):** Found in the grain's pericarp, and when mixed with the starchy endosperm, it can be used in the composition of complete feed materials packaged in 20 kg and 50 kg.
- **Germ flour (12 percent):** Sold as Grade 3 flour, and the germ is used to extract virgin maize oil.

5.2 Wheat

Wheat is one of the world's most consumed cereal grains. Whole wheat grain grinding results in 90–95 percent extraction rate flour, which retains almost all the grain's nutrients while simultaneously eliminating the indigestible parts of the grain (like cellulose and phytic acid) that binds to and carries away minerals.

Figure 5: The Wheat Grain component



The wheat grain is made up of:

1. Endosperm: 80–85%
2. Bran: 13–17%
3. Germ (Crease and Pigment Strand): 2–3%

Modern milling of wheat consists of the separation of bran and germ from the endosperm and reduction of endosperm to fine flour (whole meal flour 95 percent, brownish flour 85 percent, creamy flour 80percent, and white flour 70 percent). In addition, the industry visits documented wheat extraction during the production process of production as:

- **Flour:** Crushed and separated endosperm that becomes white flour fortified for both home baking (B2B) packaged in two kg and bakers (B2B) with enhancer in 20 kg and 50 kg.
- **Bran:** The covering in the grain that is used as an ingredient for animal feed.
- **Pollard:** Used as an ingredient for processed foods, with most exported to Kenyan companies for higher market demand and value.

5.3 Edible Oil – Palm Oil and Sunflower Oil

Refining crude palm oil and sunflower oil into edible cooking oil involves converting the oil from its crude form, typically extracted from the seed in a milling factory, to refined oil by removing impurities through hydrolysis and oxidation as well as adjusting for colour and flavour. The process involves degumming, deacidification, decolorization, bleaching, and deodorization. Alkali neutralization, which may occur between degumming and bleaching, can be used in soap making. This process requires the use of chemical refining methods and allows for the production of both refined cooking oil and soap from the same production line.

The products from the oil milling and refining include:

- **Edible oil:** Final refined oil that is fortified for human consumption from sachets (25, 50, 100, 500, and 1,000 millilitres) to opaque jerry cans (1, 2, 5, 10, and 20 litres).
- **Seed cake:** Rich in nutrients and sold as animal feed in 20 kg and 50 kg.
- **Liquid waste or Palm Oil Mill Effluent:** Generated from the processing of fresh palm oil milling; used as waste treatment, organic fertilizer, and biofuel.

5.4 Salt

Raw salt blocks are crushed and ground into finer particles, which are collected in a hooper, mixed with water, and then sent through a conveyer belt into another grinding machine to make the salt even finer. Next, the particles are transferred to a dyer to separate the powder and salt particles for human consumption. The edible salt is ground into the final required particle size and fortified before packaging. The final products are ready for human consumption.

- **Iodised salt:** For human consumption; packaged in 250 gm and 500 gm packets.
- **Fine salt dust (industrial salt):** Used for bakers and soap manufacturers packaged in 20 kg and 50 kg.

6.0 Analysis of the Market and Potential Customers

6.1 Maize

Maize end users can be divided into three primary categories: (1) human consumption; (2) ethanol for fuel; and (3) animal feed. Prominent outputs of the milling segment are categorised by particle size and include flour, grits, meal, bran, and kernels. The Ugandan maize market has:

- **Grain harvest**: post-harvest losses (30 percent), on-farm consumption (18 percent), domestic market (28 percent), export market (22 percent), and seed savings (two percent) (International Growth Center policy brief).
- **Processed maize** at domestic market is segmented as flour (60 percent), animal feed (37 percent), and breweries (three percent) (Kilimo Trust 2017).

6.2 Wheat

Most of the wheat in Uganda is imported from Russia, Ukraine, and Argentina. There's limited domestic production in Kapchorwa, and is characterized as *hard wheat* and are not preferred for processing. In 2020, Russia and Ukraine produced 28 percent of the world's total wheat exports. At pre-war crisis levels, the two-year average (2018–2019) of wheat exported from Russia was 38.6 million MT and from Ukraine was 18.7 million MT. Current dependence on wheat imports from Russia and Ukraine imperils food security in lower- and middle-income countries in North Africa and the Middle East, the Mediterranean, sub-Saharan Africa, South Asia, and throughout Southeast Asia that depend on wheat as a staple diet (FAO June 2022).

Wheat flour in Uganda is processed by major companies, as indicated on the UNBS Certification and Information Management Systems website. Wheat processing is a high capital investment which requires advanced manufacturing plant and equipment, requires procuring imported grain and premix and operating the manufacturing plant – all of which attracts high costs. The major market is mass urban population on wheat-based diets, a trending lifestyle. Wheat flour mainly sold and distributed as processed white fortified flour. The market had 54 wheat brands before the COVID-19 pandemic, 44 in 2020, and 49 in 2021 and currently at 55 in 2023 as viewed in April 2023. (UNBS Certification and Information Management Systems, 2022)

6.3 Edible Oil

The East African Community remains highly import-dependent for edible oils, with annual imports increasing by 50 percent in 2017 to nearly 1 billion USD, creating a large demand for local production (UN COMTRADE). Palm oil accounts for 70 percent of edible oil imports in East Africa (Kilimo Trust 2017), with the need for edible oil in Uganda estimated at 200,000 MT per year in 2017 (The Independent). Uganda has had 468 percent growth in edible oils imports (UIA, website). Uganda now imports 350,000 MT of vegetable oils, of which 97 percent is crude palm oil and its derivatives, and country spent about USD 300 million (UGX 1.1 trillion) on average. In 2020, Uganda spent USD 289 million (UGX 1 trillion), 93 percent of which was palm oil (Monitor July 2022).

6.4 Salt

All the widely available salt in Uganda is imported. One of the two local salt companies, Kampala Salt, produces salt from imported raw salt from Kenya, as the Katwe Salt mined in Uganda is not fortifiable, and does not have a commercially viable contribution to the overall demand and production. Mining salt at Lake Katwe is done by miners using traditional methods for harvesting the salt. The site is better known for its tourist attraction. Kampala Salt exercises a near monopoly as it faces competition from only large distributors of the imported finished product.

7.0 Economic Incentives

The incentives for food fortification along all the food vehicles (maize flour, wheat flour, edible oil, and salt) is captured in table 1 below, showing the item for consideration, current status, and the proposed incentives.

Table 1. Economic Incentives for Food Fortification

Item	Status	Proposed Incentive
Taxation	The current taxation to the industry and equipment for processed food is 18 percent value-added tax (VAT) and six percent withholding tax though, and this rate varies depending on the capacity and level of the industry. For fortified foods, that is an added input element/cost driver, increasing costs of production and to the finished product that is passed on to the consumer at a higher price.	Consider tax waivers or reductions in tax duties/levies on imported fortificants and fortification equipment/technology. Consider transfer of fortification costs within the final food product price to be met by consumers. Consider channelling government revenues from food-related tax duties or levy on taxes (e.g., value-added tax on the price differential associated with fortification of staple foods) to national and subnational budgets to strengthen inspection and enforcement of food quality and safety standards.
Premix	The price of premix/fortificant ranges from UGX 40,000 to UGX 60,000 per kg depending on: quantity, source of fortificant, purchased directly from the manufacturer or the agent in Uganda. Delivery timelines of a batch order is 90–120 days, yet fortification is a continuous process tagged to production and forward purchases. Fortificants need a high-level storage facility which can only be possible with large industries.	Availability, access, and affordable prices of fortificant are key in incentivizing fortification. In free market, supply, procurement processes (including financing), and distribution systems will help ensure premix availability, quality, and traceability. It was suggested that dedicated premix businesses, including regional operations, could sell or distribute premix to millers or other food processors within or across countries. This can be done at private level or dedicated government agency to lower costs of individual industry importation.
Technology	Below the threshold of the 20 MT maize flour, 10 MT edible oil, and all wheat flour and salt, the challenge is how to support small millers with technologies that support fortification e.g., a dosifier that is affordable within their capacity/financial adequacy- Capital	Explore business models that enable fine flour fortification to control costs e.g., subsidies on machinery, cheaper financing options. A look at the Sanku Model that supports small maize millers to fortified could be explored.

