Towards the adoption of rice fortification in Nigeria

Landscape Analysis Report

WFP World Food Programme

gain Global Alliance for Improved Nutrition

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1 EXECUTIVE SUMMARY

Nigeria's nutrition situation poses a significant challenge to public health and economic productivity. A comparative analysis of Nigeria's nutrition indices shows lack of sustained progress over the last two decades, persistently high levels of stunting, wasting and underweight among young children, and increasing levels of over-nutrition amongst women of reproductive age. Nigeria's micronutrient indices are also very poor, with recent estimates putting Nigeria's productivity loss potentially attributable to Iron deficiency at 1.5 million disability-adjusted life year (DALYs), with a further 250,000 DALYs lost to high levels of Vitamin A deficiency.[1]

The Promoting Rice Fortification in Nigeria (PRiFN) project is a collaboration between the Global Alliance for Improved Nutrition (GAIN) and the World Food Program (WFP), which aims to generate knowledge and evidence to build a feasible business case and roadmap for adopting rice fortification as part of nutrition policy in Nigeria. Rice is one of the most consumed staples in Nigeria, with Daily Food Availability (a proxy for daily food intake) estimated at 107g/c/d, compared with 92g/c/d for maize[2]. Rice is now considered essential for food security and given its high per capita consumption and household coverage, a potentially viable vehicle to deliver critical micronutrients to households across the country.

As part of critical knowledge generation to inform policy development and stakeholder alignment on the prospects for rice fortification in Nigeria, a detailed landscape analysis of Nigeria's rice sector was undertaken along with a technical feasibility assessment of the opportunities and viability of rice fortification in Nigeria. The objective of this effort was to produce the required knowledge assets that will be used to facilitate strategic multi-stakeholder engagement and advocacy on rice fortification in Nigeria and inform Nigeria's national rice fortification policy process. This report presents the landscape analysis and technical feasibility assessment outcome and outlines the important implications for the advocacy process for rice fortification adoption in Nigeria.

A mixed methods approach was adopted in undertaking this study, which involved complementing existing secondary data sources with field-based primary data collection. This landscape analysis has the following main elements:

1. An industry and market analysis of the rice sector in Nigeria that covers the entire value chain from production, processing through distribution and trading, focusing on the key parameters relevant to fortification;
2. An assessment of the primary determinants of technical feasibility for rice fortification in Nigeria and the implications for rice fortification policy;
3. A comprehensive mapping of the landscape of stakeholders relevant to the potential introduction of rice fortification in Nigeria; and a brief overview of fortification case studies in India and Brazil
4. Policy recommendations for introducing and scaling up rice fortification in Nigeria

The outcome of the findings of the analysis across the main elements of this study highlight two important factors that are central to the successful introduction of fortified rice in Nigeria:

- ➔ **Navigating demand/supply apathy:** There is currently no evidence of latent demand for fortified rice across households in Nigeria, a situation made worse by the significant inflationary pressures on rice pricing in the last 5 years. The advocacy process should therefore be primed to overcome a degree of consumer inertia, especially if introduced at a price premium. In addition, operators in rice milling and processing currently have limited incentives to actively support the process and as a result, may have

[1] Unpublished internal analysis by nutrition team of a global foundation
[2] Global Fortification Data Exchange

low levels of effective interest. Policy design for rice fortification should therefore be focused on navigating this situation.

- ➔ **Navigating supply chain pitfalls:** Staple food fortification in Nigeria is already hampered by supply chain inefficiencies, such as fortificant tariffs, significant delays at Nigeria's ports for importation of fortification relevant equipment and consumables and porous borders that uneven the playing field at the expense of fortification compliant companies. This will be no different for rice. Given that the rice sector is still quite fragmented, effort will need to be directed at navigating supply chain challenges associated with rice fortification. Policy interventions and operational strategies will therefore be critical to overcoming the challenge posed by inefficiencies in Nigeria's food product supply chain infrastructure.

The key recommendations of this report are aimed at navigating the above critical factors towards a successful introduction of rice fortification in Nigeria. These are summarized below:

1. ***Harnessing social safety nets to catalyze demand and enhance diets of those most in need*. –** Federal and regional social safety nets provide an opportunity to build industry capacity and catalyze demand from institutional buyers that purchase rice for distribution and consumption by populations most at risk of key micronutrient deficiencies. This can include institutions that purchase rice for humanitarian distribution, school feeding programs (both public and private), and community-based food safety and nutrition programs. This limited set of institutional buyers would aim at creating an annual demand of 300,000 – 500,000MT of fortified rice per annum, which will be sufficient to create a niche supply market without the need for direct FRK subsidies or direct government involvement in the FRK and/or fortified rice value chain.
2. ***Develop rice fortification standards:*** the definition of a set of standards for rice fortification that will be adopted by the suppliers that are envisaged to participate in the fortified rice market segments that emerge from the introduction through social safety nets is paramount to ensure quality, safety and adequacy of the fortified rice produced and distributed. The process of definition of standards for rice should be highly participatory and collaborative and could be undertaken by industry stakeholders within the context of a broader review of existing fortification standards and mandates, that is aimed at ensuring complementarity between fortification of all staples, as against tackling them in isolation.
3. ***Building the supply chain:*** Functional and cost-effective supply chains for FRK and fortified rice are an essential driver to bring rice fortification to scale and sustain it. Building strong supply chains brings about technology transfer, new infrastructures and access to new skills and technical know-how. Rice fortification therefore does not only present itself as a public health intervention, it also provides an occasion to bring technology and enhance the food systems capacity of the country through public-private partnerships.
1. ***Develop a bouquet of targeted incentives to support fortified rice millers:*** Building on the partial mandate, a set of targeted incentives will need to be put in place to encourage millers to participate in the emerging fortified rice market. These incentives could include import duty waivers for FRK production and rice blending machinery/equipment, as well as VAT exemption on fortificant and fortificant consumables relevant for FRK production and blending. The goal of these incentives will be to ensure security of supply to meet the needs of the market, at reasonable, market aligned cost.
2. ***Develop and implement a social marketing strategy aimed at long term market adoption* –** The social marketing strategy to support the introduction and adoption of fortified rice in Nigeria should be designed to achieve successful near-term acceptance of fortified rice in the limited markets which the recommended demand side mandate will create, and a long-term market-based approach towards a sustainable market for rice fortification in Nigeria. This will entail a significant investment in market research on consumer attitudes and practices, as well as the tracking of key demand and consumer metrics before and after execution of the social marketing campaign. Effective advocacy, underpinned by deep multi-stakeholder engagement between the public and social sectors will be a critical

component of this strategy. Lessons from countries like Brazil and other Latin American countries where market-based approaches have been complimented by strong social marketing campaigns will be very relevant in this context.

2 PREFACE

The World Food Program (WFP) and the Global Alliance for Improved Nutrition (GAIN) are working together to implement the Promoting Rice Fortification in Nigeria (PRiFN) project. The project aims to generate knowledge and evidence to build a feasible business case and roadmap for adopting rice fortification as part of micronutrient deficiency control and nutrition policy in Nigeria. Rice fortification will contribute to other ongoing efforts to reverse the effect of significant disruptions to agricultural value chains occasioned by the COVID-19 pandemic, threatening to erode some of the gains made in improving the nutritional status of the Nigerian population over the last five years.

The project is anchored on increasingly emerging evidence on the potential of rice as a fortification food vehicle in Nigeria based on high per-capita and house-hold consumption nation-wide, including data from the most recent Fortification Assessment Toolkit (FACT) surveys conducted in Sokoto and Ebonyi states by the Global Alliance for Improved Nutrition (GAIN) Nigeria, which assessed the potential of rice as a new fortification food vehicle.[3] The findings of this survey indicated that the household coverage and rice intake in a form that food producers could fortify (fortifiable rice) was high enough for rice to be potentially effective in delivering micronutrients to most households in Nigeria, including groups that are particularly vulnerable to malnutrition[4]. Through knowledge generation and stakeholder interaction, this project is expected to inform and shape the policy context for rice fortification in Nigeria and help build an enabling environment for introducing and maintaining guidelines and standards for rice fortification in Nigeria.

As part of critical knowledge generation to inform policy development and stakeholder alignment on the prospects for rice fortification in Nigeria, a detailed landscape analysis of Nigeria's rice sector was undertaken along with a technical feasibility assessment of the opportunities and viability of rice fortification in Nigeria. The objective of this effort was to produce the required knowledge assets that will be used to facilitate strategic multi-stakeholder engagement and advocacy on rice fortification in Nigeria and inform Nigeria's national rice fortification policy process. This report presents the landscape analysis and technical feasibility assessment outcome and outlines the important implications for the advocacy process for rice fortification adoption in Nigeria.

The report outlines the following:

1. An overview of the situational context for nutrition in Nigeria
2. Detailed industry and market analysis of the rice sector in Nigeria that covers the entire value chain from production, processing through distribution and trading, focusing on the key parameters relevant to fortification.
3. An assessment of the primary determinants of technical feasibility for rice fortification in Nigeria and the implications for rice fortification policy.
4. Policy recommendations for introducing and scaling up rice fortification in Nigeria.
5. A comprehensive mapping of the landscape of stakeholders relevant to the potential introduction of rice fortification in Nigeria.

[3] Global Alliance for Improved Nutrition (GAIN) and Oxford Policy Management (OPM), 2018, "Fortification Assessment Coverage Toolkit (Fact) Survey In Two Nigerian States: Ebonyi And Sokoto, 2017". Geneva, Switzerland, https://www.gainhealth.org/sites/default/files/publications/documents/fortification-assessment-coverage-toolkit-nigeria-2017-2.pdf.
[4] Ibib

3 METHODOLOGY

A mixed methods approach was adopted in undertaking this study, which involved complementing existing secondary data sources with field-based primary data collection. A detailed description of the key activities undertaken across each of the four major phases of the study, and how they aligned with the study Terms of Reference[5] is provided in Figure 1 below.

Phase	Stakeholder Mapping	Industry & Market Analysis / Technical Feasibility Analysis	Policy Analysis & Development of Recommendations
Key Activities	▪ Process mapping of fortified rice value chain based on the dominant technical approaches ▪ Identify the key stakeholder categories relevant to the rice fortification process in any fortification policy scenario (mandatory or voluntary) ▪ Identify the specific stakeholders in each of the categories identified above as it relates specifically to rice fortification in Nigeria ▪ Identify the dominant perspectives related to the approach to rice fortification and indicate likely stakeholder leanings	▪ Detailed literature review to establish rice industry and market dynamics o *KPMG 2019 Rice Industry Review* o *Global Food Security Response Nigeria Rice Study (USAID)* o *"Agricultural Performance Survey of West Season in Nigeria" (NAERLS & FDAE)* o *Multiple rice value chain development reports* ▪ Key informant interviews (including 8 rice millers) to: o *Obtain current data and validate industry and market data and analysis* o *Obtain data to inform technical feasibility assessment* ▪ Financial modelling and analysis to assess technical feasibility under three scenarios	▪ Literature review, expert discussion, case reviews and policy analysis to: o *Establish current policy context for rice fortification* o *Evaluate current and potential rice fortification delivery (mandatory, voluntary SSNs)* o *Make recommendations for the introduction and scale up of rice fortification*
Reference /Outputs	▪ TOR Item #1 ▪ Stakeholder landscape report	▪ TOR Item #2, #3, #4 ▪ Presentation of preliminary findings and insights from landscape analysis	▪ TOR Item #5, #6, #7 ▪ Detailed narrative report (50 pages) ▪ 5-page narrative executive summary report and detailed presentation deck

Figure 1 - Description of study approach and methodology

[5] See Appendix for Terms of Reference

4 NUTRITION IN NIGERIA: COUNTRY CONTEXT

4.1 OVERVIEW OF CURRENT SITUATION

Nigeria's nutrition situation poses a significant challenge to public health and economic productivity. Data from the 2018 National Demographic and Health Survey (NDHS) indicates that 37% of Nigerian children aged 6-59 months are stunted, 7% are wasted, 22% are underweight, and 2% are overweight. Similarly, among women aged 15-49, 12% are thin (BMI below 18.5), and 28% are overweight or obese. NDHS 2018 data also indicate that only 11% of children aged 6- 23 months were fed a minimum acceptable diet in the 24 hours before the survey, though 56% of women aged 15-49 reported having consumed food from five or more of 10 specified food groups in the day or night preceding the interview for the survey. [6]

A comparative analysis (Figure 2) of Nigeria's nutrition indices shows lack of sustained progress over the last two decades, persistently high levels of stunting, wasting and underweight among young children, and increasing levels of over-nutrition amongst women of reproductive age. Further analysis (Figure 3) indicates that the situation is particularly severe in the Northwest and the North-East region of the country. On stunting, the proportion of children who are stunted is highest in the North-West (57%) and lowest in the South-East (18%), with Kebbi State having the highest level of stunting prevalence (66%) and Anambra (14%) having the lowest. The proportion of children who are underweight is similarly highest in the North-West (35%) where Kebbi State has the highest level of prevalence (46%), and lowest in the South-South region (10%). The State with the lowest level of underweight prevalence among children is Enugu (6%). The proportion of children who suffer from wasting is highest in the North-East (10%) and lowest in the South-South (4%), with Sokoto State having the highest prevalence (18%) and Bayelsa (1%) being the lowest.

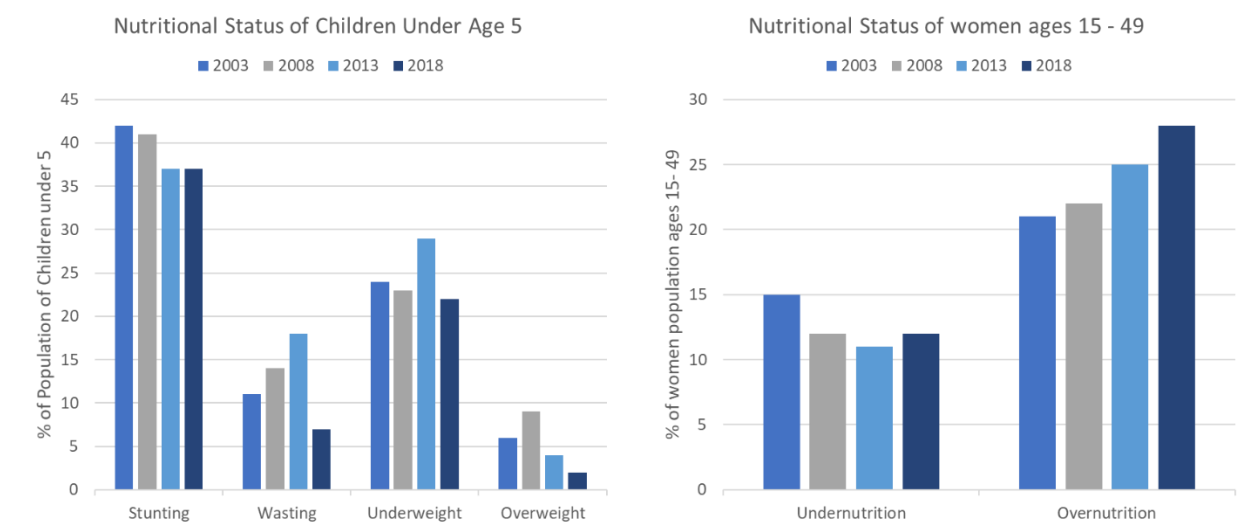

Figure 2 - Nigeria Nutritional status of women and children 2003 – 2018

[6] National Population Commission (NPC) [Nigeria] and ICF, 2019. Nigeria Demographic and Health Survey 2018. [online] Abuja Nigeria: NPC and ICF. Available at: https://www.dhsprogram.com/pubs/pdf/FR359/FR359.pdf

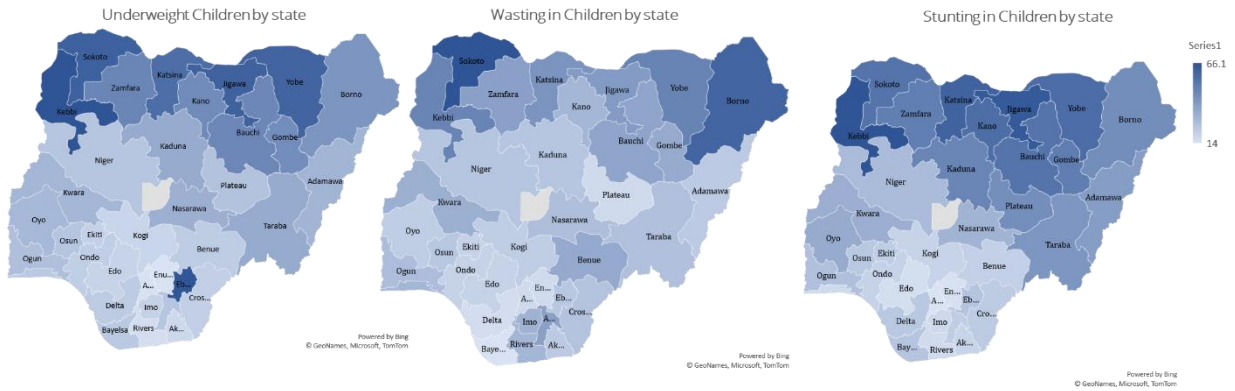

Figure 3 - Nigeria nutritional status for children under 5 by State (in percentages)

Nigeria's micronutrient indices are also very poor, with 68% of children aged 6-59 months and 58% of women aged 15-49 estimated to be anemic, and Vitamin A deficiency in children aged 6-59months reported to be up to 42%.[7]

On the national fortification program, a 2013 nationwide survey assessing content of vitamin A in oils and sugar, and iron in flours sampled from factories and markets found that only 15% to 20% of oils, 12% to 17% of sugars, and 12% to 33% of flours were fortified at or above the minimum national standard for vitamin A, and only 1% to 21% of flours were fortified at or above the minimum national standard for added iron[8]. More recent data from Fortification Assessment Coverage Toolkit (FACT) surveys conducted in Kano and Lagos states (2015)[9] and in Sokoto and Ebonyi states (2017)[10] found inconsistent and generally low compliance with fortification standards in household food samples. Supplementation programs are similarly challenged, with implementation research conducted in five states in northern Nigeria finding a general and consistent decline in vitamin A supplementation for children 6 – 59 months between 2013 and 2016. [11]

The implications of persistent high levels of malnutrition in the population along with significant vitamin and mineral deficiencies, contributes to poor health outcomes across the country, with a correspondingly significant impact on economic growth and productivity. Recent estimates put Nigeria's productivity loss potentially attributable to Iron deficiency at 1.5 million DALYs, with a further 250,000 DALYs lost to high levels of vitamin A deficiency.[12]

[7] National Population Commission (NPC) [Nigeria] and ICF, 2019. Nigeria Demographic and Health Survey 2018. [online] Abuja Nigeria: NPC and ICF. Available at: https://www.dhsprogram.com/pubs/pdf/FR359/FR359.pdf

[8] Ogunmoyela O, et al 2013, "A Critical Evaluation of Survey Results of Vitamin A And Fe Levels In The Mandatory Fortified Food Vehicles And Some Selected Processed Foods In Nigeria", Nigerian Food Journal 31 (2), doi:10.1016/s0189-7241(15)30077-1

[9] Food Fortification Initiative (FFI), Centers for Disease Control and Prevention (CDC), GAIN, and OPM, 2018. "Fortification Assessment Coverage Tool (FACT) Survey In Two Nigerian States: Kano And Lagos, 2015", Geneva Switzerland: GAIN, https://bit.ly/38JuNP2.

[10] GAIN and OPM, 2018, "Fortification Assessment Coverage Toolkit (FACT) Survey in Two Nigerian States: Ebonyi and Sokoto, 2017", Geneva, Switzerland, GAIN. https://bit.ly/3MGqHFX

[11] Anjorin Olufolakemi et all, 2019, "Coordinating Nigeria's Micronutrient Deficiency Control Programs Is Necessary to Prevent Deficiencies And Toxicity Risks", Annals Of The New York Academy Of Sciences, doi:10.1111/nyas.14055

[12] Unpublished internal analysis by nutrition team of a global foundation

4.2 POLICY/INSTITUTIONAL LANDSCAPE FOR NUTRITION AND CURRENT TARGETS

Although population level malnutrition and micronutrient deficiency rates continue to be issues of major public health significance in Nigeria, Government's commitment to addressing these issues have been remarkably persistent in the last two decades. Since the enactment of voluntary fortification regulation in 2002, at least 20 nutrition-relevant national policies, strategies, and action plans have been developed and used to advance goals directly or indirectly related to improving the nutritional status of Nigerians. The nutrition-specific national policies include the 2010 National Policy on Infant and Young Child Feeding in Nigeria (NPIYCF), the 2014 National Strategic Plan of Action for Nutrition – Health Sector Component (NSPAN), the 2016 National Policy on Food and Nutrition 2016-2025 (NPFN), the 2017 National Social and Behavioral Change Communication Strategy for Infant and Young Child Feeding in Nigeria (NSBCC-IYCN) and the 2021 National Multi-Sectoral Plan of Action for Food and Nutrition 2021-2025 (NMPFAN).

The institutional landscape for nutrition policy in Nigeria is quite well developed, with multiple multi-stakeholder vehicles in place for advocacy and engagement on nutrition policy design, implementation, and evaluation, in addition to nutrition relevant programs and initiatives executed by development sector agencies and non-governmental organisations working with relevant public institutions. This includes the Federal Ministry for Budget & Planning (FMBNP) which serves as the national focal point for food and nutrition policy programme planning and coordination in the country and is also the secretariat for both the National Committee on Food and Nutrition (NCFN) and the National Council on Nutrition (NCN). Also important is the National Fortification Alliance, which serves as a platform for private sector participation on public nutrition policy and helps forge collaboration between public sector and private sector organisations on nutrition. Similarly, the National Agency for Food & Drug Administration and Control (NAFDAC) and the Standards Organisation of Nigeria (SON) play regulatory roles on the national programme on mandatory fortification of specific food vehicles including flour (wheat/maize and its meals), semolina, sugar, vegetable oil and margarine.

Nigeria' s current goals and targets for nutrition are encapsulated in the NMPFAN (2021 – 2025), which outlines specific targets geared towards improving food security at the national, community, and household levels; reducing undernutrition among infants and children, adolescents, and women of reproductive age; significantly reducing micronutrient deficiency disorders, especially among the vulnerable, and ensuring the incorporation of nutrition education into formal and informal training. Other broad goals include promoting optimum nutrition for people in especially difficult circumstances (such as People Living With HIV/AIDS); preventing and controlling chronic nutrition-related non-communicable diseases, incorporating food and nutrition considerations into the federal, state, and local sectoral development plans; strengthening systems for providing early warning information on the food and nutrition situation; and ensuring universal access to nutrition-sensitive social protection. The plan outlines 20 specific targets to be attained by 2025 including the 8 targets outlined below[13]:

- To reduce stunting rate among under-five children to 18%
- To reduce childhood wasting including from Severe Acute Malnutrition (SAM) to 10%
- To achieve and sustain universal household access to iodized salt
- To reduce anemia among pregnant women to 40%
- To reduce prevalence of diet-related non-communicable diseases by 25%
- To increase coverage of vitamin A supplementation to 65%
- To mainstream nutrition objectives into social protection and safety net programmes

[13] Ministry of Finance, Budget and National Planning. 2020, "National Multi-Sectoral Plan of Action for Food and Nutrition (NMPFAN) 2021 - 2025", https://bit.ly/3lEvv2N

- To achieve universal access of all school children in the pre- and basic school classes to school-based feeding programmes

The targets for the plan were derived from and are consistent with the goals of the 2016 National Food & Nutrition Policy (NPFN), for which the NMPFAN is designed to be an operational document. Although the plan proposes the scaling up of nutrition intervention across Nigeria, it indicates that priority should be given to scaling up interventions (both nutrition-specific and nutrition-sensitive) in States where the incidence of stunting exceeds 40% and severe stunting exceeds 20%. It recommends that a full package of nutrition-specific and nutrition-sensitive interventions be implemented simultaneously in these priority States during the five years of the strategy to maximize impact.

4.3 LARGE SCALE STAPLE FOOD FORTIFICATION

Nigeria has had a multifaceted public policy response to the challenge of malnutrition - particularly micronutrient deficiencies - in the last 20 years. These efforts comprise routine (public health) vitamin supplementation, mandatory fortification of certain staple foods, biofortification, point-of-use fortification with multiple micronutrient powders (MNPs), and nutrition education campaigns promoting the consumption of micronutrient-rich foods. In addition, many private sector actors have engaged in voluntary fortification and there is visible evidence of individual supplement use among the general population. The breadth of interventions reflects a mix of health system and food-based approaches to address malnutrition, including micronutrient deficiency control, envisaged in most nutrition relevant policy documents including the National Policy on Food and Nutrition.

Mandatory fortification

Nigeria mandated salt fortification with iodine in 1992, and in 2002, mandated the fortification of wheat flour, semolina flour, and maize flour with multiple micronutrients, and sugar and edible oil with vitamin A. Early success in Nigeria's mandatory fortification program has been followed by mixed program performance, with lengthy periods of declining compliance intermitted with periods of positive compliance rebounds, typically limited to specific food vehicles and/or industry sub-segments.

Nigeria's current level of progress with mandatory fortification at national level is outlined below for each food vehicle.

- ***Edible Oils:*** Compliance estimated at 33% for 2021. Key challenges with edible oil fortification include high consumption of bulk oil by the population, significant smuggling of unbranded bulk oil into Nigeria due to poor border control and high level of industry fragmentation. Up to 46% of Nigeria's approximately 5.5mmt/pa total edible oil consumption (2.5mmt/pa) is imported and 45% of domestic production is processed by hundreds of small-scale processors.[14]
- ***Wheat Flour:*** Compliance estimated at 31% for 2021 which reflected a decline from an estimated high of 92% as at December 2020 due to COVID-19 pandemic related supply chain problems. Previous high levels of compliance have been mostly because 99% of wheat flour consumed in Nigeria (4.8mmt/pa) is imported by 11 large sized companies in a highly consolidated industry – making for relatively easier compliance monitoring. Compliance levels for semolina flour and maize flour are almost negligible as both segments of the industry are highly fragmented and dominated by small/very small-scale processors.[15]

[14] Data from multiple sources: Analysis done as part of BMGF 5-year nutrition strategy refresh and Global Alliance for Improved Nutrition & Technoserve study under the SAPFF Project
[15] ibid

- ***Sugar:*** Compliance estimated at 33% for 2021 which like wheat flour, was a decline from 94% as at December 2020 due to pandemic related disruptions. High levels of compliance have been mostly because almost 100% of sugar consumed in Nigeria (3.3mmt/pa) is produced locally by only 3 large sized companies, two of whom account for more than 90% of total production.[16]
- ***Salt:*** Compliance estimates indicate that 98% of Nigerian households have access to adequate levels of iodized salt. Success has been attributed to effective collaboration between the private sector actors and public sector stakeholders to develop required human and institutional capacities and the existence of a system to consistently implement and monitor the Universal Salt Iodization (USI) program in Nigeria.[17]

	Fortification standards	
Food vehicle	Micronutrient (chemical form)	Level
Wheat flour	Vitamin A (dry VA palmitate 250 CWS)	2.0 mg/kg
Wheat semolina	Vitamin B9 (folic acid food grade)	2.6 mg/kg
Maize flour	Vitamin B12 (vitamin B12 0.1% CWS)	0.02 mg/kg
Whole maize meal	Iron (NaFeEDTA)	40.0 mg/kg
Composite flour	Vitamin B2 (riboflavin fine powder)	5.0 mg/kg
	Zinc (zinc oxide)	50.0 mg/kg
	Vitamin B1 (thiamine mononitrate)	6.0 mg/kg
	Vitamin B3 (niacinamide)	45.0 mg/kg
	Vitamin B6 (pyridoxine hydrochloride)	6.0 mg/kg
Vegetable oil Margarine	Vitamin A	≥20,000 I.U./kg
White sugar	Vitamin A	≥25,000 I.U./kg
Salt	Iodine (potassium iodate)	50 parts per million (ppm) at ports/factories 30 ppm at retail level 15 ppm at household level

Table 1. Mandatory fortification standards for specified staple food vehicles[18]

The data on content fortification show that industries are fortifying but not adequately as mandated by the regulatory agencies[19]. The data on fortification adequacy for both imported and locally produced brands indicate lack of effective border control and possible deficits in regulatory monitoring capacity for food quality and safety.

Voluntary fortification

While not considered core to Nigeria's strategy for micronutrient deficiency control, voluntary fortification of food vehicles is encouraged in Nigeria's nutrition policy, and the MNDC guidelines promote the use of fortificants that are bioavailable, stable, compatible with food vehicles, and have been proven to be effective. Many businesses in Nigeria engage in voluntary fortification to differentiate their products and attract a price premium. Product categories most likely to be fortified are infant formula, powdered milk, breakfast cereals and cocoa drinks. Nigeria's main food safety regulator currently identifies several foods that should be fortified voluntarily and indicates the micronutrients to be used but does not define the specific levels or standards.

[16] ibid
[17] ibid
[18] Anjorin Olufolakemi et all, 2019, "Coordinating Nigeria's Micronutrient Deficiency Control Programs Is Necessary to Prevent Deficiencies And Toxicity Risks", *Annals Of The New York Academy Of Sciences*, doi:10.1111/nyas.14055
[19] ibid

Food safety regulators also manage several regulatory control processes that are aimed at ensuring that food products contain the level of nutrients claimed on product labels, and that product labelling and advertisement does not mislead consumers on the nutrient content.

Fortification advocacy in Nigeria is increasingly being focused on securing more private sector participation through voluntary fortification, and higher levels of proactivity of the regulatory authorities by defining standards for products that are designated for voluntary fortification. Advocacy for the introduction of standards for the voluntary fortification of bouillon cubes is the most advanced, given the high levels of consolidation in the industry, and the high levels of consumption, with over 95% of the West African population consuming bouillon, and over 100 million cubes sold in Nigeria daily.[20] Recent data from West Africa focused advocacy for bouillon fortification indicates coverage at 97% and 99% respectively in two states of Nigeria studied (Akwa Ibom and Borno).[21]

Given the limited capacity of regulatory agencies, successful voluntary fortification in Nigeria will depend to a large extent on industry self-regulation and is likely to be viable for food products where majority of producers are part of strong, functional industry associations that have the capacity to obtain member compliance and have workable methods for enforcing compliance among members.

[20] Data from multiple sources: Analysis done as part of BMGF 5 year nutrition strategy refresh and Global Alliance for Improved Nutrition & Technoserve study under the SAPFF Project
[21] ibid

5 LANDSCAPE ANALYSIS: OVERVIEW OF THE RICE SECTOR IN NIGERIA

5.1 INTRODUCTION

Rice is one of the most consumed staples in Nigeria, with Daily Food Availability (a proxy for daily food intake) estimated at 107g/c/d, compared with 92g/c/d for maize[22]. Rice is now considered essential for food security. There is a growing market for rice in Nigeria due to Nigeria's large population (195 – 200 million) and high population growth rate (2.6%). These factors will continue to sustain demand for rice.

A total land area of around 4 million hectares was harvested by 1.43 million farmers in the 2018/2019 harvest season[23]. The two types of rice mainly cultivated in Nigeria are the African Rice (Oryza glaberrima) and the Asian rice (Oryza sativa). In recent times however, new hybrid varieties have been introduced such as NERICA[24]. A key determinant of rice consumption is quality. The growing urban population (with more disposable income) drive demand for higher quality rice. Large integrated millers can compete with imported rice on quality, but availability of high-quality paddy rice is a major challenge.

The rice value chain in Nigeria is illustrated in Table 2 below. It depicts the structural connections among actors and provides a framework for a sequential analysis of the key sub-segments that make up the sector and understanding the relationship between these segments and how it affects value chain performance in the context of rice fortification.