Item	Status	Proposed Incentive
	Expenditure (CAPEX) and Operational Expenditure (OPEX to adopted processes that give rise to added costs.	
Electricity	Milling that includes fortification is highly dependent on a stable, reliable, and fairly priced electricity to avoid price escalation to consumers. There is agreement among all manufacturers/industries that it is a high-cost component that needs to be addressed especially with the use of dosifier and ensuring mixing of fortificant is properly done at the production level.	Decentralisation of industry and zoning of industrial parks for supply of amenities (stable and cheaper power, water, road/rail transport) for manufacturers/industries need to be fostered and administered. De-zoning for factories across the country must follow the long-term infrastructure plans for adequate supply of required support services for efficient and cost-effective operations.
Quality Assurance and Quality Control	Current QC and QA inspections are coordinated with UNBS, UIRI, and other designated entities. Some of these costs at industry level require specific food fortification QC/QA that have properly trained personnel, and adherence to protocols to meet set standards. Costs of testing samples at designated certified labs ranged from UGX 30,000 to 80,000 per sample, with a timeline ranging for completion from one week to one month.	Structure the QC/QA processes at certification for fortificants/premix to address premix quality concerns that affect compliance to standards by the finished fortified product. The QC/QA process needs to be expounded in the Food Fortification Regulations 2005; 2011. Avail and disseminate operational guidelines to all processors as part of business support to the QC functions. A demarcation of required skills for Food Scientists needs to be detailed along QA/QC requirements.

Source: Study Research Notes

8.0 Marketing Strategy

Legislation on Marketing Fortified Food: The Food and Drug (Food Fortification) Regulations 2011 10 (1) states, *"The Minister of Health shall regulate the conduct of promotional and advocacy activities on the use of fortified foods through the food fortification logo and other programs designed to promote nutrition."* The question raised is 'What can fortifying food producers do to market products? Can they use fortified foods as a differentiator in marketing to existing and potential customers'?

For consumers in the mass market, studies have shown there is lack of knowledge of what a fortified food means. The consumer is interested in being able to purchase what is available, and price is a key factor in making a choice of what to buy. The major manufacturers produce and provide fortified food as a means of meeting the legislative requirement. To increase sales revenue, companies should focus on the 4Ps of marketing (product, price, place, and promotion):

- **Product:** Fortified foods can be sold as a means of improving a dietary deficiency, taking into consideration the legislation guidance on advocacy and promotion of the use of fortified foods as stated above. The completeness of the product must answer who needs it and why? Who else is producing it, and how can one differentiate? Most important is to capture the consumer imagination on the fortified food by targeting lifestyle consumption. For Uganda, this means joint efforts between public and private entities for the four food vehicles while factoring both the dietary-nutritional concerns and the business viability of feeding the masses with quality well priced/ affordable fortified foods.

- **Price:** Fortified food producers can emulate the success of companies that have marketed fortified foods legally, emphasizing quality, packaging, and brand image. To appeal to consumers, companies should align the price of their products to their real and perceived value with an aim of a price that covers supply costs, seasonal discounts, market substitute prices, and retail mark-up for distribution.

- **Place:** The choice to either have mass advertising or discrete placement is a means to consider where the product should be availed. With market segmentation, the fortified producer must choose distribution channels that cater to the final consumer. Efforts could include targeting the household level with emphasis on women, who determine (gate keepers) what food to buy for the family.

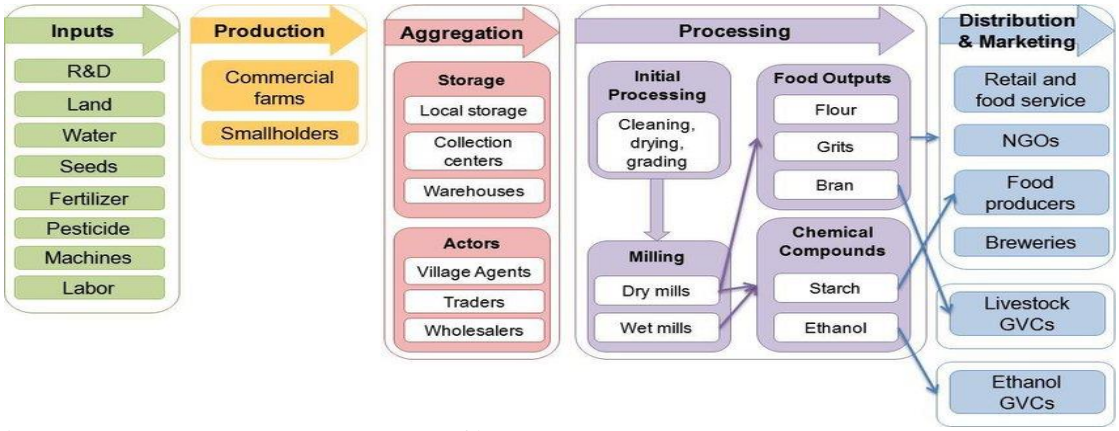
- **Promotion:** To promote fortified foods, producers must gain support from the Minister of Health in charge of this domain. By collaborating and partnering with country programs, producers can work to create policies that promote fortified foods, such as working with the Ministry of Education and Sports to promote healthier meals for students/learners. Promotion includes advertising, public relations, and media strategy to introduce the product to new markets and retain existing consumers.

9.0 Value Chain Mapping

9.1 Maize Value Chain

The maize value chain can be divided into five categories: inputs, production, aggregation, processing, and distribution and marketing. See details on the maize value chain in figure 6 below.

Figure 6: The Maize Value Chain



Source: www.theigc.org – Maize value chains in East Africa

Inputs: The most important inputs in agricultural value chains are typically land, seeds, fertilizers, agrochemicals (herbicides, fungicides, and pesticides), farm machinery and equipment, water, and labour. Other services include those that support this stage of the value chain: extension services, market information, credit, and certifications for production in niche organic or other high-value markets. The majority of production is done at small farm holdings with minimal add-on support services while heavily dependent on natural climatic settings. There is low use of purchased inputs (fertilizer, pesticides) at the farm level and confined to minimum requirements for production.

Production: The geographic, environmental, social, and political characteristics are important contextual drivers of competitiveness in production. Soil types, rainfall or access to water, temperature variations, and land ownership structures significantly affect maize productivity. Production is under great pressure due to climate change. In Uganda, maize is produced across regions: Eastern (47 percent) Western (21 percent), Central (19 percent), and Northern (13 percent). There are 2.5–3 million smallholder farmers on plots less than 0.5 HA; a few foreign companies have invested in commercial maize production with contract farming for incentivizing small farms (International Growth Centre, 2017).

Aggregation: This segment of the chain is more prominent in Uganda, where there are few large-scale modern productions. Integration is not widespread; networks of village agents, retail traders, and wholesalers buy maize from small-scale farmers and sell it to processors. There is no capacity to differentiate outputs by quality, and farmers have no incentive to invest in expensive inputs. In aggregation and bulking, there are post-harvest losses (22–30 percent) and 20–25 percent moisture higher than the 13.5 percent East African Community (EAC) standards. While there have been several attempts for centralized commodity trading and warehouse receipts system, many processors opt to directly purchase maize grain from bulkers and aggregate it.

Processing: Maize must be processed before being incorporated into a range of end products. Initial processing includes cleaning, drying, and grading. There are two primary milling techniques for maize: dry milling and wet milling, and the dry mill technology is dominated by the medium-scale urban millers who use roller mills to produce 50 MT/day of grade 1 (highest quality) targeting regional markets, institutional buyers, and animal feeds; and 600 small-scale rural millers (85 percent of millers) who use hammer mills to produce less than 10 MT/day of grade 2 (second-highest quality).

Marketing and Distribution: Maize's outputs of the milling segment are categorised by particle size and include: flour in packaging for individual bakeries; grits and meal for final consumption and other manufacturers; bran for livestock and animal feed; and kernels for germ flour as grade 3 flour for consumption. Distribution:

Tier 1: Kenyan large-scale buyers (20 – 30 percent); asks for high EAC/Kenyan standards and pays 30 percent premium

Tier 2: Major institutions; World Food Programme buys 50 percent but lower margins than Kenyan buyers

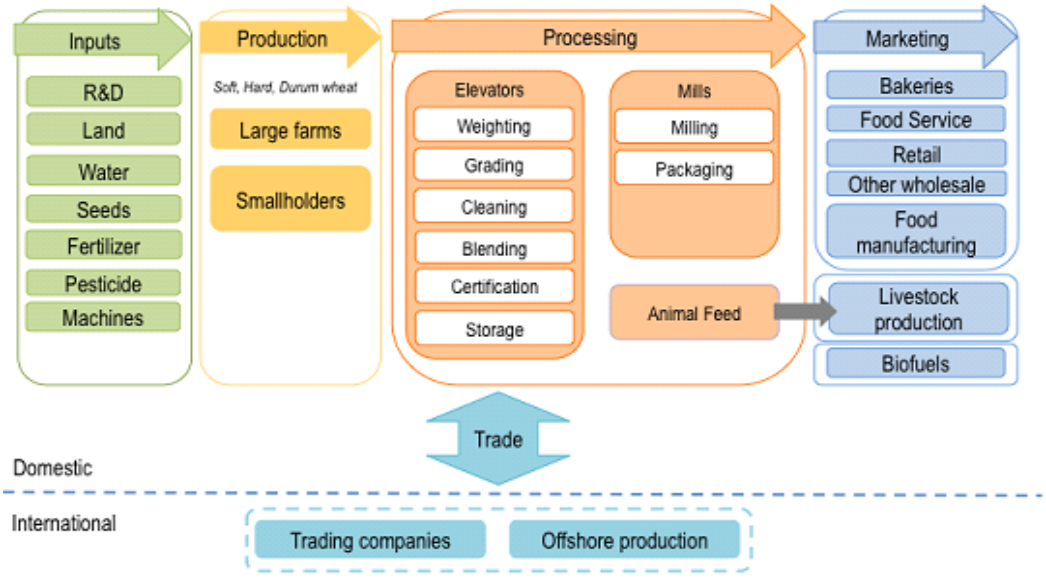
Tier 3: Regional customers in Rwanda, South Sudan, or small mills in Kenya (10–20 percent)

Tier 4: Informal buyers with no quality demands, five percent.

9.2 Wheat Value Chain

The wheat value chain is depicted in figure 7 below:

Figure 7: Wheat Value Chain



Source: https://sites.duke.edu/minerva/the-global-value-chain/

Inputs and Production: Domestic production of wheat in Uganda is limited. It mainly happens in Kapchorwa. Supply is inconsistent and has poor post-handling practices. The wheat varieties grown in the two rainy seasons are considered the "hard wheat" and not preferred for processing.

Processing: Most of the wheat input for processing comes from imported wheat grain. Given the large global supply chain, wheat is delivered from off-shore production at Mombasa and Dar es Salaam ports in high volumes for consolidated single purchases. The two main off-takers (trading companies) at port for wheat grain destined to Uganda are Grain Pulse and Master Grain mills, who purchase in bulk and distribute to millers. Utilizing infrastructure like cargo trains and hauler trucks, the companies provide consistent supply delivery with use of large storage silos in Jinja and Kampala.

Marketing: Wheat flour and its by-products are marketed under three primary categories: (1) home baking flour for individuals; (2) bakers' flour and pollard for businesses; and (3) bran animal feed. Home baking is sold in retail outlets using distribution networks. Bakers flour and pollard are sold to food service segment (bakers' flour to bakeries, pollard to food manufacturers). Bran is sold to livestock production and animal feed manufacturers.

9.3 Edible Oil Value Chain – Palm Oil and Sunflower

Edible (cooking) oil is either liquid or fat that is produced in well laid out manufacturing systems. See details on the edible oil value chain in figure 8 below.

Figure 8: Edible Oil Value Chain

Production: Oil seed (palm oil and sunflower oil) is grown by farmers as a major cash crop. The main processors of edible oil provide quality seed to attain productivity of higher oil content. For imported palm oil, production systems are extensive and skewed to supply global markets. In Uganda, sunflower is grown by small-scale farmers largely in the Northern part of Uganda (Lira and Masindi districts). Commercial Palm oil plantations have recently been introduced in Lake Victoria islands of Kalangala and Buvuma.

Milling: Oil is extracted from the seed. The process is done quickly as soon as harvest is made. At this point, crude oil is extracted either with heating or cold press mills. The oil is cleaned to avoid impurities and ready for shipment to the refineries. Lira town is now a hub for crude oil milling from sunflower seed.

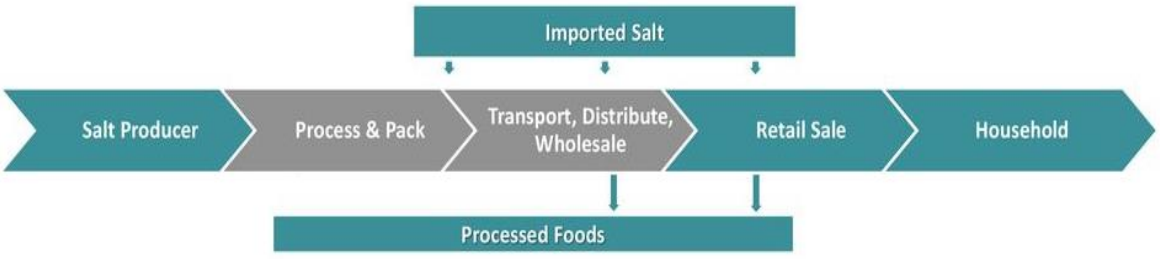
Refining: Crude edible oil is an input for further processing, while extracts of cake and other by-products are utilized for animal feed. Majority of palm oil processed in Uganda is derived from its crude oil that is sourced on a global network with installed offshore refineries at major ports of delivery like Mombasa which serves the East African market.

Manufacturing: Refining is the final processing into edible oil that is fortified. Major companies producing edible oils in Uganda include: BIDCO Uganda Limited Mukwano (also trading under the subsidiary A.K. Oils and Fats), Vegol Limited, Nile Agro Industries, and Bajaber Industries for the domestic market and some exports to the region.

9.4 Salt Value Chain

Salt production processing and marketing is highly structured given it's a necessity and having evolved over the long historical background. Salt is delivered as iodized salt for home consumption and fine salt dust for industrial use (B2B). Fortified (Iodized) salt is largely imported from Kenya and Tanzania, with only about three percent local production and the fortifiable rock salt is imported from Kenya and India. All fortifiable rock salt for local production is imported as the Katwe salt is unfortifiable. See details on the salt value chain in figure 9 below.

Figure 9: Salt Value Chain



Source: https://slideplayer.com/slide/14630494/

Salt Production: In Uganda, there are two local salt producers. The assembly line set is largely driven by availability of electricity and rock salt (which is the main raw material). At a capacity of 200 MT per day, the company can respond to demand.

Processing and Packaging: Processing of salt along the assembly line is competed with the important step of fortification (iodization). The remainder which is fine industrial salt is separated and packaged as a different product.

Transportation, Distribution, and Wholesale: Salt is marketed and distributed across the country through a hierarchy of national and regional distributors, wholesalers, and retailers, including large supermarkets and small stores.

Retail Sale and Household: The last mile of salt consumption is done at the point of sale (POS) where consumers can purchase salt. The POS is taken to be as the final distribution point and where intake as a fortified product takes place.

10.0 Risk Analysis and Mitigation Measures

Stakeholders, including governmental institutions, should recognize the private sector imperative that their operations must be profitable. The private sector should be encouraged and supported to comply with fortification standards because it is both socially responsible and good business to meet food quality and safety standards. Fortification costs can be largely or entirely offset by improved efficiencies, financing, and pricing of fortified foods.

The purpose of a quality risk management plan is to help ensure continued compliance with regulatory requirements, such as good manufacturing practices or excellent laboratory practices, where and when events occur during manufacturing that potentially impact product quality. Table 2 below provides the potential risks in the food industry business.