[22] Global Fortification Data Exchange
[23] KPMG, 2019, "Rice Industry Review", KPMG Nigeria. https://bit.ly/3LFgHM0
[24] ibid

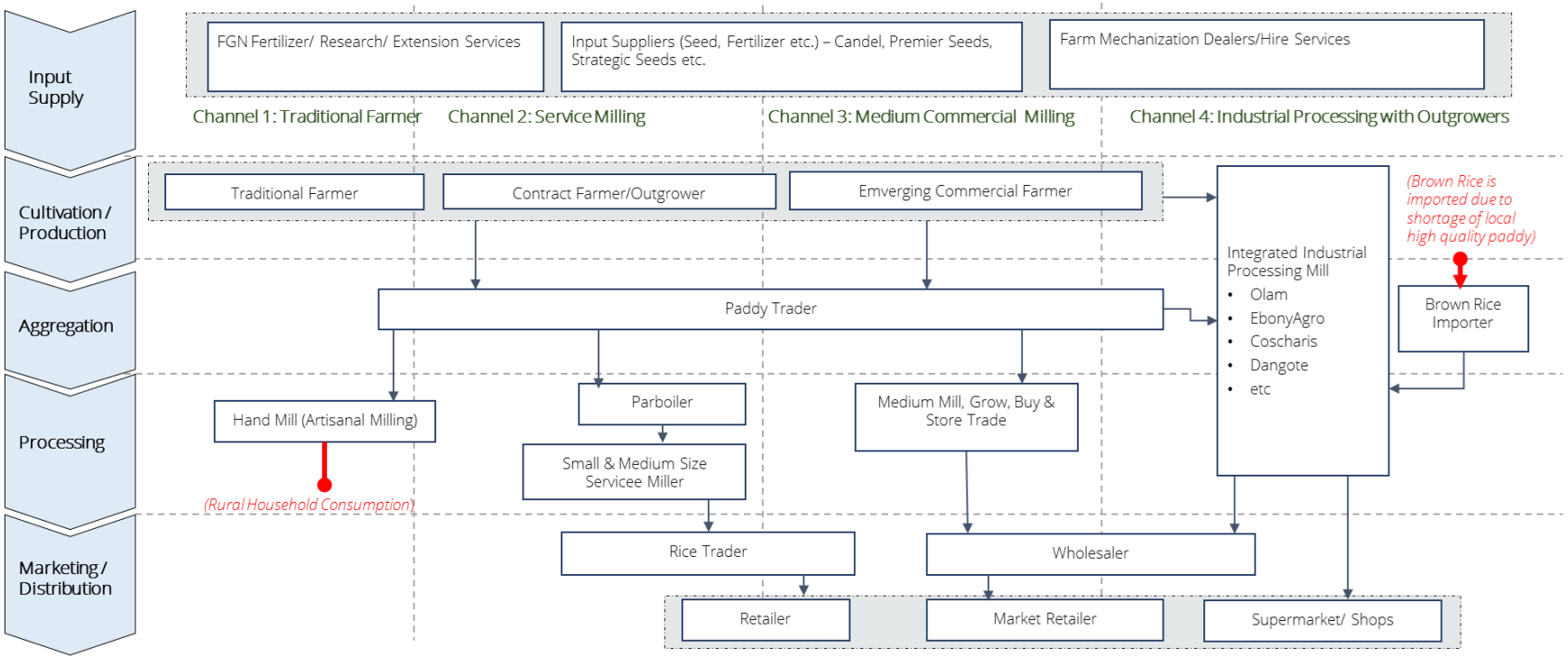

Table 2. Rice Value Chain: Nigeria

A study by USAID identified 5 key value chain actors, aligned with 5 main channels for the production, processing, and marketing for rice.[25]

Channel One (Traditional Farmer)

- Consists of traditional farmers who mainly produce for personal consumption.
- Sell surplus rice to rural markets.

Channel Two (Service Miller)

- 80% of all domestically grown rice that is processed and marketed passes through this channel, employs thousands of millers around the country
- Two kinds of services – parboiling and milling
- Characterized by speculation and trading[2]

Channel Three (Medium Commercial Milling)

- Targets the middle-end urban market
- "Medium" is relative as these mills might process between 500 – 2,000 MT of rice/annum. Sales are minimal – this depends on access to supply
- Core supply comes from the miller's own production of quality paddy on medium to large – size of farms (20 – 150 hectares).
- Two kinds of services – parboiling and milling
- Characterized by speculation and trading[2]
- Supply of paddy from own farms is complemented by paddy from out growers schemes.
- Provide inputs and sometimes cash to channel 2 farmers.
- Often receive limited amount of paddy from channel 2 farmers.
- Mills also purchase additional paddy from open market (quality is not consistent and will go to lower end brand).

Channel Four (Industrial Processing with Out Growers)

- Directly competing with imported rice with high quality locally grown rice.
- New channel, target of significant investment, but in early stages of development.
- Players more likely to have background in trading than in production/ processing

Channel Five (Imported Rice)

- Dominant source of milled rice in the past, but the current Federal Government Administration has focused on banning/severely restricting rice imports.

[25] USAID, 2009, "Global Food Security Response Nigeria Rice Study", https://pdf.usaid.gov/pdf_docs/pnaea873.pdf

5.2 RICE CULTIVATION AND PRODUCTION

Data on rice cultivation in Nigeria is largely inconsistent across multiple sources. However, most sources indicate the rainfed lowlands as the dominant environment for rice cultivation in Nigeria. Rice is cultivated in all Nigeria's agro-ecological zones, from the mangrove swamps of the Niger Delta to the dry zones of the Sahel in the North. However, the Northwest accounts for 72% of total rice production.[26] A total land area of 3.2 million hectares was harvested by 1.43 million farmers in the 2018/2019 season.[27] Rainfed lowland is the most predominant rice production environment covering 47% of cultivated area and accounting for over 50% of the total rice produced in Nigeria, while rainfed upland rice (30% cultivated area, 17% domestic production), irrigated systems (17% cultivated area, 27% domestic production), deep water and mangrove swamp environments (6% cultivated area, 4% domestic production) are the other rice production environments in Nigeria.[28] The estimated cropped area for paddy in 2020 was about 4,195,070 hectares (an increase of about 1.66% over 4,126,670 hectares cultivated in 2019.[29]

Production ecology	Estimated Share of Farmed Area	Share of Domestic Production	Average Yield/ha MT	Potential Yield/ha MT
Rain-fed Upland	30%	17%	1.7	3.5
Rain-fed Lowland (aka "Fadama")	47%	53%	2.2	5
Irrigated	17%	27%	3.5	6-7
Deep Water Floating	5%	3%	1.3	2.5
Mangrove Swamp	1%	1%	2	4

Table 3 - Rice Production Systems in Nigeria[30]

[26] KPMG, 2019, "Rice Industry Review", KPMG Nigeria. https://bit.ly/3LFgHM0
[27] ibid
[28] ibid
[29] National Agricultural Extension and Research Liaison Services (NAERLS), Agricultural Performance Survey of 2012 Wet Season in Nigeria, 2020
[30] USAID, 2009, "Global Food Security Response Nigeria Rice Study", https://pdf.usaid.gov/pdf_docs/pnaea873.pdf

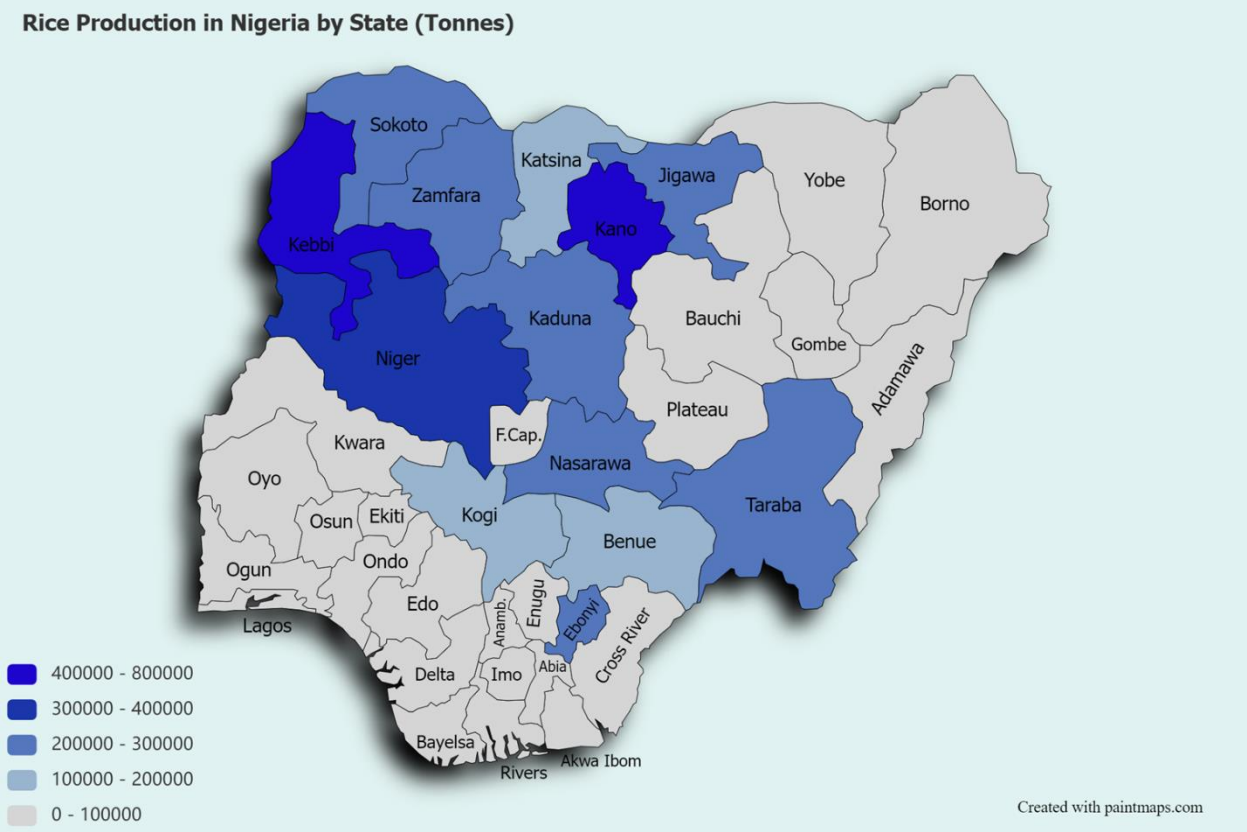

Figure 4 - Rice Paddy Production by State

Northern Nigeria dominates rice production in Nigeria, with Northern regions accounting for around 80% of total rice production in Nigeria.

Region	Production ('000 MT)	Yield (MT/Ha)
South East	466.99	1.92
South West	638.91	1.87
South South	546.19	2.03
North East	1,448.70	1.65
North West	1,944.89	2.06
North Central	3,126.09	2.05

Table 4 - Rice Production and Yield 2020

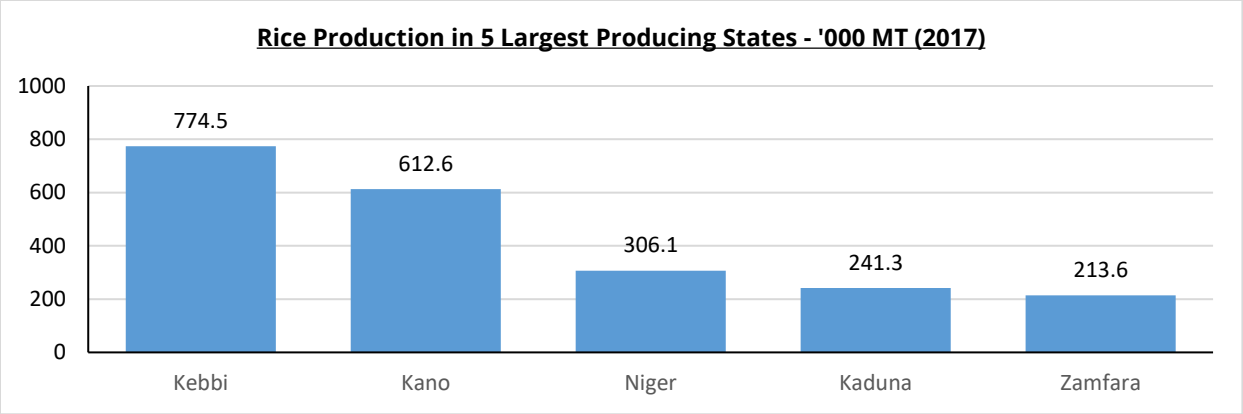

Figure 5 - Rice Production in 5 Largest Producing States - '000 MT (2017)

Domestic Production Estimates

Data on paddy rice production in Nigeria is similarly inconsistent across multiple Sources. Rice (paddy) production output estimates for the 2020 wet season prepared by the *National Agricultural Extension and Research Liaison Services (NAERLS)* estimates total national production of rice (paddy) for the 2020 Wet Season to be **8.178 million metric tons**[31] and average yield (metric tons/hectare) to be **1.93 metric tons/hectare.** However, data from USDA from the same period, indicates an average yield of **2.17 metric tons/hectare.**[32] Table 5 below highlights paddy production data from 2 sources from 2010 – 2021

	Rice Paddy (Area Harvested, hectare)		Rice Paddy (Production, tonnes)	
Year	FAO	USDA	FAO	USDA
2010	2,432,630	-	4,472,520	-
2011	2,269,410	-	4,612,614	-
2012	2,863,815	-	5,432,930	-
2013	2,931,400	-	4,823,330	-
2014	3,081,923	2,500,000	6,002,831	4,400,000
2015	3,121,562	2,700,000	6,256,228	4,500,000
2016	4,935,500	2,500,000	7,564,050	4,300,000
2017	5,627,700	2,500,000	7,826,120	4,286,000
2018	5,913,418	3,600,000	8,403,000	7,400,000
2019	5,312,320	3,600,000	8,435,000	7,600,000
2020	5,257,153	3,500,000	8,172,000	8,000,000
2021		3,600,000		7,762,000

Table 5 – Paddy Cultivation and Production Data from USDA and FAO (2010 – 2021)

[31] National Agricultural Extension and Research Liaison Services (NAERLS), Agricultural Performance Survey of 2012 Wet Season in Nigeria, 2020
[32] ibid

Data from the *Food and Agricultural Organisation (FAO)* on Rice Paddy (Milled Equivalent)[33] – i.e., Rice Paddy production if it were to be converted to and equivalent weight of milled rice, over the past 10 years, is shown in the chart below. The trend illustrates a significant increase in the production of Rice Paddy and Milled Rice and is consistent with the growth rates implied from USDA data also.

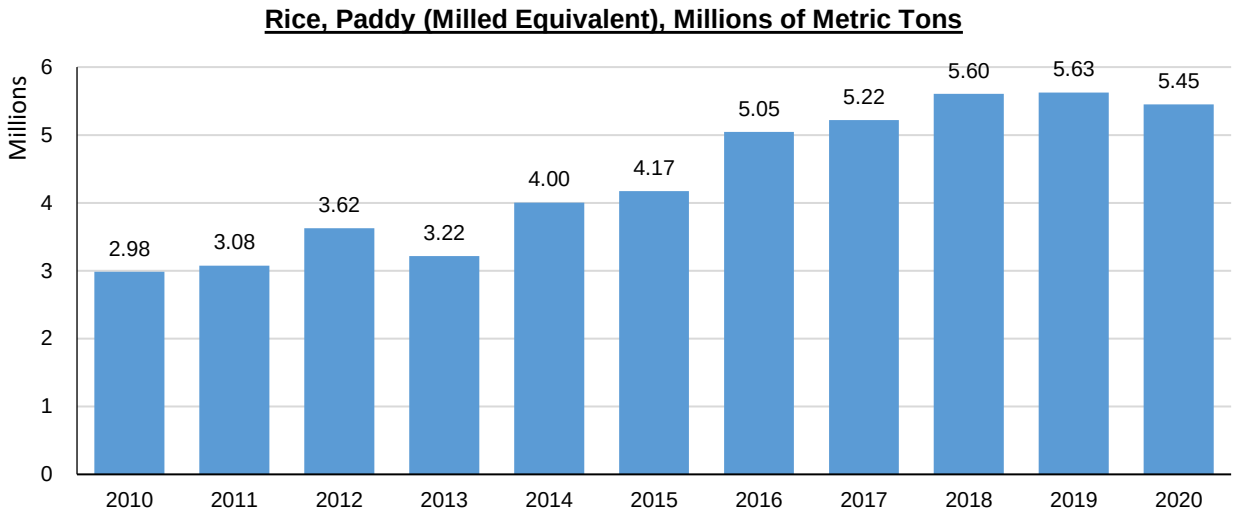

Figure 6 - Milled Rice Production Trends (2010 - 2020) based on FAO data[34]

Cultivation and Production Value Chain Dynamics

Small holders dominate rice production in Nigeria, accounting for around 90% of domestic consumption.[35] Methods employed are often rudimentary (minimal use of purchased inputs like fertilizers and seeds, as well as minimal crop control and protection). Correspondingly, yields are low at less than 2 metric tons/hectare. Contract growing farmers or out-growers are an emerging category largely populated by former small holders. Integrated Industrial processing millers assist these out growers by providing inputs, access to financing/improved production practices and linking them to commercial channels. Yields are higher than for small holders based on data obtained from large millers who use them.

Medium Scale Commercial Farmers, with farms over 20 hectares, tend to be dominated by retired military officers/civil servants[36]. Large scale commercial farmers are also an emerging segment. Examples include Olam and Dangote – who is attempting rice farming on a scale never seen before in Nigeria at 150,000 hectares.

Rice farmers experience cyclical cash flows, thus require substantial working capital, especially during planting and mid-season. The crop calendar for rice normally begins from May to June in the South and June to July in the North. Irrigation increases productivity, but irrigation is scarce – especially in the South.

Threshing, harvesting, weeding and transplanting are usually done manually. Efficiency gains from mechanization will help lower costs and minimize wastage (especially threshing). Most locally produced paddy is manually threshed and parboiled using inefficient/ non-environmentally sustainable methods (e.g., use of firewood for parboiling). Lack of access to finance hinders the use of more efficient means of threshing paddy in the sector. Other key parameters of this segment of the value chain are provided in the figure below.

[33] FAOSTAT, 2022, https://www.fao.org/faostat/en/#data/QCL
[34] FAOSTAT, 2022, https://www.fao.org/faostat/en/#data/QCL
[35] USAID, 2009, "Global Food Security Response Nigeria Rice Study", https://pdf.usaid.gov/pdf_docs/pnaea873.pdf
[36] ibid

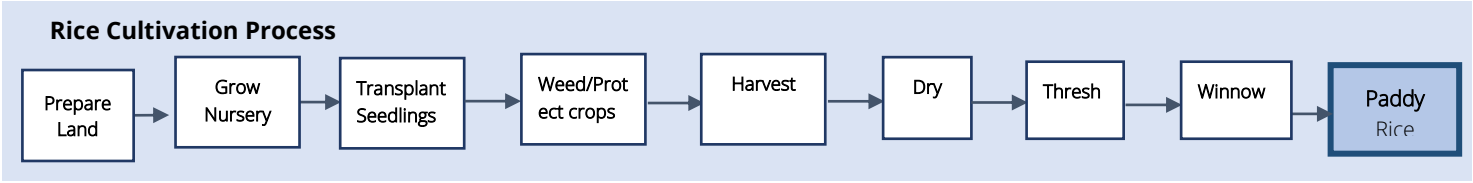

Figure 7 - Rice Cultivation Process

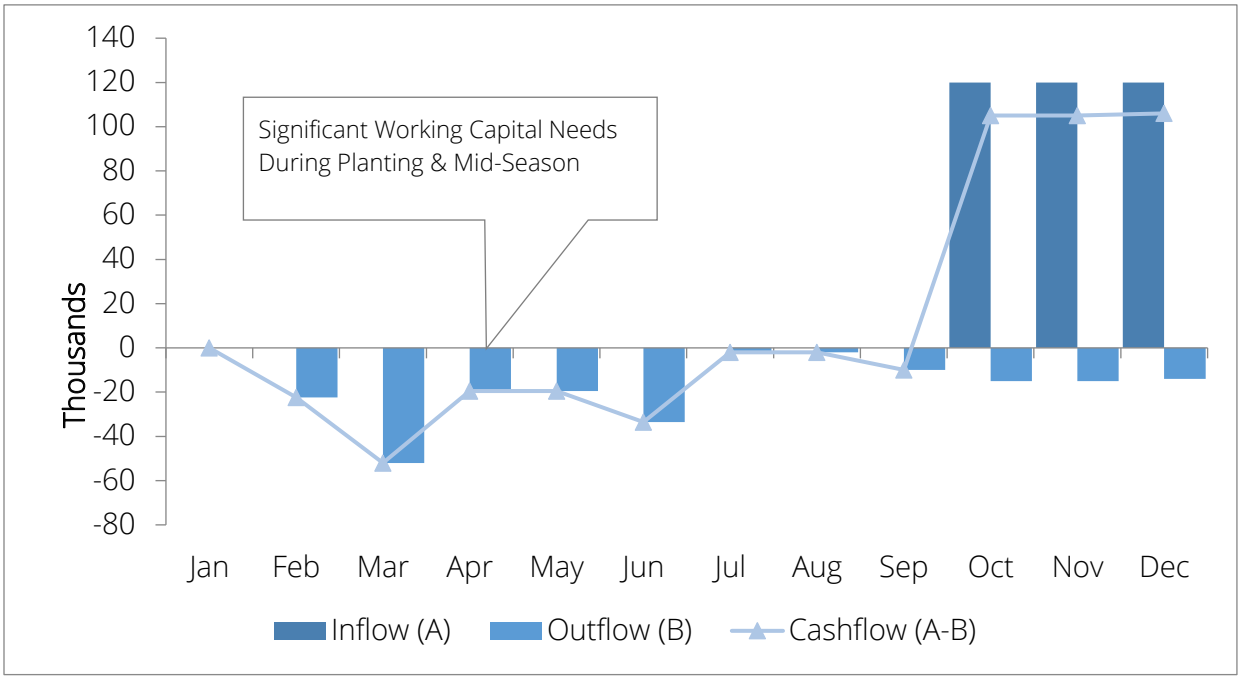

Figure 7 - Illustrative Cash flows for Rice Farmer

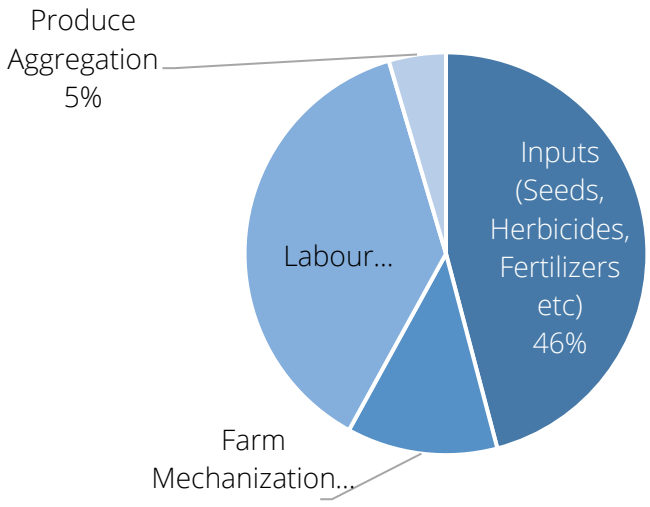

Figure 8 - Cost Breakdown (Cultivation of 1 ha of Paddy)

5.3 RICE AGGREGATION AND MILLING

According to a study by KPMG, small and medium scale millers account for around 80% of processed rice in Nigeria.[37] Small scale millers are defined (by the study) as millers with an annual milled rice output of < 3,000 MT per annum. Large scale millers, on the other hand, account for around 20% of processed (milled) rice output in Nigeria – with large scale millers defined as millers with an annual (milled) rice output > 10,000 MT.[38] The Nigerian Rice Milling Industry can be described as a fragmented milling landscape, with many large, medium and small-scale millers.[39] Key players (large scale millers) are listed in the following table.

Players	Location	Milling Model	Current Capacity (MT/Annum)	Rice Brand
WACOT	Kebbi	Milling only	500,000	Big Bull, Patriot
Stallion Group	Lagos, Kano	Integrated	430,000	Royal Stallion, Caprice, etc.
Lolo Rice	Kebbi	Integrated	370,000	Lolo Gold
Dangote	Jigawa	Integrated	240,000	Dangote[40]
Bua Rice	Kwara	Integrated	200,000	Bua
Umza Rice	Kano	Integrated	190,000	Umza Classic, Tomato
Stine Rice	Anambra	Milling only	141,000	Anambra Rice, Stine Rice, Oyoyo Rice
Coscharis Group	Anambra	Integrated	120,000	Cosrice
Labana	Kebbi	Integrated	96,000	Labana Rice
Hillcrest Agro-Allied	Kwara	Integrated	75,000	Famos Rice
Mikap Nigeria	Benue	Integrated	44,880	Miva Rice
Foodland Mills	FCT	Integrated	43,680	Jubilee Sortexed Rice
Tara Agro	Ebonyi	Milling only	42,000	
Ebony Agro	Ebonyi	Milling only	42,000	Ebony Rice
Velox Integrated Rice	FCT	Integrated	40,000	Azyro Rice
Olam	Nasarawa	Integrated	36,000	Mama's Pride

[37] KPMG, 2019, "Rice Industry Review", KPMG Nigeria. https://bit.ly/3LFgHM0
[38] ibid
[39] ibid
[40] Yet to commence production

Haske and Williams	Adamawa	Integrated	28,000	
Wicklow Group	Kwara	Milling only	16,250	Quarra Rice

Table 6 - Key Rice Millers in Nigeria and their capacity

Aggregation and Milling Value Chain Dynamics

Paddy Traders dominate aggregation and are a major source of short-term financing for farmers.[41] Female participation in this segment of the value chain is significant. Paddy traders largely thrive on the prevailing market inefficiencies[42] to derive their value.

Parboiling is mainly artisanal and will be a major casualty of upgrading activities in the rice value chain. Most parboiling in Nigeria is done before milling, this has cost implications. Industrial mills have appropriate technology for parboiling – large mechanical parboilers.[43]

Milling is dominated by Small Millers working in clusters of small-scale milling in locations like Bida, Abakaliki and Lafia.[44] These towns serve as milling, parboiling, and marketing hubs for Rice in Nigeria and also attract paddy traders and buyers. Most locally produced paddy is parboiled using inefficient/ non-environmentally sustainable methods (e.g., use of firewood for parboiling). There are two categories of small miller types – millers who offer milling as a service, and millers who purchase paddy and mill for personal use. Value of actual milling service is low (< 1% of end value of rice).[45] Main margins are made by purchasing paddy, milling, and selling as milled rice to traders.

Medium Scale Millers usually have integrated operations – in addition to mills, also have large scale paddy farms (greater than 15 – 20 hectares). Large Scale Millers such as Olam and Ebony Agro produce cleaned and polished rice that competes with imported rice on quality (if not cost).[46]

5.4 DISTRIBUTION AND CONSUMPTION

Nigeria is one of the leading rice consuming and importing nations. Per capita rice consumption has increased from about 3.4 kg/capita in the 1970s to over 34 kg/capita today.[47] There are two major groups of consumers in Nigeria[48]: household consumers and institutional/ food service markets (restaurants). Two major segments for household consumers are:

- **High quality rice consumers (mainly urban).** These consumers are less bothered about price but are particular about the quality of rice (seek better cleaned rice). This is a rapidly growing segment of the market. For locally made rice to appeal to this segment, it has to compete with imported rice on quality (primarily) and then on cost.

[41] USAID, 2009, "Global Food Security Response Nigeria Rice Study", https://pdf.usaid.gov/pdf_docs/pnaea873.pdf
[42] ibid
[43] ibid
[44] ibid
[45] ibid
[46] ibid
[47] KPMG, 2019, "Rice Industry Review", KPMG Nigeria. https://bit.ly/3LFgHM0
[48] ibid

➔ **Lower quality rice consumers.** This category is more sensitive to price and prefers the taste of local rice.

Demand from institutional /food service markets (restaurants) consumers also comprise multiple segments

- Private or public school feeding programs that purchase rice, prepare and feed children with, or distribute rice in bags to underserved populations
- Purchase large amounts of rice to prepare and sell. Purchase mainly imported rice but are less concerned about quality variations. Rice is a major staple of the restaurant business.

Distribution and Consumption Value Chain Dynamics

Rice consumption exceeds production, with a yearly deficit of around 2.4 million MT of milled rice recorded between 2007 and 2018. 3 million MT of rice was imported into Nigeria in 2018 (this figure does not include the amount smuggled in via land borders).[49] Most rice is imported from Thailand, India and the USA.[50] Total demand between 2007 and 2018 increased at a rate of 5.3%, while imports increased at a rate 5.24% in the same period.[51]

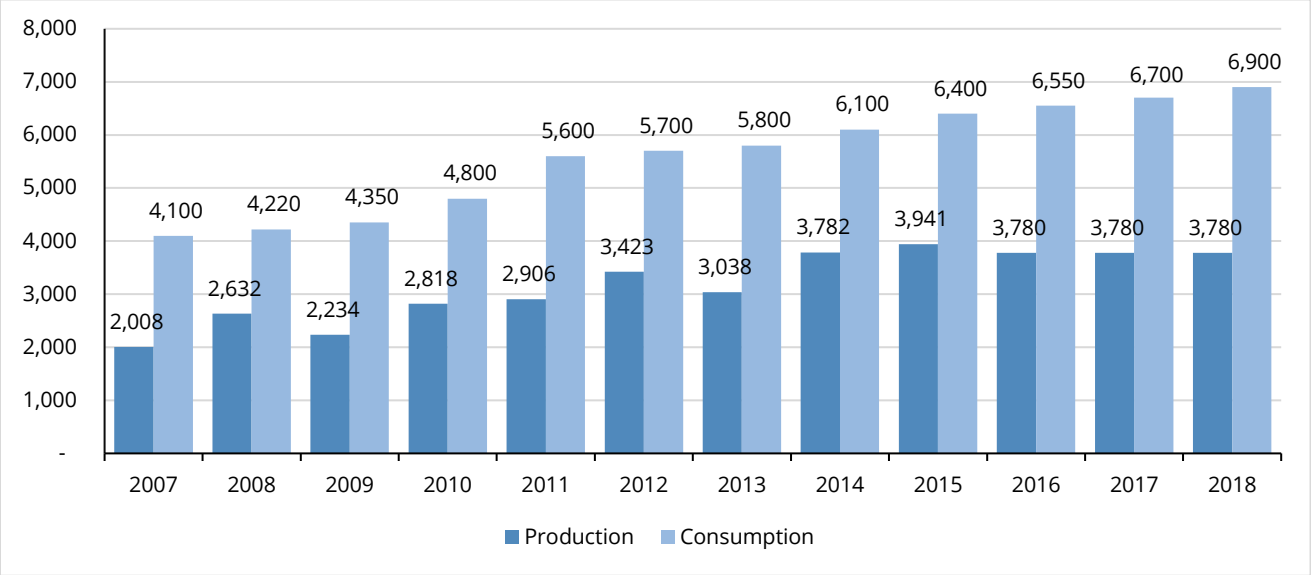

Figure 9 - Rice Demand and Supply (2007 -2018) '000 MT

According to a study by KPMG, modern grocery retailers like supermarkets, hypermarkets and convenience stores account for less than 0.5% of all rice sold in Nigeria.[52] Nigerians depend heavily on independent small traders to purchase rice. Formal retail outlets account for around 10% of total rice sales (N245 billion). The top three brands bought through formal retail outlets include Caprice, Royal Stallion and Mama Gold (not imported into Nigeria since 2015), accounting for over 50% of the market. They are all Thai brands of rice. Consumers still prefer imported brands over local brands, and imported brands tend to sell at a premium compared to local brands.[53]

[49] KPMG, 2019, "Rice Industry Review", KPMG Nigeria. https://bit.ly/3LFgHM0
[50] ibid
[51] ibid
[52] KPMG, 2019, "Rice Industry Review", KPMG Nigeria. https://bit.ly/3LFgHM0
[53] ibid

	₦ (Billions)
Others	77.3
Royal Stallion	66.1
Caprice	41.6
Mama Gold	40.7
Uncle Ben's	15.3
TRS Basmati	8.4
Lintex	5.1

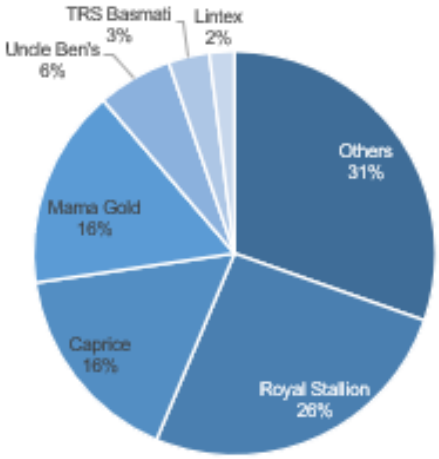

Figure 10 - Competitive landscape for Rice in the formal retail market

Based on sampling of branded rice products from supermarkets across the country as of June 2022, comparative prices of local rice brands versus imported rice brands are presented below.