Table 2. Risk Analysis Matrix

Type	Trigger, Description, and Mitigation	Level
Market Risk	**Trigger:** Fluctuations in the availability and price of raw materials on the supply side and on the demand side purchase prices by consumers **Description:** Production and pricing of inputs are determined by constantly changing market forces of supply and demand over which a business has limited or no control, like weather patterns/climate change and disease throughout the world, as agricultural and energy policies of domestic and foreign governments. **Mitigation:** Offset commodity fluctuations with pricing actions over time. Use of forward contracts along production quantities to demand quantities and prices.	Low Medium High
Operational Risk	**Trigger:** Demand for products can be adversely impacted by utilities costs (water and electricity tariffs); breakdown in equipment can have a significant impact on production. **Description:** Interruptions delays and loss of manufacturing batches as cost escalate with failure to deliver quality product at set price. **Mitigation:** Efforts are taken to deal with manufacturing costs with adherence to processes that lead to both excellence in processes and extensive precautionary measures designed to target full production levels.	Low Medium High
Consumer Risk	**Trigger:** Changes in consumer preference and/or sourcing of product can negatively impact demand. **Description:** The food industry is subject to changing consumer trends, demands, and preferences. Failure to identify and react to changes in these trends could lead to, among other things, reduced demand and price reductions for products. **Mitigation:** Advocate and advertise with packaging and branding to attain consumer confidence on food safety and influence preferences and acceptance. Have signed written contracts with major clients.	Low Medium High

Type	Trigger, Description, and Mitigation	Level
Economic Risk	**Trigger:** Deterioration of economic conditions with negative impact. **Description:** Business may be adversely affected by changes in economic conditions, including inflation, interest rates, consumer spending rates, energy availability and costs, and the effects of governmental initiatives to manage economic conditions. **Mitigation:** Need to hedge against changes could adversely affect the demand, specifically price discounts and promotions, interest rate and inflation hedging, negotiated and alternative energy sources, and long-term supply contracts of raw materials and packaging materials.	Low Medium High
Compliance or Regulatory Risk	**Trigger:** New or more stringent government regulations could impose material costs and could adversely affect business. **Description:** Changes in laws or regulations that impose additional compliance requirements on the business could increase the cost of doing business or restrict operations, causing adverse results. **Mitigation:** Lobby, collaborate, and partner with government through trade and agricultural associations at the local and national level.	Low Medium High

Building from the Risk Definitions in table 2 above, the respondents provided insights on risk levels summarised in table 3 below:

Table 3. Risk Levels for the Food Vehicles

Type	Maize	Wheat	Edible Oil	Salt
Market Risk	Low	High	Medium	High
Operational Risk	Low	Medium	Low	High
Consumer Risk	Low	Medium	Medium	Low
Economic Risk	Medium	Medium	Medium	Medium
Compliance/Regulatory Risk	Medium	Medium	Medium	Medium

11.0 Financing Strategy

The financing strategy on fortification for a food industry must be viable. At any level of production, the additional process of fortification should cover the costs and attain benefits for its revenue, profitability, and growth in the market.

The financing strategy for food fortification must consider the following factors:

- **Cost drivers of production:** Can they be identified so that fortification process can be attributed and laid out for consideration and analysis?
- **Scalability:** The incremental cost of fortifying at the various levels of production capacity.
- **Pricing of the final product:** Can the additional fortification process still have the product within the competitive range of final price to consumer? Or alternatively attract a premium based on added value out of fortification?
- **Funding sources:** What is the source of funds for additional equipment, materials, and staffing/personnel required? Is it available, and at what cost?

In this study, the factors above were used in designing the business case models for maize flour, wheat flour, edible oils, and salt fortification as guided by the Food and Drug (Food Fortification) Regulation and Standards. It entailed analyzing the funding levels to break even and showing trends along the different levels of production.

The financing strategy within the business model builds the costs as the foundation for operationalizing fortification as an effective business approach, including but not limited to the required organizational structure, technical skills and trainings, economic incentives, and financing (inclusive of income and costing projects and business financing requirements). It establishes the unit cost, then thorough analysis builds on the income revenues of each of the products, along the different production levels.

Financing for food processors is built around plant and equipment leasing for the factory and OPEX required to establish full costs of production. The business owner funding contribution is equity covered in land acquisition and construction of buildings required. Typical financing structure in Uganda is laid out in a credit facility built along: 1) drawdown with set limits of interest rates set by both development and commercial banks; 2) utilization of central bank established facilities; 3) emphasis on collateral cover on the business assets; and 4) seeking government guarantee for priority industry like edible oils and/or those that use of locally produced inputs like maize.

11.1 Assumptions and Factors for Fortification

Fortification is integrated into the manufacturing process at a stage that precedes packing to ensure the nutrients are preserved in the final product.

The cost items associated with fortification include:

- **Input costs:** Sourcing of raw material, i.e., price, quality, and delivery cost to the processing plant.
- **Premix:** The cost of premix and amount required to add onto the product. This combination is based on the regulation standards.
- **Technology:** The use of the dossier as a Capital Expenditure (CAPEX) cost and its placement on the production assembly line. Includes the amount of electricity it consumes as an added cost and the manpower required to operate and monitor its functionality.
- **QC:** Internal monitoring of the fortification with regard to ensuring that production is attaining the fortification levels. Includes the costs of running the QC unit in the manufacturing plant. Involves monitoring the quality of the end product.
- **QA:** External costs for adhering and ensuring compliance to regulations and standard. Includes the inspection, audits, certification fees, and costs. Involves the monitoring of the process.

11.2 Unit Cost Analysis – Fortification as a Component

Based on the cost components of the premix, an array of costs was collected from the manufacturers of maize flour, wheat flour, and salt from the finance departments. Edible oil information was not accessed. The table below captures the cost information for three commodities.

Food Fortification Model

Costing per MT

USD/UGX exchange rate	3750

Sales Price per commodity

Maize		***Wheat***		***Salt***	
Fortified Flour	3280	*Fortified Flour*	3625	*Fortified Salt*	800
Bran	800	*Bran*	700	*Fine Dust Salt*	900
Germ/Pollard	800	*Germ/Pollard*	800		
Units (KG to MT)	1000				

Commodity	**Maize**	**Wheat**	**NOTES**		**Salt**	**NOTES**
Sales Prices						
Fortified Flour	3,280,000	3,625,000	per MT	Fortified Salt	800,000	per MT
Bran	800,000	700,000	per MT	Fine Dust Salt	900,000	per MT
Germ/Pollard	800,000	800,000	per MT			
Output Matrix				**Output Matrix**		
Capacity of Plant	1	1	MT of flour per Hour	Capacity of Plant	8	MT of Salt per Hour
Production Cycle Time	20	20	hours worked in 24hours	Production Cycle Time	12	hours worked in 24 hours
Working Days in a Month	26	26		Working Days in a Month	12	
Working Days in a Quarter	78	78		Working Days in a Quarter	36	
Working days in Half year	156	156		Working days in Half year	72	
Extraction Rates %				**Extraction Rates %**		
Flour	59%	75%	dependent on type of grain	Fortified Salt	81%	per MT
Bran	26%	20%		Fine Salt	9%	per MT
Germ/Pollard	11%	3%		Normal loss	7%	per MT
Loss (Flour Dust And Chuff)	2%	2%		Abnormal loss	3%	per MT
Purchase Costs				**Purchase Costs**		
Price per MT of grain	1,980,000	2,380,000	as of 21/09/2022	Price	740,000	as at 21/09/2022
Supply time	Daily or Weekly	after 6 months	currently maize was purchased weekly	Supply time	7	Supply-delivery time
Fortificant				**Fortificant**		
Price per Kg	50,000	46,000		Price per Kg	20	Kg of Iodine
Supply Time	after 2 weeks	after 3 weeks		Supply Time	7	Supply Time
Ratio of Application Kg/MT	0.5	0.4	500gm (maize) 400gm(Wheat) per MT	Ratio of Application		35gm per Kg
Technology Costs				**Technology Costs**		
Dosifier CAPEX	1%	1%	at 12.5% per year or 1.04% per month	Dosifier CAPEX	2%	at 25% per year or 2.125% per month
Utility Costs (Electricity)	29,000,000	30,000,000	per month (UGX) for a1MT per hour	Utility Costs (Electricity)	31,000,000	per month UGX for 8 MT hour plant
Production Salaries	12,000,000	14,000,000	salary paid per month	Production Man Hours	8,000,000	total salary paid per month
Production Rates	20%	20%	Fortification Stage is the last before packaging	Production Rates	15%	Fortification stage is the last stage before packaging
Quality Control Costs				**Quality Control Costs**		**Quality Control Costs**
Staffing Costs	1,000,000	1,000,000	per month	Staffing Costs	106,000	20% of the 530,000 costs per month
Testing reagents	NONE REQUIRED	NONE REQUIRED	Internal testing methods	Testing reagents	26,500	5% of the UGX 530,000 costs per month
Equipment costs	250,000	250,000	equipment for lab (wheat and Maize) at UGX 30,000,00 o for 60months comes to UGX 500,000 per month	Equipment costs	200,000	Equipment costs for the QC Labs is UGX 12,000,000 for 60 months to UGX 200,000 per month
Reporting Frequency	Daily	Daily	Internal reporting	Reporting Frequency	12	Reporting Frequency
Quality Assurance Costs				**Quality Assurance Costs**		**Quality Assurance Costs**
Inspection/Audit fees	1,002,000	250,000	for six months	Inspection/Audit fees	172,000	per month (UGX 2,060,000 annual)
Lab Testing fees	2,505,000	2,505,000	fees for one set of samples (x 4 samples every time)	Lab Testing fees	46,000	per month (UGX 550,000 annual)
Reporting frequency	quaterly	quaterly	Test taken to UNBS LABS	Reporting frequency	12	Reporting frequency
				Pre Packaging	500,000	per month (UGX 6,000,000 per annum)
				Trade Mark	13,300	per month (5 years UGX 8,000,000)
Mark Up%	11%	13%		Gross Profit	3%	Other Costs Incremental

Sales Prices: The models capture the current price of a fortified food currently on the market as of September 21, 2022, and the prices for the by-products that came off the processing: bran and germ flour (for maize), bran and pollard (wheat) and fine salt dust (salt).