FOREIGN RICE		PRICE FOR 50KG IN NAIRA	LOCAL RICE		PRICE FOR 50KG IN NAIRA
Caprice		28000-34000	Mama Gold		30000-35000
Falcon Rice		29000-33000	Royal Stallion		25000-27500

Table 7. Retail prices for local versus imported rice

5.5 Rice Sector Value Chain Constraints

The most important key constraints in the Rice Value Chain (which represent opportunities for investment and significant return on investment) are:

- ➔ **Low yields per hectare and low productivity** – stemming from poor agronomic practices and low adoption of technology. Average yields/ hectare in Nigeria (1.93 MT/Ha) are very low compared to

global averages.[54] Many small and medium sized farmers use manual and rudimentary techniques for threshing, harvesting, weeding and transplanting. Efficiency gains from affordable mechanization will help lower costs and minimize wastage. The National Cereals Research Institute, Badegi (NCRI), developed a mechanical thresher with the capacity for 3,000 kg of rice seeds/day but private sector adoption is not evident.[55] Availability of quality seed and agronomic inputs like fertilizers is also major challenge for small and medium rice farmers/producers – and has an impact on large scale (integrated) millers, who source their raw materials (paddy) from small holders.

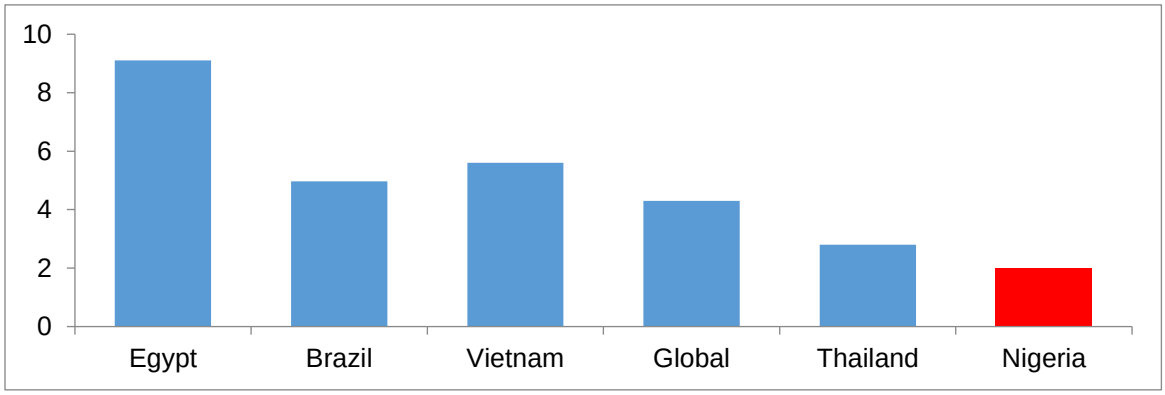

Figure 11 - Average yields/ hectare in Nigeria vs Other Countries (MT/Ha)

- **Inconsistent policy environment:** The rice value chain is extremely sensitive to government policies and since government policies have been inconsistently implemented over the years, there are significant risks to investing in the rice value chain in Nigeria.[56] The overarching aim of government policy has been import substitution, but inconsistent implementation could lead to the opposite effect. Another issue is lax enforcement of border controls. Official statistics from Nigeria seldom provide an accurate picture of the true trade situation. Statistics from Benin show that per capita consumption of rice in Benin is consistently higher than it is in Nigeria – especially when protectionist measures are enforced in Nigeria.[57]
- **Issues with availability of paddy and low milling capacity utilisation:** There are significant challenges in sourcing the required quantities of high-quality paddy required for modern milling. Field data suggests a paddy to milled rice conversion rate of about 53%.[58] This is much lower than 72% which can be achieved in high quality mills or the >60% which is the norm in major rice producing nations like Thailand. In a 100kg bag of paddy, there is 87kg of "clean paddy".[59] 13% of 13kg of the 100kg bag is waste. Processed paddy produces: 21% of chaff, 6% of broken rice, 5-6% of bran, 1% of black residues (rejects) and 53% of milled rice.[60] The challenges with paddy availability translate to a significant under-utilization of milling capacity, with anecdotal evidence indicating that most mills run at between 40-60% of their installed capacity annually.

[54] Adapted from International Finance Corporation (IFC) & Diamond Bank, Nigerian Agriculture Value Chain Mapping Project (Unpublished Work), 2016
[55] Nigerian Cereal Research Institute (NCR() Website
[56] USAID, 2009, "Global Food Security Response Nigeria Rice Study", https://pdf.usaid.gov/pdf_docs/pnaea873.pdf
[57] ibid
[58] Field Data (from interviews with stakeholders)
[59] ibid
[60] ibid

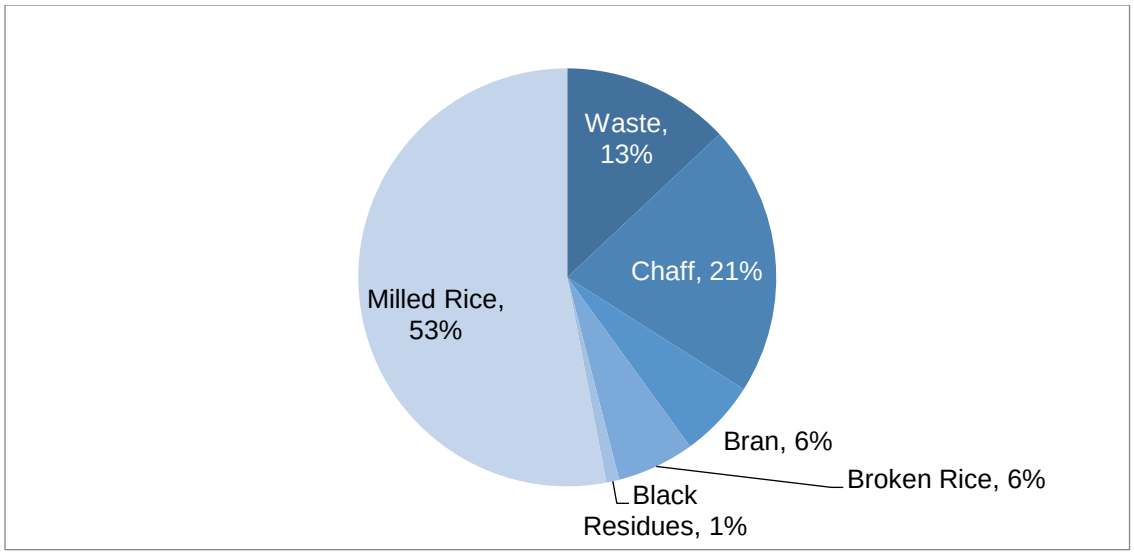

Figure 12 - Paddy composition by percentage

- **Underdeveloped infrastructure and insecurity:** Lack of access roads, electricity and increasing restiveness in rural communities, impact on the operations and profitability of value chain actors.

6 LANDSCAPE ANALYSIS: TECHNICAL FEASIBILITY ASSESSMENT FOR RICE FORTIFICATION IN NIGERIA

6.1 OVERVIEW AND SCOPE

Rice is primarily consumed as a kernel, not in flour form (like other grains like wheat and maize). Consequently, fortification of rice to improve its micronutrient status has been significantly more challenging to implement on a global scale.[61] According to estimates by the Food Fortification Initiative, less than 1% of industrially milled rice is fortified globally.[62] In comparison, it is estimated that approximately 28% of industrially milled wheat flour and 58% of industrially milled maize flour is fortified with at least iron and folic acid.[63] Ninety countries have mandatory legislation to fortify wheat flour, while only eight countries have mandates in place for the fortification of rice.[64]

There are two recommended technologies for rice fortification:

1. **Extrusion (Extruded Kernels):** In this process, rice flour (from broken rice) is mixed with a concentrated vitamin-mineral mix to create a dough, which is shaped into rice-shaped kernels, by an extrusion machine, and then dried. Fortified kernels are blended with non-fortified milled rice (at a ratio ranging from 0.5 – 2.0%) to create fortified rice.
2. **Coating (Coated Kernels):** Milled rice is coated with a concentrated liquid vitamin-mineral premix, suspended in a wax or gum. The fortified kernels are then dried. Fortified kernels are blended with non-fortified milled rice (at a ratio ranging from 0.5%-2%) to create fortified rice. Coating technology must be rinse-resistant to prevent nutrients from being washed off the kernel. However, nutrients may seep into the water during cooking, making coating ineffective in cultures (like Nigeria) where excess water is poured away during the cooking process.

The dominant consensus amongst experts is that extrusion is the most appropriate technology for rice kernel fortification in Nigeria.

[61] Global Alliance for Improved Nutrition (GAIN) & Food Fortification Initiative (FFI), "Feasibility and Potential Coverage of Fortified Rice in the African Rice Supply Chain", 2016
[62] ibid
[63] ibid
[64] ibid

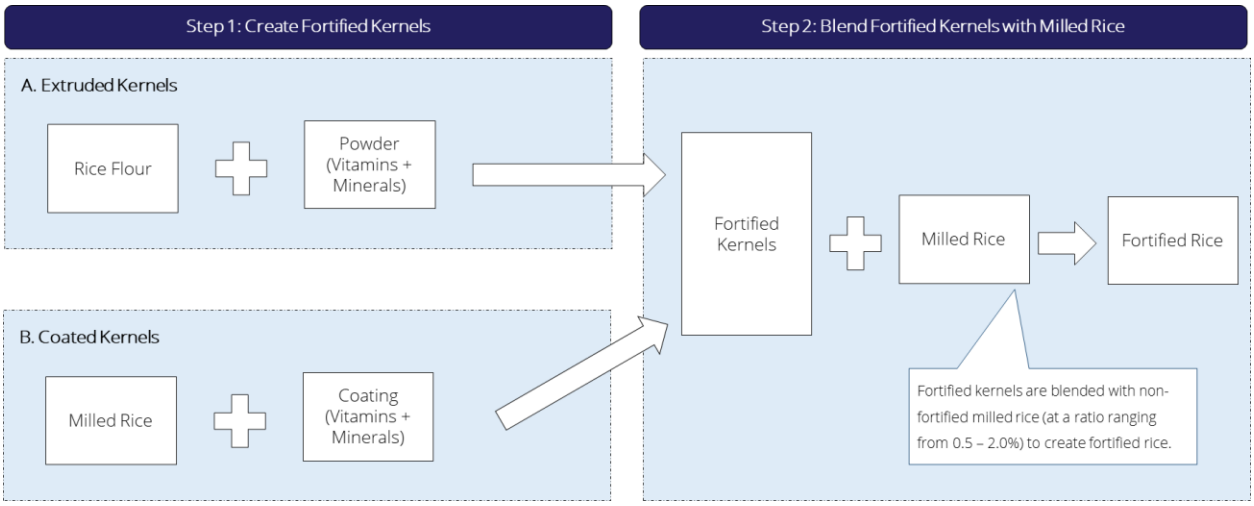

Figure 13 - Process flow for Rice fortification technologies

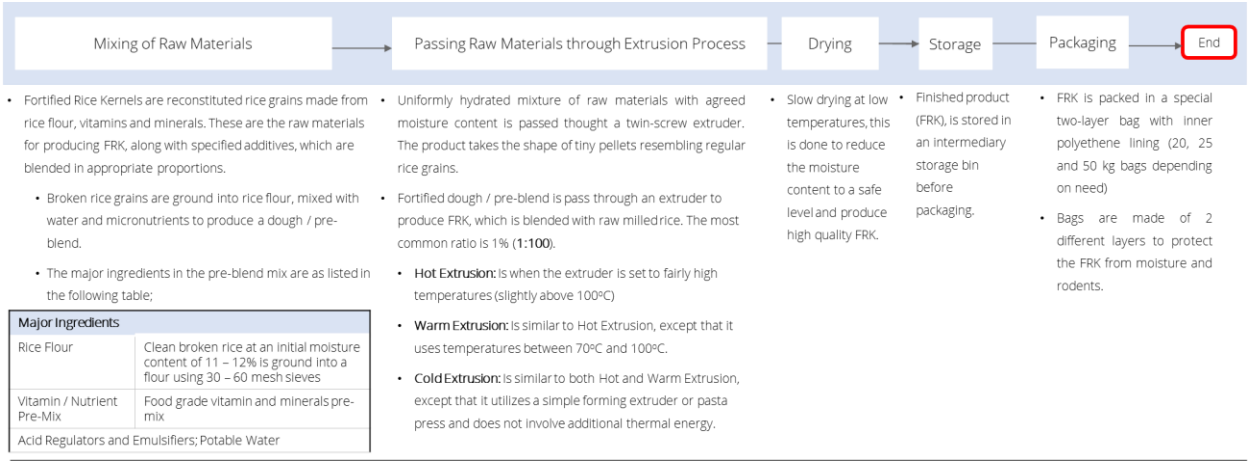

Figure 14 - FRK (Extruded Kernels) Process flow

The feasibility of rice fortification in a country is significantly influenced by the viability of the local manufacturing industry. Rice fortification at village or small scale (<5MT/hr of paddy mills), is typically less efficient than fortification in large industrial mills that can take advantage of economies of scale. The Nigerian rice milling industry is characterized by high numbers of small mills which are therefore difficult to regulate and may not have the resources to invest in building the capacity to fortify rice on a sustained basis. Some larger mills, however, operate at a scale that allows them to have the resources for investment in equipment, quality control, quality assurance training and be able to secure a stable source of fortified kernels.

This section of the study presents the findings of an assessment of the technical feasibility of rice fortification in Nigeria, as an additional tool to fight malnutrition and micro-nutrient deficiencies aimed at optimizing the significant potential of rice as a food vehicle, given its high level of consumption and significant household coverage in Nigeria.

6.2 APPROACH TO TECHNICAL FEASIBILITY ASSESSMENT

The approach adopted for this technical feasibility assessment is anchored on establishing the parameters around which a potential intervention on rice fortification can be sustained, based on the alternative options for producing fortified rice kernels and their integration into the rice milling process. This approach provides a data-driven evidence base to guide policy makers and stakeholders within any fortification policy context – mandatory, voluntary or hybrid. The data outlined in the sections that follow represent the expected outcomes when fortified rice production in Nigeria is modelled under different production scenarios, given a set of assumptions around the various factors of production, from sourcing through to processing and distribution. These figures must therefore be considered as primarily directional, and only interpreted in the context of multi-scenario analysis, not as definitive conclusions.

The feasibility and sustainability of a potential intervention on rice fortification in the rice value chain, is dependent on several key factors including:

1. Structure and capacity of the rice milling Industry
2. Available distribution channels
3. Rice consumption patterns
4. Consumer preferences
5. Market size
6. Policy and regulatory environment

The approach adopted to establish technical feasibility in this study is to estimate the cost of introducing fortification into industrial rice processing and assess the impact on overall costs and profit margins of rice processors under three different production scenarios for FRKs. Scenarios in this context refer specifically to the alternative approaches to introducing FRKs into the rice value chain regardless of the overarching policy choice (mandatory or voluntary).

- Scenario 1: Introducing fortification to locally processed rice by blending with imported FRKs.
- Scenario 2: Introducing fortification to locally processed rice by blending with locally produced FRKs (produced by third party).
- Scenario 3: Introducing fortification to locally processed rice by blending with locally produced FRKs produced in-house by the rice miller.

Figure 16 illustrates actors, activities and materials leading to the production of fortified rice kernels, which is used as a framework for assessing the viability of the three technical approaches/scenarios for envisaged rice fortification in Nigeria.