Output Matrix: Included the output capacity of the machinery as the derived the information for fortification. Along with this, the model included the production cycle time for the manufacturing plant in a day, then derived the number of days worked per month. The current salt production time is six hours.

Extraction Rates: The manufacturing plant processing conversion rates were captured. It provided a breakdown of the main product and the by-products, including the waste out of the process. The rates of extraction depend on the source of input for each of the commodities.

Purchase Cost: Derives the cost on market prices of seed and raw salt inputs for the product. The cost includes the delivery to the site of the manufacturing plant.

Fortificant: The cost of one kg of fortificant sold in batches of 50 kg. The price of fortificant captures the ratio that is used in the processing of the product.

Technology Costs: With use of dosifier, the model captures the capital expenditure associated with the equipment. Along with this is the utility cost that drives the process with the associated staff costs and component of fortification process across the production line as a percentage.

QC Costs: In order to implement fortification in the manufacturing process, there is an established unit of QC that monitors the process. It includes dedicated salaried staff that have equipment for testing the level of standards.

QA Costs: The capture of data is for the inspection and audit fees that are paid to designated regulatory bodies to analyze the samples derived from the production line. The testing fees applied are standard and within the set time frames at quarterly, biannual, annual, and ad hoc times.

12.0 Top-line Indicators

A top-line indicator for investment starts with the income statement, specifically sales and gross profit margin. Projections are then made based on different levels of capacity production, and the break-even point is determined. This methodology allows for an understanding of the financial and operational performance, including turn-around time, profitability ratios, payback period, rate of ROI, liquidity ratios, and stock turnover.

Information used for the modelling was derived with key assumptions made for the calculations and projections:

- Production line was single product, and the business was more than five years old.
- Costs of production were provided as per incurred and noted at monthly timeline, based years of data collection.
- The machinery and its automation were relatively new at three years of continuous production.
- Included only costs attributable to fortification and how they affect gross margin.
- Captured the production in point of time (September) with set date for prices and the month cycle.

The gross margin is an indicator of financial performance. It builds the model as a means of reviewing the business as a going concern. It sets the rational of using gross margin to make the business case across:

1. **Strategic context:** The compelling case for change.
2. **Economic analysis:** ROI based on investment appraisal of options.
3. **Commercial approach:** Derived from the sourcing strategy and procurement strategy.
4. **Financial case:** Affordability to the organization in the time frame.
5. **Management approach:** Roles, governance structure, life cycle choice.

Gross margin incorporates the pricing decision and production scenarios of the business when fortification is applied.

12.1 Maize Projections

The information drawn from two maize processors provides a layout of projections to capture the gross margin as the basis for assessing the investments across levels of capacity.

Food Fortification Model

Maize Production Output Matrix

Capacity of Plant MT	**1**	**5**	**10**	**20**	**50**	**75**	**100**
Production Cycle Time/Utilization							
Sales	**2,247,200**	**11,236,000**	**22,472,000**	**44,944,000**	**112,360,000**	**168,540,000**	**224,720,000**
Fortified Flour	1,935,200	9,676,000	19,352,000	38,704,000	96,760,000	145,140,000	193,520,000
Bran	224,000	1,120,000	2,240,000	4,480,000	11,200,000	16,800,000	22,400,000
Germ/Pollard	88,000	440,000	880,000	1,760,000	4,400,000	6,600,000	8,800,000
Input Costs	**2,019,600**	**10,098,000**	**20,196,000**	**40,392,000**	**100,980,000**	**151,470,000**	**201,960,000**
Purchases (1MT)	1,980,000	9,900,000	19,800,000	39,600,000	99,000,000	148,500,000	198,000,000
Loss in Grain	39,600	198,000	396,000	792,000	1,980,000	2,970,000	3,960,000
		-					
Production Costs	**11,678**	**58,391**	**93,705**	**164,333**	**376,217**	**552,787**	**729,357**
Fortificant	15	74	148	295	738	1,106	1,475
Technology	467	2,336	4,673	9,346	23,364	35,046	46,728
Utility	6,581	32,904	65,808	131,615	329,038	493,558	658,077
Production Salaries	4,615	23,077	23,077	23,077	23,077	23,077	23,077
Quality Control Costs	**2,404**	**2,404**	**2,404**	**2,404**	**2,404**	**2,404**	**2,404**
Staffing Cost	1,923	1,923	1,923	1,923	1,923	1,923	1,923
Reagents							
Equipment Lab	481	481	481	481	481	481	481
Quality Assurance Costs	**1,927**	**1,927**	**1,927**	**1,927**	**1,927**	**1,927**	**1,927**
Inspection/Audit fees	321	321	321	321	321	321	321
Lab Testing fees	1,606	1,606	1,606	1,606	1,606	1,606	1,606
Gross Margin	**211,591**	**1,075,278**	**2,177,964**	**4,383,336**	**10,999,452**	**16,512,882**	**22,026,312**
Gross Margin Actual	9.42%	9.57%	9.69%	9.75%	9.79%	9.80%	9.80%
Gross Margin Target	11.40%	11.40%	11.40%	11.40%	11.40%	11.40%	11.40%
Variance	*-1.98%*	*-1.83%*	*-1.71%*	*-1.65%*	*-1.61%*	*-1.60%*	*-1.60%*
Without Fortification							
Gross Margin	**215,922**	**1,079,609**	**2,182,295**	**4,387,667**	**11,003,783**	**16,517,213**	**22,030,643**
Gross Margin Actual	9.61%	9.61%	9.71%	9.76%	9.79%	9.80%	9.80%
Gross Margin Target	11.40%	11.40%	11.40%	11.40%	11.40%	11.40%	11.40%
Variance	*-1.79%*	*-1.79%*	*-1.69%*	*-1.64%*	*-1.61%*	*-1.60%*	*-1.60%*
Margin Difference when fortified	4,331	4,331	4,331	4,331	4,331	4,331	4,331
Difference in Margins							
Fortified/Unfortified	-0.19%	-0.04%	-0.02%	-0.01%	0.00%	0.00%	0.00%

Milling and Fortifying Maize Flour: Using the breakout of costs of fortification aggregated into margin (gross profit) provides the basis for investing in fortification for scenarios of one MT to 100 MT. It captures small-scale to large-scale processors in the market. The model shows:

- *As the scale of operation increases, total production costs increase with a higher capital outlay as gross margin increases from UGX 215,922 to UGX 22,026,312.*
- *The margin improvement (from 9.42 percent to 9.8 percent) is attained because the costs of fortification are spread out over the levels of production.*

Maize Fortification and Regulation: The breakout of incremental costs of fortification explains why some players may choose not to fortify their products. The findings show that the difference in gross profit between fortified and non-fortified products is not significant enough to justify fortification for some players. Key take ways:

- *Apart from slightly higher gross profit levels, the margins rate of return on the lower end of 1–10 MT was higher for miller fortifying, while at 20 MT, the miller fortifying and non-fortifier had the same margin level.*

- *After 20 MT both the fortified and non-fortified had the same level of return. It did not have any comparative advantage to fortify or not.*
- *For lower levels of production below 20 MT, returns are higher (though slight) that make the lower capacity miller to avoid fortification. The processor operating at this lower end would like to maximize profits.*

Scale-up Scenarios: Taking a close analysis at the levels of production at one to 100 MT across both fortification and non-fortification, we note that the gross margin differences between the fortifier and non-fortifier is insignificant. As the scale goes up, there is minimal difference between the fortifier and non-fortifier. The 20 MT is the break-even point where, regardless of fortifying or not, the returns are the same. The scalability of these projections builds on the apportionment of variable and fixed costs.

12.2 Wheat Projections

Information for the projections were made from the established producer entities in the study. The detailed layout is below.

Food Fortification Model

Wheat Production Output Matrix

Capacity of Plant MT	1	5	10	20	50	75	100
Sales	**2,882,750**	**14,413,750**	**28,827,500**	**57,655,000**	**144,137,500**	**216,206,250**	**288,275,000**
Fortified Flour	2,718,750	13,593,750	27,187,500	54,375,000	135,937,500	203,906,250	271,875,000
Bran	140,000	700,000	1,400,000	2,800,000	7,000,000	10,500,000	14,000,000
Germ/Pollard	24,000	120,000	240,000	480,000	1,200,000	1,800,000	2,400,000
Input Costs	**2,427,600**	**12,138,000**	**24,276,000**	**48,552,000**	**121,380,000**	**182,070,000**	**242,760,000**
Purchases	2,380,000	11,900,000	23,800,000	47,600,000	119,000,000	178,500,000	238,000,000
Loss in Grain	47,600	238,000	476,000	952,000	2,380,000	3,570,000	4,760,000
Production Costs	**30,375**	**62,774**	**102,470**	**181,864**	**420,044**	**618,527**	**817,011**
Fortificant	14	69	138	276	690	1,035	1,380
Technology	714	3,570	7,140	14,280	35,700	53,550	71,400
Utility	7,212	36,058	72,115	144,231	360,577	540,865	721,154
Production Salaries	22,436	23,077	23,077	23,077	23,077	23,077	23,077
Quality Control Costs	**2,083**	**2,083**	**2,083**	**2,083**	**2,083**	**2,083**	**2,083**
Staffing Cost	1,603	1,603	1,603	1,603	1,603	1,603	1,603
Reagents							
Equipment	481	481	481	481	481	481	481
Quality Assurance Costs	**1,405**	**1,405**	**1,405**	**1,405**	**1,405**	**1,405**	**1,405**
Inspection/Audit fees	67	67	67	67	67	67	67
Lab Testing fees	1,338	1,338	1,338	1,338	1,338	1,338	1,338
Gross Margin	**421,287**	**2,209,488**	**4,445,541**	**8,917,648**	**22,333,968**	**33,514,234**	**44,694,501**
Gross Margin Actual	14.6%	15.3%	15.4%	15.5%	15.5%	15.5%	15.5%
Gross Margin Target	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**
Variance	*1.6%*	*2.3%*	*2.4%*	*2.5%*	*2.5%*	*2.5%*	*2.5%*
Without Fortification							
Gross Margin	**424,775**	**2,212,976**	**4,449,030**	**8,921,136**	**22,337,456**	**33,517,723**	**44,697,989**
Gross Margin	14.7%	15.4%	15.4%	15.5%	15.5%	15.5%	15.5%
Gross Margin Target	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**
Variance	*1.7%*	*2.4%*	*2.4%*	*2.5%*	*2.5%*	*2.5%*	*2.5%*
Margin Difference when fortified	3,488	3,488	3,488	3,488	3,488	3,488	3,488
Difference in Margins Fortified/Unfortified	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Milling and Fortifying Wheat Flour: Using the breakout of costs of fortification aggregated into margin (gross profit) provides the basis for investing in fortification for scenarios of one MT to 100 MT. It captures small-scale to large-scale processors in the market. The model shows:

- *As the scale of operation increases, total production costs increase with a higher capital outlay as gross margin increases from UGX 421,287 to UGX 44,694,501.*
- *The gross margin improvement (from 14.7 percent to 15.5 percent) is attained as production increases, and this is above the.*
- *The costs of fortification are not prohibitive as target margin levels for the manufacturer is achieved at levels of production.*

Wheat Fortification and Regulation: The breakout of incremental costs of fortification explains why some players may choose not to fortify their products. The findings show that the difference in gross profit between fortified and non-fortified products is not significant enough to justify fortification for some players. The study noted that:

- *Apart from slightly higher gross profit levels, the margins rate of return on the lower end of 1–10 MT were higher for miller not fortifying.*
- *After 10 MT, both the fortified and non-fortified had the same level of return. It did not have any comparative advantage to fortify or not.*
- *For any processor below the 10 MT, milling against the regulation translates to whole grain milling away from fine flour.*

Scale-up Scenarios: Taking a close analysis at the levels of production at one to100 MT across both fortification and non-fortification, we note that the gross margin differences between fortifier and non-fortifier is built on these levels. As the scale goes up, there is minimal difference between the fortifier and non-fortifier. The 10 MT is the break-even point where, regardless of fortifying or not, the returns are the same. The scalability of these projections builds on the apportionment of variable and fixed costs.

12.3 Salt Projections

Utilizing information from a single producer, Kampala Salt, we mapped out the costs and set out the projection as per the fortification process at their factory premises.

Fortifying Salt: The matrix on the salt below shows losses in the production for both fortified and unfortified irrespective of whether it is 1 MT or 100 MT. The model captures small-scale to large-scale processors. The model shows:

- *As the scale of operation increases, total production costs increase with a higher capital outlay as Gross Margin increases.*
- *The margin improvement does get attained along the different levels of processing.*
- *The cost of fortification is negligible when spread out over the levels of production.*

Salt Fortification and Regulation: The breakout of incremental costs of fortification between fortification and non-fortification at different levels of fortification are almost the same. The findings show that salt fortification is not necessarily a comparative process for one to avoid. On the contrary, avoiding fortification could lead to opportunity costs if compliance regulation sets in. The model shows that:

- *There is no difference between fortification and non-fortification given the low levels of fortificants required at 35mg per kg and very low sales price.*

Food Fortification Model

Salt Production Output Matrix							
Capacity of Plant MT	1	5	10	20	50	75	100
Sales	**729,000**	**3,645,000**	**7,290,000**	**14,580,000**	**36,450,000**	**54,675,000**	**72,900,000**
Fortified Salt	648,000	3,240,000	6,480,000	12,960,000	32,400,000	48,600,000	64,800,000
Fine Salt	81,000	405,000	810,000	1,620,000	4,050,000	6,075,000	8,100,000
Input Costs	**814,000**	**3,959,000**	**7,918,000**	**15,836,000**	**39,590,000**	**59,385,000**	**79,180,000**
Purchases	740,000	3,700,000	7,400,000	14,800,000	37,000,000	55,500,000	74,000,000
Normal loss	51,800	259,000	518,000	1,036,000	2,590,000	3,885,000	5,180,000
Abnormal loss	22,200	111,000	222,000	444,000	1,110,000	1,665,000	2,220,000
Production Costs	**11,275**	**28,599**	**50,254**	**93,564**	**223,493**	**331,767**	**440,041**
Fortificant	-	-	-	-	-	-	-
Technology	1,061	5,307	10,614	21,229	53,072	79,608	106,144
Utility	3,270	16,348	32,695	65,391	163,477	245,215	326,953
Production Salaries	6,944	6,944	6,944	6,944	6,944	6,944	6,944
Quality Control Costs	**115**	**115**	**115**	**115**	**115**	**115**	**115**
Staffing Cost	92	92	92	92	92	92	92
Reagents	23	23	23	23	23	23	23
Equipment	174	174	174	174	174	174	174
Quality Assurance Costs	**189**	**189**	**189**	**189**	**189**	**189**	**189**
Inspection/Audit fees	149	149	149	149	149	149	149
Lab Testing fees	40	40	40	40	40	40	40
Pre Packaging	434	434	434	434	434	434	434
Trade Mark	12	12	12	12	12	12	12
Gross Margin	**(96,580)**	**(342,904)**	**(678,558)**	**(1,349,868)**	**(3,363,797)**	**(5,042,071)**	**(6,720,346)**
Gross Margin Actual	-13.2%	-9.4%	-9.3%	-9.3%	-9.2%	-9.2%	-9.2%
Gross Margin Target	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**
Varinace	*-16.2%*	*-12.4%*	*-12.3%*	*-12.3%*	*-12.2%*	*-12.2%*	*-12.2%*
Without Fortification							
Gross Margin	**(96,275)**	**(342,599)**	**(678,254)**	**(1,349,564)**	**(3,363,493)**	**(5,041,767)**	**(6,720,041)**
Gross Margin	-13.2%	-9.4%	-9.3%	-9.3%	-9.2%	-9.2%	-9.2%
Gross Margin Target	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**
Competitor Range	*-16.2%*	*-12.4%*	*-12.3%*	*-12.3%*	*-12.2%*	*-12.2%*	*-12.2%*
Margin Difference when fortified	304	304	304	304	304	304	304
Difference in Margins Fortified/Unfortified	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Scale-up Scenarios: Taking a close analysis at the levels of production at 1 MT to 100 MT across both fortification and non-fortification, we note that the gross margin differences between fortifier and non-fortifier is built on these levels. As the scale goes up, there is minimal difference between the one fortifier and the one not doing so; they merge to that same rate of -9.2 percent.