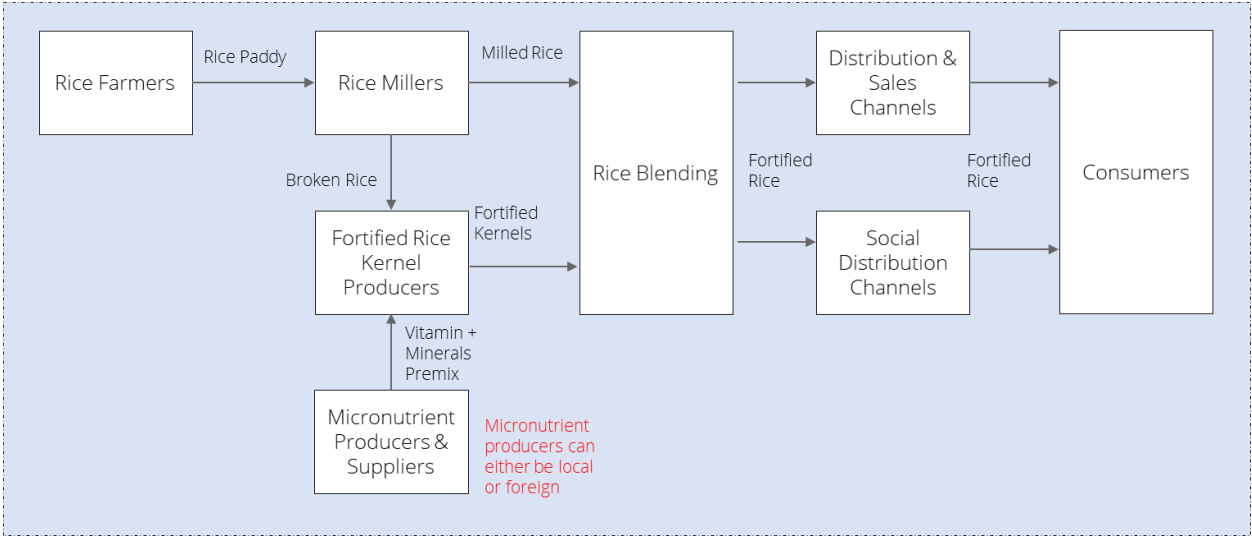

Figure 15 - Fortified Rice Supply Chain Illustration

6.3 SCENARIO 1: LOCALLY PROCESSED RICE WITH IMPORTED FORTIFIED RICE KERNELS

Scenario Description

In this scenario, an already existing large integrated miller who has invested significantly in backward integration, with a large (nucleus) farm, which doubles as a demonstration center for contract farmers (outgrowers), to assure of a reliable supply rice paddy, decides to invest in a rice blending plant, to process fortified rice with imported fortified rice kernels. This is illustrated in the following schematic.

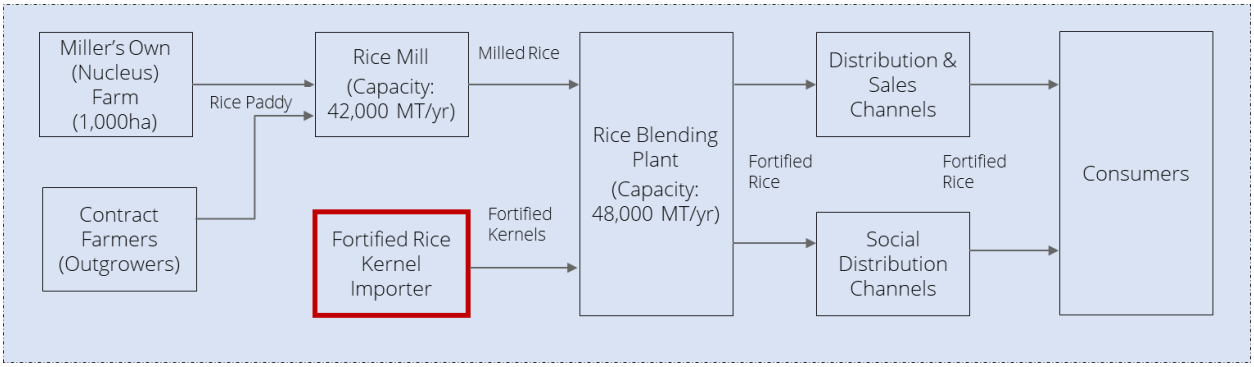

Figure 16 - Scenario 1 graphical description

Profile of the Large Scale (Integrated) Processor

Large Scale (Integrated) Rice Processors in Nigeria have the following broad characteristics:

- Produce high quality locally grown rice which directly competes with imported rice;
- Are a new channel, target of significant investment, but in early stages of development;
- More likely to have background in trading than in production/ processing;
- Tend to invest significantly in backward integration and have the financial resources to import brown rice to supplement local supplies of rice paddy;

- To ensure high quality inputs from small holder farmers, processors act as "value chain coordinators" for small holders. (e.g. Olam's scheme for farmers in Nasarawa State);
- Buyers can improve their control over crop supply, often at pre-agreed prices, as well as crop quality standards;
- Their farmers access more secure markets, often receiving technical and financial support by cultivating within out grower schemes.

Key Assumptions

For this scenario, we assume that this miller operates a 1000 ha nucleus farm at 5MT/ha, and a rice mill with an average capacity utilization of 84-100MT/day for 300 days in a year. This translates to a total direct cost of producing a bag of normal milled rice of N18,800 to N20,600 per 50kg bag.

Costs associated with importation of Fortified Rice Kernels

Based on an initial Free on Board (FOB) cost of $641 per ton, and the assumption that costs per ton will increase by 5% year on year, the FOB cost projections per ton of fortified rice kernels over a 5-year period, are presented following:

	Year 1	2	3	4	5
US$/MT	641	673	707	742	779

Table 8 - Free on-board Cost projections per ton over a 5 year period (US$/Metric Ton)

Based on tariff computations (see Appendix) and a US$/₦ conversion rate of (1:600), the landing costs of FRKs over a five-year period is projected in the following table.

Landing Cost of Imported Fortified Rice Kernels						
Year		**1**	**2**	**3**	**4**	**5**
FRK (Landed Costs) per Metric Ton	₦/Ton	591,261	620,286	650,762	682,762	716,362
FRK (Landed Costs) per 50 kg	₦/50 kg bag	29,563	31,014	32,538	34,138	35,818

Table 9 – Scenario 1, Landing Cost of Imported Fortified Rice Kernels (Projected)

Costs associated with Integrated Processor's Blending Plant

For this scenario, we have assumed an 8MT/hour FRK blending plant installed at a cost of US$100,000 producing 12,000 – 14,000 tons of FRK annually.

Key Results

Based on the preceding analysis, there would be a 1.6%-1.9% increase in direct costs per 50kg bag for an integrated processor of this type, due to the introduction of fortification using imported FRKs. This amounts to a potential impact of 5%-6% on estimated processor margins per 50kg bag.

6.4 SCENARIO 2: LOCALLY PROCESSED RICE WITH LOCALLY PRODUCED FRKS (BY THIRD PARTY)

Scenario Description

This scenario builds on the same assumptions for Scenario 1, with the major difference being that fortified rice kernels are sourced from a stand-alone Fortified Rice Kernel Plant, probably established by a major player or by Government.

Costs associated with Third-Party Plant for Local Production of FRKs

An analysis of the costs involved in setting up and producing fortified rice kernels as a stand-alone international standard plant. The costs of setting up this plant are typically significant, in the range of $4.5 million, although cheaper plants can be procured for less than $100,000 with lower throughput and quality of output.

Key Results

For this analysis, we use a plant with the capacity to produce 4.10-6.84 thousand metric tons per year with an average capacity utilization achieved by plant of 1 metric ton per hour with broken rice sourced from the open market. Based on these parameters, our analysis indicates a 2.4% to 2.7% increase in direct costs per 50kg bag for an integrated processor that has introduced fortification using FRKs made locally by a third party standalone FRK producer using the FRK production plant specifications described. The estimated potential impact on processor margins in this scenario is in the range of 7.5% to 10% per 50kg bag.

Our analysis indicates that with a lower capacity FRK production plant at 250-400kg per hour, the increase in direct costs per 50kg bag in this scenario will be in the range of 2.0% to 2.2% with an estimated potential impact on processor margins in the range of 4% to 6% per 50kg bag. This increase can be further reduced if broken rice obtained as a by-product of rice milling in an integrated mill, as against being sourced from the open market.

6.5 SCENARIO 3: LOCALLY PROCESSED RICE WITH LOCALLY PRODUCED FRKS (BY MILLER)

Scenario Description

This scenario builds on Scenario 2, with the major difference in this scenario being that a miller has a stand-alone fortified rice kernel plant, which uses broken rice output from the mill as raw material. Broken rice is also purchased from the open market, as the broken rice output from the mill is insufficient to meet the needs of the fortified rice kernel plant. The miller's own fortified rice kernel plant is assumed to be of lower capacity than the stand-alone 1MT/hour FRK plant described in Scenario 2.

Key Assumptions

Costs associated with Miller's Plant for Local Production of FRKs

An analysis of the costs involved in setting up and producing fortified rice kernels was carried out, with data obtained from sources like Jinan Shengrun Machinery Company, Limited (a Chinese manufacturer). The costs of setting up this plant with the FOB (Free on Board) cost of the equipment is in the range of $65,000.

Capital Outlay	Totals (₦)
Fortified Rice Kernel Plant	58,384,076
Generator	27,790,000
Total Capital Expenditure	86,174,076
Year 1 COGS and OPEX	2,284,809,267
Totals	2,370,983,343

Table 10 – Scenario 3, Initial Capital Outlay for FRK Processing Plant (attached to Mill)

Key Results

In this scenario, the increase in direct costs for an integrated processor due to introduction of fortification using FRKs produced by a miller with a lower capacity FRK plant embedded within its own mill will range from 1.9% to 2.2% with an impact on processor margins of between 6% and 7% per 50kg bag.

6.6 CONCLUSIONS ON TECHNICAL FEASIBILITY ASSESSMENT

Our analysis indicates that for large sized millers, the introduction of fortification could increase direct costs by between 1.6% and 2.7% depending on the approach adopted in sourcing for the FRKs, and that this change could impact processor margins by between 4% and 7%. Although the scenarios analysed above apply directly to large size mills, reasonable inferences can be deduced on the potential impact for small and medium sized mills based on the above figures. The extent to which these processors can absorb these direct costs without transferring them to the consumer in the form of an increase in final retail price will differ from one processor/category of processors to the other, but the key determinants will be the policy environment within which rice fortification is introduced. Our analysis indicates that the most important factors in the policy environment will be the level of sophistication and initial setup cost of local FRK processing plants; the extent of economies of scale achievable in the deployment of local FRK plants to serve the entire market efficiently; the cost of raw material sourcing for FRK production; and the technology deployed for FRK blending. Policy focus on these areas with due consideration of systemic impact of policy actions will be critical to success.

Some perspectives of processors on whether consumers will pay the extra cost of fortified rice were obtained as part of this study. Majority of stakeholders interviewed believe that consumers in higher income brackets will pay if the benefits of the product (fortified rice) are marketed well to them, but consumers in lower income brackets and in the most vulnerable population segments will not. However, existing literature indicates that the demand for local rice in Nigeria is price inelastic. There is a pervasive view that if fortified rice comes at a higher price, consumers will likely stick with the cheaper alternatives, so some form of government mandate or intervention might be needed to facilitate wide scale adoption of fortified rice.

The findings from the overall landscape analysis and the technical feasibility assessment indicate that an ideal fortified rice intervention in Nigeria will be characterized by a few larger rice mills supplying fortified kernels to multiple mills as it is not cost effective for many medium and large-scale millers to invest in the production of fortified kernels. Medium, and large-scale millers can incorporate blending facilities relatively easily in this scenario. Although this scenario will trigger additional costs for raw material and finished product transportation (broken /head rice etc.), its pressure on processor margins and/or farm gate price of rice, will still be less than independent FRK producers using sophisticated extrusion lines. The pressure on margins and prices will however be more compared with using only imported FRKs, though this can be mitigated with policy actions targeted at reducing initial set-up cost and costs associated with ongoing fortification for rice millers involved with domestic FRK production. The viability of domestic production of FRKs depends in part on several factors:

1. Domestic production of rice
2. Market size of fortified rice
3. Industrial capacity
4. Transportation costs
5. Existing regulatory framework

Given the high level of fragmentation in the rice processing sector**,** the main challenges to establishing a national rice fortification program based on this approach will be logistical as well as quality assurance/quality control, with the blending step being a potentially difficult bottleneck. Alternatively, an approach that is focused on strategic use of social safety net programs to provide a foundation for long term market-based adoption of fortified rice could also be workable.

7 RICE FORTIFICATION: STAKEHOLDER MAPPING AND ANALYSIS

7.1 METHODOLOGY

The stakeholder mapping was based on qualitative data obtained through secondary desk research and literature reviews, complemented with expert opinion/perspectives. The objective of the mapping process was to answer the following questions:

- *Which actor is doing what with respect to rice fortification in Nigeria and what interventions are being implemented?*
- *Who are the key market actors and who could the key policy actors?*
- *What are the likely perspectives of the key stakeholder groups on the strategic direction for rice fortification? How do these perspectives differ and what are the implications for policy?*
- *What are the relationship dynamics between these stakeholder groups?*

The key steps followed were:

- ➔ ***Process mapping:*** Develop a process map/value chain of the rice fortification process based on the dominant technical approaches and identify the key stakeholder categories relevant to the rice fortification process in any fortification policy scenario (mandatory or voluntary).
- ➔ ***Stakeholder Identification:*** Identify the specific stakeholders in each of the categories identified above as it relates specifically to rice fortification in Nigeria; and
- ➔ ***Stakeholder analysis:*** Identify the dominant perspectives related to the approach to rice fortification and indicate likely stakeholder leanings towards these perspectives.

Process Mapping

The project team undertook a desk review of relevant technical documents describing the various technical approaches to fortifying rice at the process level. This review formed the basis of identifying the range of actors involved at each stage and outlining a fortified rice value chain highlighting the specific differences compared with the standard rice value chain. The description of the specific activities across each segment of the value chain provided the basis for identifying the broad categories of stakeholders relevant to rice fortification, informing the next stage of identification and analysis.

Stakeholder Identification

The identification of stakeholders was based on further desk research and literature review focused on generating a long list of entities in Nigeria, for each of the broad categories of stakeholders identified in the preceding step. For this purpose, a stakeholder is defined as any person, organization, or social group that has a stake (vital interest) in any of the activities in each of the segments of the fortified rice value chain, provided such segment is critical to the advocacy process for adoption of rice fortification. The team relied on previous knowledge of the rice industry and the national nutrition landscape to refine and prioritize the list to select the most relevant stakeholders in each category as it pertains to the specific context of introducing rice as a fortification vehicle in Nigeria.

Stakeholder analysis

The objective of the stakeholder analysis was to understand the likely perspectives of the key stakeholders on the strategic direction for rice fortification, reach informed conclusions on the likely impact of these perspectives on the advocacy process for adoption of rice fortification, and identify the implications for policy. The framework adopted on the analysis was to identify for each stakeholder organization or group, the likely

degree of interest (or lack of it) in rice fortification and the potential degree of influence (positively or otherwise) on the advocacy process. The team utilized a pragmatic approach to data gathering for this analysis by:

Reviewing known media sources where perspectives from these stakeholder groups on the issue of rice fortification or other closely related issues may have been previously expressed;

Reviewing public information on the prevailing situational dynamics (economic, organizational, or political) of each of the stakeholder organization groups to assess likely impact on their perspective towards a fortification program for rice; and

Seeking expert opinion on an informal basis from individuals with close relationships with stakeholder organizations or groups to elicit indicative views on likely perspectives.

The data gathered was used to qualitatively assess the degree of stakeholder interest and influence on a graduating scale.

7.2 KEY FINDINGS

Process Mapping Stakeholder and Identification

The mapping and stakeholder identification process resulted in the identification of thirteen (13) relevant stakeholder categories. To ensure adequate stakeholder coverage, two considerations for assessing relevance are reflected:

1. Relevance to the advocacy process aimed at introducing rice as food fortification vehicle in Nigeria; and
2. Relevance to the long-term goal of adoption to ensure optimal availability and accessibility of fortified rice which contributes significantly to meeting Nigeria's micronutrient deficiency control goals.

The outcome of the process is summarized in Table 18 below:

Sn	Stakeholder Category	Relevance (1)	Relevance (2)
1.	Input suppliers (across all rice fortification techniques)	Medium	High
2	Rice farmers (producers of rice paddy)	Low	Low
3	Small scale rice millers/processors	Medium	High
4	Large scale rice millers/processors	High	High
5	Wholesale rice traders (paddy aggregators and rice traders)	Medium	High
6	Institutional consumers (of processed rice)	High	Medium
7	Research institutes (involved in grains and cereals)	Low	High
8	Food safety and control agencies/authorities	Medium	Medium
9	Policy making organizations	High	High
10	Rice value chain financiers	High	High
11	Advocacy organizations (for rice fortification and nutrition)	High	High

12	Business Accountability Mechanisms (relevant to Rice)	Low	High
13	Rice importers (including countries of origin for imported rice)	Medium	High

Table 11 – Key Stakeholder categories relevant to rice fortification in Nigeria

The outcome of the stakeholder mapping and identification process is illustrated in Figure 28, which highlights the broad stakeholder categories relative to the respective value chain sub-segments that they are associated with. A detailed list of identified stakeholders is provided in Appendix A.

Stakeholder Analysis

As described in the methodology section, the project team undertook an analysis to understand the likely perspectives of different stakeholders on rice fortification, by assessing likely degree of interest vis-a-vis degree of influence. For more clarity, interest and influence as used for this analysis are defined below:

- **Interest:** This refers to the level of interest, based on the extent to which the stakeholders are impacted by the outcome of the initiative. For this mapping effort, it refers to the extent to which stakeholders consider the introduction of rice fortification impactful to their organizational or group objectives. Positively impactful will indicate high interest, while negatively impactful or not impactful at all will translate to low interest.
- **Influence:** This measures the stakeholder's level of influence, or how much can the stakeholder impact the outcome of the initiative. It indicates their ability to successfully resist the recommendation or change emerging from this initiative. For this mapping effort, it refers to the extent to which stakeholders wield the power to actively support the introduction of rice fortification, passively support it, or actively oppose it – all to great effect.

The outcome of this analysis is reflected in the form of an Influence-Interest matrix in Figure 29. Please note that the data used for this analysis as described in the methodology section is deductive, so as more information and insights become available, this matrix should be updated accordingly.

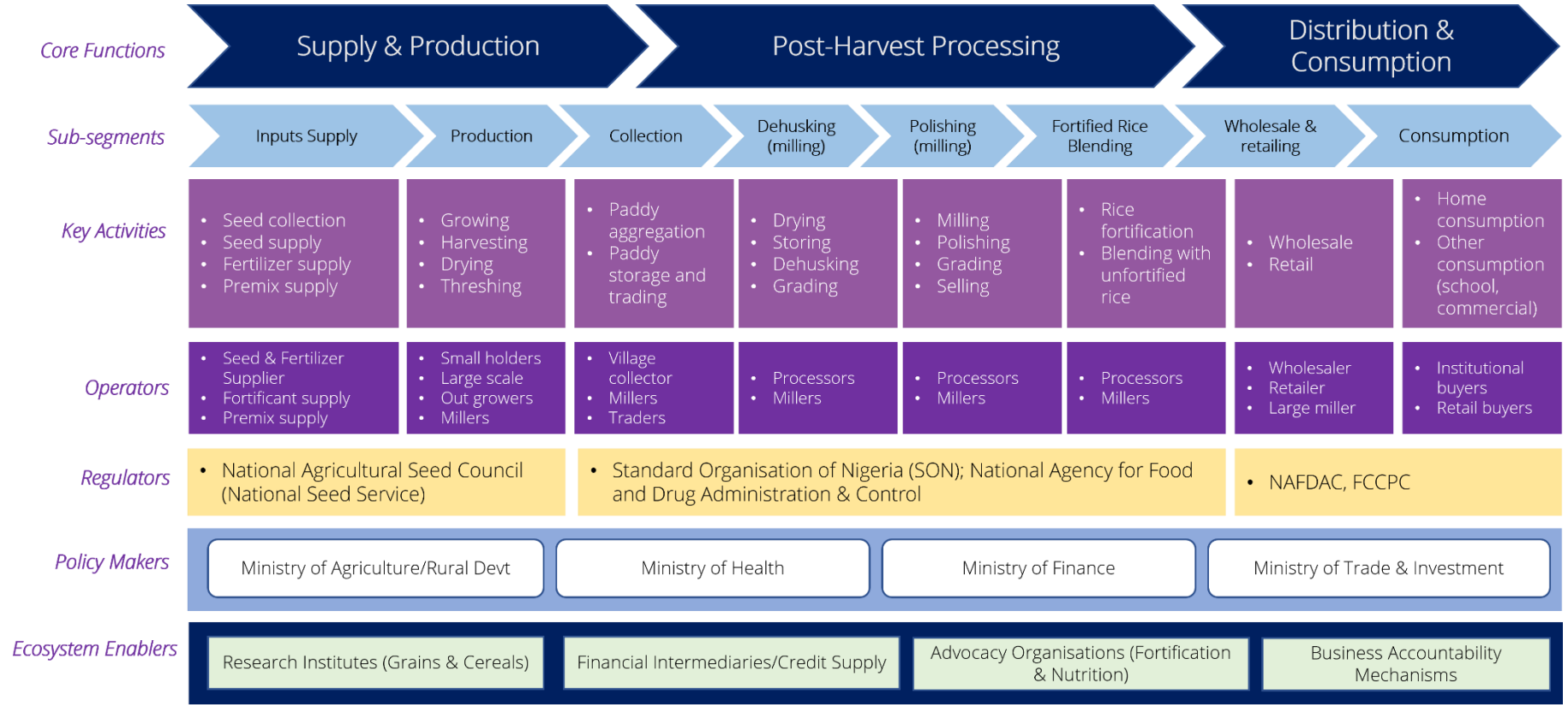

Figure 17 - Fortified rice value chain process mapping and stakeholder identification

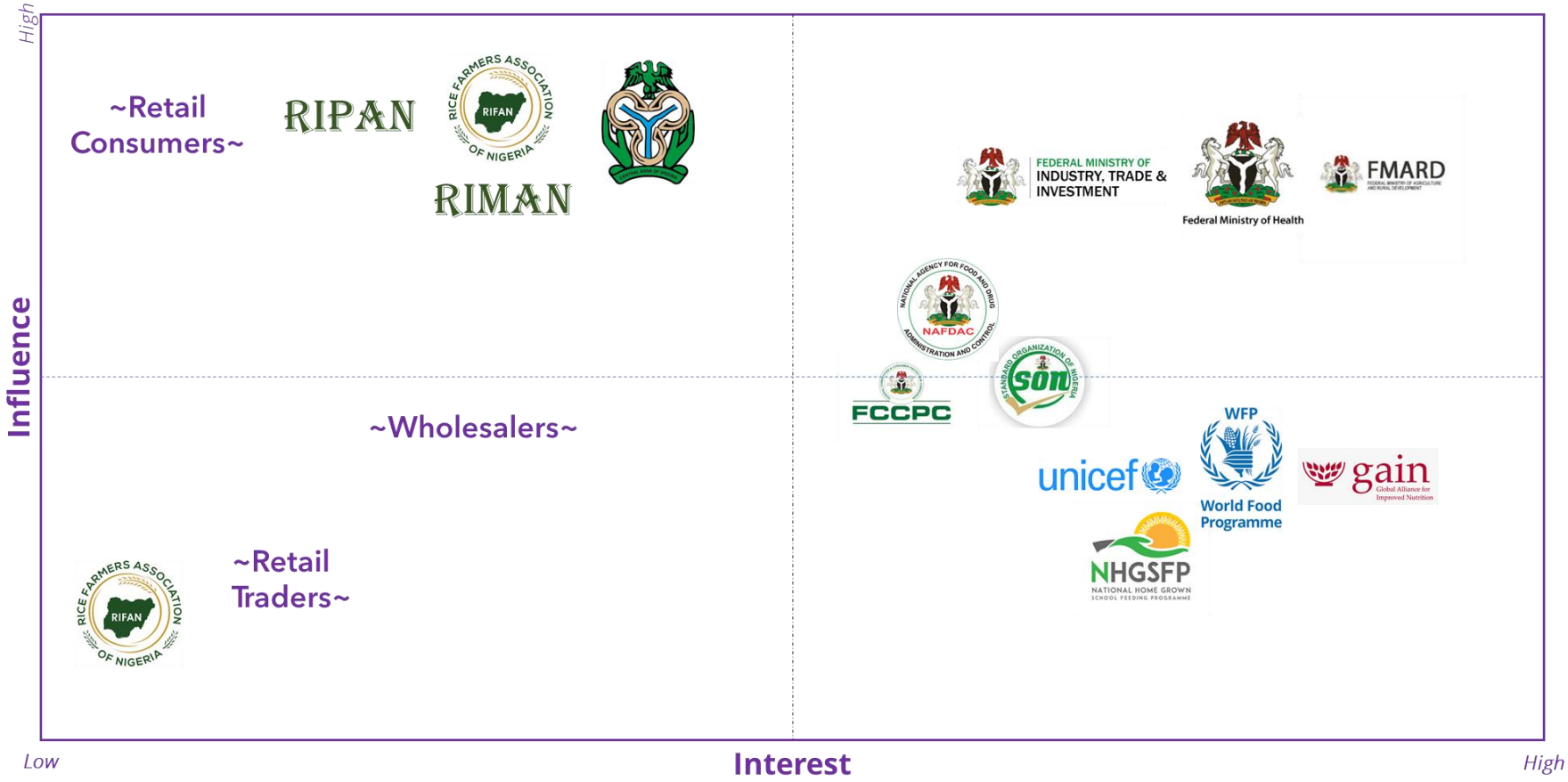

Figure 18 - Stakeholder analysis findings outlined within an interest vs influence framework

Key observations on stakeholder mapping and analysis

Several important observations are highlighted based on the outcome of the stakeholder mapping and analysis effort:

1. Unclear path to sustained demand for adoption – Retail consumers, the largest stakeholder segment and potentially the most influential stakeholder group in terms of long-term adoption of fortified rice, are not currently perceived as having a strong interest in fortified rice. This is largely because the commodity has become price sensitive in recent years due to inflationary pressures on rice pricing. Experts suggest that a price premium on fortified rice could possibly trigger passive opposition to the idea from consumers.
2. High likelihood of supply apathy – Key operators in rice milling and processing, with a high level of influence on the successful introduction of fortified rice have limited incentives to actively support the process and as a result, may have low levels of effective interest. This is informed by largely economic factors and price pressures already faced by these millers in a highly competitive and price sensitive market. The basis of competition in this market has also been largely about availability and accessibility rather than quality, which could translate into adoption of fortification being perceived as an indication of corporate responsibility, or a basis for finding alignment with political leadership, rather than a market imperative, unless a mandatory policy is adopted
3. Regulatory conundrum – Nigeria's key food safety and control authorities default into a 'fence-sitting' position, as they have minimal influence on the stakeholder categories with the highest level of influence, and their degree of interest can also be considered marginal. As these authorities typically have derived their influence on Nigeria's food sector based on their powers of regulatory enforcement of food quality statutes, their capacity to exert a degree of influence over a voluntary process might be limited, which suggests that they are more likely to support a process that leads to the emergence of mandates.
4. Potential to anchor on institutional procurement - The analysis indicates the highest level of interest lie with advocacy organisations and potential institutional buyers of fortified rice as the initiative largely aligns with the mission and goals of these actors. However, the volume of institutional procurement at present is not at the scale required to significantly alter behaviors of rice millers and processors. This however indicates an opportunity to achieve some degree o of success by focusing adoption of rice fortification within specific market segments in the near term. A part of this landscape study will seek to assess the extent to which such market segments could extend beyond public institutional buyers to private institutional buyers.
5. Unclear policy alignment – although the key policy authorities relevant to the long-term adoption of rice as a food vehicle are all indicated as having high interest and influence, the degree of alignment across the three Federal Ministries (Health, Agriculture and Trade) with respect to cross-government coordination to support the introduction of this policy is not clear.

7.3 CONCLUSIONS ON STAKEHOLDER MAPPING

Some recommendations based on the implications of the findings on the advocacy process *(for the introduction and adoption of rice fortification)* are provided in this section.

1. ***Cost considerations should be given priority*** – Attention needs to be given during the policy advocacy process to engaging all key stakeholders who could potentially influence the final cost at which fortified rice will be delivered to consumers. This is to ensure that the nutrition imperative is adequately balanced with the economic context within which most actors are operating.
2. ***More stakeholder insights need to be obtained*** – Additional effort must be invested to developing further understanding of the stakeholder groups. Specifically, the rice processing, and rice farming associations are large groups with significant level of diversity of location, affiliations, and interests. It will be important to know the characteristics of potential power sub-blocs that may exist within these groups and assess the extent to which their positions might differ from the expressed positions of the larger group. Information on who they are and how they like to communicate and engage will be critical to successful advocacy.
3. ***Leveraging financial intermediary organisations*** – The primary organisation here is the Central Bank of Nigeria, given its relationship with two of the most influential rice production and processing associations (RIMAN and RIFAN) forged over the last few years as the Federal Government sought to boost domestic rice production and processing while enforcing an import ban. The CBN is in a unique position to exert some leverage over those organizations on the strength of this relationship, and the extent to which this influence can be used to advance rice fortification should be explored.
4. ***Navigating complexities in relation to the import ban*** – Majority of domestic producers and processors still believe there is a massive degree of smuggled rice coming into the country – and the impact of this on their business means that it is a burning issue for them which will certainly surface around any discussion of an initiative that translates to higher production costs and potentially more competitive disadvantage against smugglers. The advocacy plan should have clear messaging on this.
5. ***Inclusive engagement and clear communications***: Stakeholder engagement on this advocacy journey should be inclusive and communication should be clear. Messaging should be context and region specific, but consistent. Emphasis should be placed on highlighting the scientific facts around the efficacy of rice as a fortification vehicle and what the specific benefits are to both vulnerable populations and to the larger society.

8 POLICY ANALYSIS AND RECOMMENDATIONS

8.1 POLICY CONTEXT FOR RICE FORTIFICATION IN NIGERIA

Credible evidence on household consumption and coverage suggest that rice fortification has significant opportunity for Nigeria to address its major micronutrient deficiencies across the entire population. The key challenge is the structure of the rice industry, which portends significant implementation challenges and provides an overarching lens from which the policy context should be viewed. There are currently no major policy levers currently in place to support rice fortification in Nigeria. With the exception of foods for which mandatory fortification laws apply, e food fortification regulations highlight foods that should be voluntarily fortified but does not specific to what level, and rice is currently not on this list.. Standards for rice fortification are largely under development but only as part of an ongoing advocacy process for the introduction of rice as a food vehicle for fortification. The most recent National Food Consumption Survey (NFCS) is not yet formally published but is widely expected to indicate the scale of iron deficiency anemia in Nigeria, which should positively tilt policy efforts towards rice fortification. There are currently limited publicly available literature on recommended nutrients but there is evidence of dialogue within the food/nutrition stakeholder community on iron, zinc and possibly to a lesser extent, vitamin A given evidence from other countries of rice being an effective food vehicle for these micronutrients. The NFCS is expected to provide supporting evidence to influence this process.

Nigeria's key health/nutrition policy making authorities appear to be highly favorable disposed to rice fortification as an additional tool for tackling micro-nutrient deficiency and are keen to enact necessary policy support for this to proceed at pace. Nigeria's key food safety and control regulators also seem positively disposed towards adopting a mandatory fortification policy for Rice. Their positions appear to be informed by the data on the scale of the micronutrient deficiency, but also the fact that their powers of regulatory enforcement of food quality statutes are more effective, while their capacity to exert a degree of influence over a voluntary policy will be limited. Although the key policy authorities relevant to the long-term adoption of rice as a voluntary food vehicle are all indicated as having high interest and influence, the degree of alignment across the three Federal Ministries (Health, Agriculture and Trade) with respect to cross-government coordination to support the introduction of this policy is not clear.

Although Nigeria's relationship with its border countries may have been recently strained by the recent 18-month long border closure, evidence of regional cooperation on food fortification exists. For example, bouillon fortification standards development and adoption has been on the agenda of the ECOWAS institutions responsible for regional health policy for a few years now, though progress has been mixed. Such mechanisms may be helpful to leverage depending on Nigeria's choice of policy on rice fortification.

8.2 ANALYSIS OF POTENTIAL DELIVERY OPTIONS

Option 1 – Mandatory Fortification

Analysis of technical feasibility indicates high level of feasibility for mandatory fortification, especially in a delivery configuration where large Independent fortified kernel producing facilities, FRK importers, and/or large-scale rice processors supply fortified kernels to multiple mills across the market. This approach is illustrated below.