13.0 Discussion and Recommendations

13.1 Applying the Business Models

Defining the Business Models: To recap, a business model is a strategic plan of how a company will make money (profits and revenues). The business model describes the way a company offers its product to the market and attains revenues at a profit. A business model determines what products make sense for a company to produce and sell, how it wants to promote its products, what market to focus on, and the expected revenue streams. It is an ecosystem that lays out who to sell to, what to sell, what to charge, and what value the product creates. The business model describes what an organization does to systematically create long-term value for its customers. A well-built business model provides the direction for a company on how it wants to operate and what its financial future outcome will be.

Pricing and Costs: The two primary levers of a company's business model are pricing and costs. A company can raise prices, and it can find inventory (input) at reduced costs. Both actions increase gross profit margin. Many analysts consider gross profit to be more important in evaluating a business plan. A good gross profit suggests a sound business model. If expenses are out of control, the management team could be at fault, and the problems are correctable. Companies that figure out their business models manage to operate as going concerns where they meet their obligations and are able to attain growth.

Inputs: A manufacturer undertaking food fortification should focus on sourcing quality raw materials at a lower cost, which will lead to producing finished products at a lower cost and higher gross profit margin. Food manufacturers can seek to manage the input-supply chain by setting out an elaborate procurement/sourcing system. It can entail forward contracts, subsiding input producers, or attaining long term relationships with providers of the raw material. By providing an array of prices for differentiated quality levels of input material, consolidation and aggregation of inputs is attained to even out costs.

Gross Profit Margin: Evaluating a successful business model can be done by analyzing the company's gross profit margin information. Gross profit margin is a company's total revenue minus the Cost of Goods Sold (COGS). Comparing one's gross profit to that of its main competitor or the industry sheds light on the efficiency and effectiveness of its business model. Gross profit alone can be misleading, however. Analysts need to evaluate cash flows and net profit (gross profit minus operating expenses) and monitor trends of working capital (inventory plus debtors minus creditors).

For the model above, analysis of the gross profit margins between fortified and non-fortified products that were projected with different production levels across the three different products: maize, wheat, and salt.

Building a successful business model along the gross profit margin entails:

- **Revenue:** Generate sales; determine what you plan to sell and how you present the product to customers (value propositions, positioning, effective messaging, product/market fit).
- **Gross profit margin:** Pricing and costs to attain gross margins that balance the customer purchase price with the cost of producing the item.
- **Operations:** Scale and modality of the business daily tasks; where and how it is implemented, which can be reflected in the costs to the business.
- **Working capital:** Balancing between payables (purchase on credit), receivables (sales on credit), and stock of inventory (raw materials and final products) to attain maximum cash flow.
- **Financing and/or investment:** The availability of finance capital to fund the production undertaking.

Product Model: Product-centric delivery is less about products and more about the value that is delivered. In the product model, the basis to increase revenue is plan to sell and present the fortified product to the customer as a value proposition with effective messaging, making the product fit for the market. In the Product Model, fortification as an added cost requires selling the product at a relatively higher sales price with compensation derived from higher cost of marketing as it presented at a premium with the higher price presented as value for the consumer.

Input-Process-Output: The IPO analysis assumes that business entities (such as firms, offices, and plants/industries) use inputs, perform processes, and produce outputs to sustain themselves and to expand. In this model, the food manufacturer utilizes the maximization of lowered costs of raw materials to attain higher margin due to lower COGS. Through a mix of sourcing directly from supplier for lower cost, controlling the input chain, the manufacture ensures: 1) stable supply of inputs at lowered costs through: subsiding input producers, or attaining long term relationships with raw material providers and 2) improving efficiency of the manufacturing operation.

Economies of Scale: Achieving economies of scale means the business must reap technical, procurement, and financial economies of scale. A company must be able to manage its pricing to achieve gross margins of fortified products that are well into the competitive margins. Going through a large-scale operation, the food manufacturer takes on a dominant role in the commodity from inputs, processing, and distribution of the product. With use of volumes and financial muscle, the manufacturer can determine pricing from input commodity to final product to the consumer. Fortification can be made an industrial standard for the product and means of competitive advantage.

13.2 Limitations

The study limitations are related to challenges encountered in the food fortification process. Limitations related to business models, scope, and study assumptions were considered.

Pricing: While we noted the pricing as the underlying aspect for the model at finished product, it is important to articulate the factors behind some of the pricing across each of the commodities. The question remains is the price of the final product consumer driven? Additional study along the consumer perspective to alternatives of whole grain milling to fortified flour needs to be undertaken. While there are established prices set by the food producers, it would call for customer survey to establish their opinion on fortified food prices. Thus, the model along the gross profit margin utilized the prevailing price regime set by the producer.

Input Sourcing: Building on the business model that articulates costs with the factor under COGS, the input materials are a major factor in establishing food fortification. Along the study it was driven by limited information on product source pricing. Underlying costs of delivery to the manufacturer across a locally fragmented farm production of maize, or for the case established global supply chains for delivery of wheat, were assumed to all be reflected in the final input cost. Differences of input costs can distort the modelling.

Financing: The costs associated with funding entire manufacturing operations differ. From long-term large debt at low interest rates based on inherent lower risks for higher thresholds of funding to the opposite for low debt with high interest rates, the model did not articulate how that translates to setting out the gross margin. Further studies could factor in the cost of capital when coming up with a business modelling for food fortification.

Time Period: To have a comprehensive modelling study would require a time frame to map out the operation of a food fortification plant over a period of at least one year. It would need going beyond a price point in time and using historical data to map onto real/actual costs observed during the processing from input to the end.

13.3 Recommendations

When considering the investment case for food fortification (maize flour, wheat flour, edible oils and fats, and salt), food manufacturers should consider all three business models addressed in this report. The business models can help define the following:

1. **Strategic context:** The compelling case for change.
2. **Economic analysis:** ROI based on investment appraisal of options.
3. **Commercial approach:** Derived from the sourcing strategy and procurement strategy.
4. **Financial case:** Affordability to the organization in the time frame.
5. **Management approach:** Roles, governance structure, life cycle choice, etc.

The company must create long-term value for its customers by considering the following:

Target Customer (Market): Define who the customer is, what are their needs from the product (fortified food), and then build a strong customer base who can be satisfied by what the company is offering – the value preposition. A food manufacturer incorporating fortification must articulate a brand image that reflects the take on the customisation along the product (packaging), pricing, and delivery (promotion).

Manage Commodity Value Chain: Adapting food fortification for a manufacturer must align to the core of business vision and its competence. A complete mapping of what the commodity ecosystem looks like needs to be appreciated. As one adapts food fortification, they must meet the existing gaps with a value proposition. They have to position procurement and production systems to maximize inputs, premix, plant and equipment, and cost of finance so as to attain target sales and revenues. This lays out the foundation for expansion and strengthens company role in the value chain.

Resources and Operations: Attaining gross profit requires that operations be built on available resources. Physical assets, human resources, and financial resources provide a unique and competitive edge to lay out the supply chain that fulfils demand of products (maize, wheat, and how best it will operate when it adopts food fortification.

Partnerships and Collaborations: A working business model must entail strategic alliances to attain goals and objectives. Taking on food fortification must have a realistic approach to the existing policy and legislative environment (legislation). A food manufacturer needs to on-board all the key stakeholders on Regulators and Compliance, Consumers, Producers, Advocacy and Lobbying to have food fortification as a means of improving not only profit but meet nutritional goals.

Adaptation: Have a continuous learning that keeps adapting to the changing market environment with innovations. Other than being static, the food processor needs to be dynamic, getting processes streamlined along organizational structures that pivot key management to embed food fortification in good manufacturing practices without distorting the operational bottom line.

14.0 Conclusion

Several critical elements must be met to operationalize fortification as an effective business approach. There must be a clearly defined organizational structure with technically skilled professionals. Operational systems must be developed and implemented, and innovative economic incentives and opportunities should be sought. Success will require investments in time and resources by all stakeholders within the business.

Study outcomes indicate that large manufacturers are best positioned for food fortification. That said, the market does provide opportunity for small manufacturers. Small manufacturers will be better positioned for success if they have successful strategies and implementation processes for elements such as: input costs, premix, technology, QC, and QA to ensure compliance with regulation standards.

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Annex 1: Business Key Informant Interview (KKI)

KII Guide for Food Fortification Businesses/Industries

NOTE TO DATA COLLECTORS: The objective of this interview is to undertake research to generate an understanding of the business models that the institutions have adopted for the food fortification industry. The tool targets executives' companies that are extensively involved in maize flour, wheat flour, edible oils and fats, and salt fortifications.

INTRODUCTION SCRIPT: *Use the following script to introduce the interview to participant:*
Hello, my name is _____. Thank you for taking the time to speak to me today. We are working with USAID Advancing Nutrition to generate business models for the Food Fortification sector in Uganda. Your institution is among those that have been identified as being quite resourceful in contributing to our research, and we would like to ask you a few questions in an interview that will last no more than 45 minutes. USAID Advancing Nutrition intends to use the information provided strictly for the purposes of designing business models that will support further growth of the food fortification program in Uganda.

Can we continue with the interview?
□ No (0) □ Yes, (1)

IDENTIFIER DETAILS

Company Name:	No. of Years in the Fortification Business;	Region: City/Town:
Title/Position of Respondent:	Sex 1. Male 2. Female	Date of interview:
Respondent Cell No:	Interview Start Time:	Interviewer Cell No:
Email:	Interview End Time:	Email:

Guiding Questions

1. Briefly tell us about your corporation and the services/products it offers. Probes:
    a. *Ask about the different fortifications that the company engages in.*
2. What level of growth would you classify your company business? Probes:
    a. *Ask whether it is an emerging/early growth, medium or large-scale company in terms of operations and coverage.*

Mapping and Analysis of Value Chain and Business Approaches

3. Please describe the production processes for the foods that you fortify? Probes:
    a. *Who are the growers?*
    b. *How do they reach your company?*
    c. *Do you grow some of the foods within the company?*
4. How do you handle out growers? Probes:
    a. *How often do you engage?*

   b. *What activities do you conduct with them?*
   c. *How do you handle supply agreements?*
   d. *How do you negotiate prices and how do you pay them?*

5. What procedures do you follow after supply? Probes:
   a. *Sorting & cleaning*
   b. *Storage procedures*
   c. *Personnel involved*

6. What is the capacity production and storage capacity of your silos? *Probe type and models of equipment, which are the recommended, tonnage, personnel to man the equipment, etc.*

7. What considerations apply in fortification? Probes:
   a. *Value addition/additives, why the specific ones?*
   b. *Mixing processes and QA*
   c. *Packaging types and quantities*
   d. *Personnel involved this phase*

8. What marketing strategies do you have in place to reach your target market? Probes:
   a. *How does the company reach product market fit?*
   b. *Market size*
   c. *Probe the distribution model within and outside Uganda*
   d. *Probe for supply contracts, values, and category of the clientele*
   e. *Competitive edge*

9. Do you work with partnerships? What partnership models have worked and which ones have not worked? Why? Probe top-down and bottom-up approaches.

Regulation and Standards

10. What laws are in place that guide your fortification value chain processes?
    a. *Probe for local and international laws/regulations, legal issues, patents etc. What regulatory standards are in place that have to be followed?*
    b. *Probe for quality, ISO, etc. Have they enabled your business to thrive?*

11. How have they (the laws and regulatory standards) been challenging in business growth? What gaps exist, and how do you suggest that the gaps be addressed?

12. What are the key challenges and business risks do you face in this industry and could you identify some of the ways to manage and mitigate them?

Production and Financials

13. What are the top-line trends for production level? Sales amount? What percentage represents fortified products?

14. What are the major costs for the food fortification process? *Premix, sourcing, labour, technology*

15. What opportunities (resources, networks, and other services) are available within the industry? Probes:
    a. *Which opportunities are available within your corporation?*
    b. *What about those within this context?*

16. What promising and emerging trends have you identified within the value chain?

17. What would you consider as the opportunities that may not have been explored that could enable a strong business approach to fortification? Probes:
    a. *Product differentiation, segments, markets (domestic and regional)*

Thank you for your time!

Annex 2: Key Informant Interviews with Key institutions

KII Guide for Food Fortification Businesses

NOTE TO DATA COLLECTORS: The objective of this interview is to undertake research to generate an understanding of the business models that the institutions have adopted for the food fortification industry. The tool targets executives' companies that are extensively involved in maize flour, wheat flour, edible oils and fats, and salt fortifications.

INTRODUCTION SCRIPT: *Use the following script to introduce the interview to participant:*
Hello, my name is _____. Thank you for taking the time to speak to me today. We are working with USAID Advancing Nutrition to generate business models for the Food Fortification sector in Uganda. Your institution is among those that have been identified as being quite resourceful in contributing to our research, and we would like to ask you a few questions in an interview that will last no more than 45 minutes. USAID Advancing Nutrition intends to use the information provided strictly for the purposes of designing business models that will support further growth of the food fortification program in Uganda.

Can we continue with the interview?
□ No (0) □ Yes (1)

IDENTIFIER DETAILS

Organization Name:	No. of Years in the Fortification Business:	Region: City/Town:
Title/Position of Respondent:	Sex Male Female	Date of Interview:
Respondent Cell No:	Interview Start Time:	Interviewer Cell No:
Email:	Interview End Time:	Email:

Guiding Questions

1. Briefly tell us about your corporation and the services offered in food fortification. Probes:
    a. *Ask about the different roles that the company engages in.*
2. What scope is your institution involved in? Probes:
    a. *Ask whether it is a regulatory, support extension, advocate for consumers, promote manufacturers for emerging/early growth, medium or large-scale company in terms of operations and coverage.*

Mapping and Analysis of Value Chain and Business Approaches

3. Please describe the processes of the food fortification you are involved in? Probes:
    a. *Who are the producers?*
    b. *How do they reach and/or interact with your organization?*
4. How does your business operate? Probes:
    a. *How often do you engage?*
    b. *What activities do you conduct with them?*
    c. *How do you handle supply agreements?*
    d. *How do you negotiate prices and how do you ensure them?*
5. What procedures do you emphasize regarding fortification? Probes:

   a. *Components and ingredients*
   b. *Standardisation and QA procedures*
   c. *Qualification and training of personnel involved*

6. What level of fortification do you follow and/or advocate for businesses, processors, or producers? Probes:
   a. *Type and models of equipment, which equipment are recommended, tonnage, personnel to man the equipment, etc.*

7. Let's talk about fortification at product level. What considerations apply in fortification your business? Probe:
   a. *Value addition/additives, why the specific ones?*
   b. *Mixing processes and QA*
   c. *Packaging types and quantities*

8. What outreach do you conduct to reach businesses involved in food fortification within Uganda? Probes:
   a. *How does the organization identify the company?*
   b. *Market size and target – local domestic, export*
   c. *Probe the market segments for product distribution model within and outside Uganda*
   d. *Probe for inputs of fortification*
   e. *Incentives for fortification*

9. Do you work with other players in the food fortification? What collaborations are you involved in? What has worked and what has not worked? Why? Probes:
   a. *Agreements, MOUs, and other enforceable mandates*

Regulation and Standards

10. What laws and regulations are you referencing to guide your fortification efforts across the product value chain processes?
    a. *Probe for local and international laws/regulations, legal issues, patents, etc.*

11. What regulatory standards are in place to be followed?
    a. *Probe for quality, ISO, etc.*

12. How much involvement/influence do you have on the laws and standards related to formulation, implementation, and/or reporting?

13. What gaps exist in laws and regulatory standards, and how do you suggest that the gaps be addressed? Can you make some recommendations?

Challenges and Opportunities

14. Is fortification taking root in the food chain you are working with? What are some of the industrial figures on production and sales for food fortification?

15. What opportunities (resources, networks, and other services) are available to enhance food fortification across the industry? Probes:
    a. *Which ones are available within your organization? What about those within this context?*

16. What promising and emerging trends have you identified within the product chains, and what does the future hold to enable a strong business approach to fortification?

USAID ADVANCING NUTRITION

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