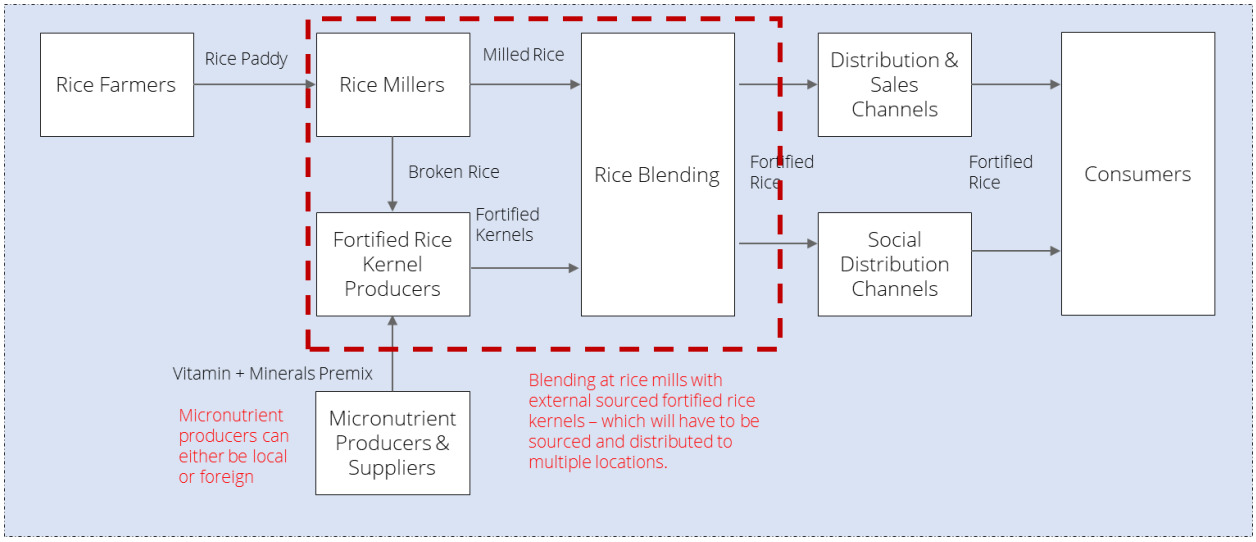

Figure 19 – Delivery configuration under mandatory fortification policy

Successful implementation under this option will depend on the following:

- Government support for enabling small scale millers to comply.
- Innovation around blending equipment to lower purchase costs and increase affordability for small and medium scale millers.
- Successful industry collaboration to build and use centralized blending facilities.
- Investment in consumer engagement and social marketing to ensure acceptance and sustainable adoption over the long term
- Collaborative approach to standards development
- Self-regulation to reduce regulatory overhead required to enforce compliance

Option 2 – SSN Based Fortification Policy

Analysis of technical feasibility indicates high level of feasibility for leveraging Social Safety Net Programs as the primary anchor point for rice fortification. This will require centralized blending for onward distribution to social programs. This approach is illustrated below.

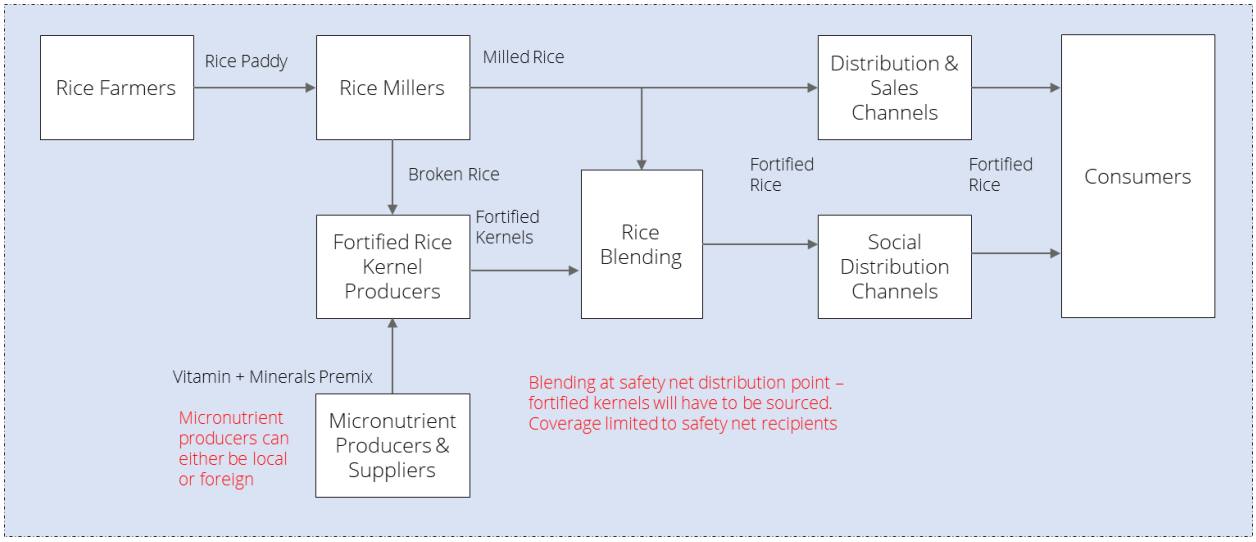

Figure 20 - Delivery configuration under SSN anchored fortification policy

Success under this option will depend on the following:

- Investment in data generation on the existing market size of SSN based procurement
- Government support to drive SSN procurement through large institutional procurement led by Governments at both Federal and State level
- Degree of efficiency in logistics and coordination to ensure product quality, reach, and consistency in availability
- Innovation around blending equipment and potentially use of centralized blending facilities
- Investment in consumer engagement and social marketing to ensure that acceptance within humanitarian programs does not come at the expense of long-term open market adoption

Option 3 – Voluntary Fortification

Analysis of technical feasibility indicates high level of feasibility for voluntary fortification, purely on a marginal cost basis, especially for large sized millers in a delivery configuration where they are supported with the flexibility to import FRKs or produce FRKs within their own mills. This approach is illustrated below.

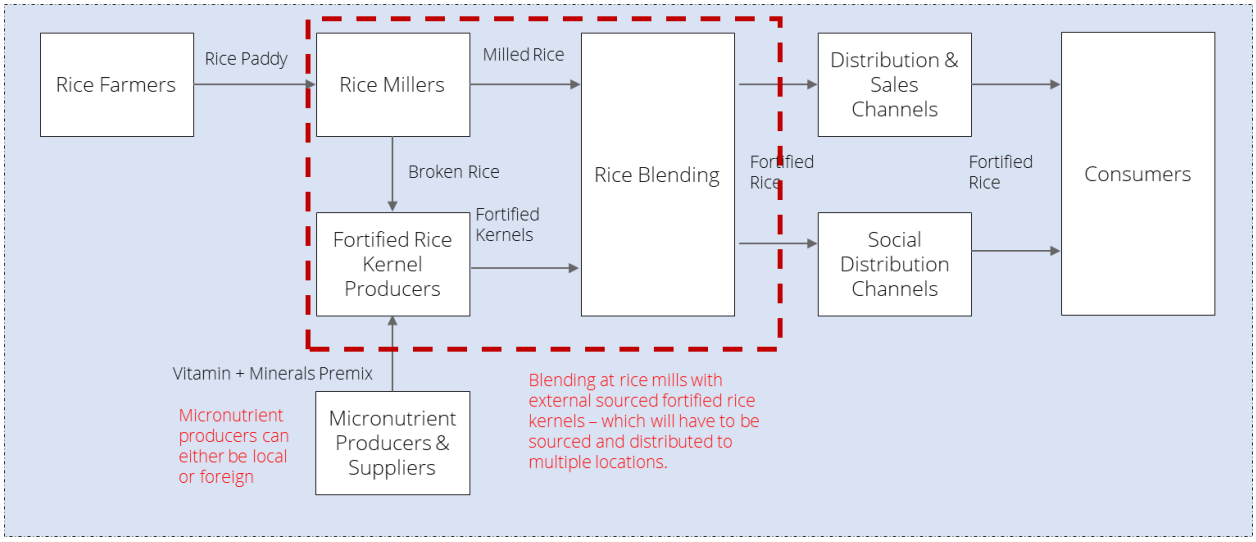

Figure 21 – Delivery configuration under mandatory fortification policy

Success under this option will depend on the following:

- Degree of investment in social marketing and demand generation targeted at long term market adoption
- Government support for enabling small scale millers to participate at minimal incremental cost by investing in supply chain efficiency for fortification relevant consumables.
- Innovation around blending equipment and potentially use of centralized blending facilities
- Investment in consumer engagement and social marketing to ensure acceptance and sustainable adoption
- Collaborative approach to standards development

8.3 CHARTING A PATH FORWARD: KEY ISSUES TO NAVIGATE

Based on the landscape analysis and the stakeholder mapping, two important factors are central to the successful introduction of fortified rice in Nigeria.

1. **Navigating demand/supply apathy:** There is currently no evidence of latent demand for fortified rice across households in Nigeria, a situation made worse by the significant inflationary pressures on rice pricing in the last 5 years. Rice fortification advocates should therefore expect to overcome a degree of consumer inertia, especially if introduced at a price premium. In addition, operators in rice milling and processing currently have limited incentives to actively support the process and as a result, may have low levels of effective interest. Policy design for rice fortification should therefore be focused on navigating this situation.
2. **Navigating supply chain pitfalls:** Staple food fortification in Nigeria is already hampered by supply chain inefficiencies, such as fortificant tariffs, significant delays at Nigeria's ports for importation of fortification relevant equipment and consumables and porous borders that uneven the playing field at the expense of fortification compliant countries. This will be no different for rice. The results of the overall landscape analysis and the technical feasibility assessment indicate that an ideal fortified rice intervention in Nigeria will be characterized by a few larger rice mills supplying fortified kernels to multiple mills as it is not cost effective for many medium and large-scale millers to invest in the production of fortified kernels. The supply chain implications of such a

system, if implemented at national scale will be significant, and bottlenecks will contribute to significant variability of fortified rice price. Policy interventions and operational strategies will therefore be critical to overcoming the challenge posed by inefficiencies in Nigeria's food product supply chain infrastructure.

The recommendations in this section of the report, are aimed at navigating the above critical factors towards a successful introduction of rice fortification in Nigeria.

8.4 PURSUING UPTAKE AND ADOPTION: LEARNING FROM BRAZIL[65] AND INDIA[66]

Rice fortification advocacy for Nigeria can leverage knowledge gained by other countries in their rice fortification programs. Examples from Brazil and India are outlined in two case study summaries in this section.

India Case Study

The World Food Program (WFP) in collaboration with the Gajapati regional government of India introduced rice fortification initiative because its population was identified as heavily burdened by malnutrition.

Since the state government was already providing rice based hot cooked meals to school children in primary and upper primary classes, the intervention only required that the rice used in Mid-Day Meals (MDM) be fortified with iron.

For the program to have the desired effects, the following were done:

1. State government officials were trained to build their capacity for the procurement of fortified rice and to assure its quality.
2. Rice millers were also trained on how to blend regular rice grains with fortified rice kernels.
3. WFP entered a contract with a producer of FRKs. The FRK producer was responsible for the regular delivery of FRKs at the rice mill in Gajapati. Each lot of FRKs was received with a Certificate of Analysis (COA) from an accredited lab to ensure quality and the requisite nutritional content.

It should be noted that the MDM program feeds about 115 million school children between the ages of 5-15.

Impact

The Gajapati rice fortification project through the school Mid-Day Meal (MDM) scheme was a significant contributor to reduction in anaemia in the region. The improvement was as high as 20 percentage points in Gajapati compared with 14 percentage points in the neighboring Rayagada district where the fortified rice was not supplied.

[65] WFP, 2017 “A Case for Fortified Rice”, https://cdn.wfp.org/wfp.org/publications/FINALPrintBook%20(007).pdf

[66] Milani Peiman, et al 2016. "Piloting A Commercial Model for Fortified Rice". Food And Nutrition Bulletin 37 (3): 290-302. doi:10.1177/0379572116648447.

Brazil Case Study

From 1999 to 2010, with the support of the Bill & Melinda Gates Foundation (BMGF), PATH advanced Ultra Rice, an extrusion technology that produces fortified rice with minimal or unnoticeable change in organoleptic properties and transferred this technology to rice millers in Brazil. In Brazil, rice is primarily sold through sealed, branded packages. This tends to facilitate consumer recognition of fortified rice products.

Brazil's rice fortification program was designed to achieve the following:

1. expand production capacity of fortified kernels;
2. build the supply chain: establish supply of fortified rice through commercial mills;
3. distribute fortified rice through commercial channels and select public sector programs;
4. generate demand through social marketing; and
5. advocate for an enabling environment to promote sustainable impact.

Key elements of the introduction and adoption strategy:

1. Given that the technology to produce Ultra Rice kernels required a significant initial capital investment, a pilot model based on vertical integration, enabling few upstream rice kernel producers to supply fortified kernels to numerous rice millers was established.
2. Millers with established rice brands in Brazil, could blend the fortified kernels with unfortified rice to market fortified rice to consumers. Through establishing a commercial rice fortification production and distribution system, the project aimed to deliver fortified rice to at least 10 million consumers or about 5% of the Brazilian population. The project would also transfer the fortification technology to a national institution, which would establish and enforce quality standards, ensuring that the rice was consistently fortified in compliance with standards.
3. To achieve rice fortification, 3 major supermarket chains operating in Brazil were coopted through their corporate social responsibility divisions. The requests were for point-of-sale promotion, shelf space allocation, and the development and launch of fortified rice private labels.
4. Small and mid-sized retail chains throughout the country were engaged on the concept of fortified rice as a novel consumer offering.
5. To generate demand through social marketing, six nationally esteemed figures were used to promote the launch of fortified rice products as line extensions of traditional brands rather than new brands of their own. Of particular impact to the social marketing endeavor was the "ambassadorship" of Mauricio de Sousa, Brazil's most respected popular cartoonist, who lent his personal support for the campaign on the consumption of fortified rice.

Impact

In 3 years, the rice fortification campaign established a category brand and expanded production of fortified kernels to 1 of the 5 largest rice millers in Brazil, who also launched its own fortified rice product. Commercial retail channels that began stocking fortified rice on shelves included the top 3 national retailers, many mid-sized chains, and 1 national wholesaler. One of the leading supermarket chains, Carrefour, launched its own private label. Fortified rice sales began in February 2013 and reached over 2.5 million consumers, an estimated 460 000 of which repeat consumers and the majority of which belonging to the bottom 3 of Brazil's 5 socioeconomic classes, by April 2015. Two rounds of consumer research conducted in February 2014 and August 2014 indicated that during that time, although the percentage of consumers aware of fortified rice remained flat at 32% of those sampled, the percentage of those aware who purchased fortified rice increased from 13% to 23%.

8.5 SUMMARY OF KEY RECOMMENDATIONS

Four (4) key recommendations based on the implications of the market and industry analysis, the technical feasibility assessment, the stakeholder mapping, and the case studies reviewed are provided in this section.

4. ***Harnessing social safety nets to catalyze demand and enhance diets of those most in need. –*** Federal and regional social safety nets provide an opportunity to build industry capacity and catalyze demand from institutional buyers that purchase rice for distribution and consumption by populations most at risk of key micronutrient deficiencies. This can include institutions that purchase rice for humanitarian distribution, school feeding programs (both public and private), and community-based food safety and nutrition programs. This limited set of institutional buyers would aim at creating an annual demand of 300,000 – 500,000MT of fortified rice per annum, which will be sufficient to create a niche supply market without the need for direct FRK subsidies or direct government involvement in the FRK and/or fortified rice value chain.
5. ***Develop rice fortification standards:*** the definition of a set of standards for rice fortification that will be adopted by the suppliers that are envisaged to participate in the fortified rice market segments that emerge from the introduction through social safety nets is paramount to ensure quality, safety and adequacy of the fortified rice produced and distributed. The process of definition of standards for rice should be highly participatory and collaborative and could be undertaken by industry stakeholders within the context of a broader review of existing fortification standards and mandates, that is aimed at ensuring complementarity between fortification of all staples, as against tackling them in isolation.
6. ***Building the supply chain:*** Functional and cost-effective supply chains for FRK and fortified rice are an essential driver to bring rice fortification to scale and sustain it. Building strong supply chains brings about technology transfer, new infrastructures and access to new skills and technical know-how. Rice fortification therefore does not only present itself as a public health intervention, it also provides an occasion to bring technology and enhance the food systems capacity of the country through public-private partnerships.
3. ***Develop a bouquet of targeted incentives to support fortified rice millers:*** Building on the partial mandate, a set of targeted incentives will need to be put in place to encourage millers to participate in the emerging fortified rice market. These incentives could include import duty waivers for FRK production and rice blending machinery/equipment, as well as VAT exemption on fortificant and fortificant consumables relevant for FRK production and blending. The goal of these incentives will be to ensure security of supply to meet the needs of the market, at reasonable, market aligned cost.
4. ***Develop and implement a social marketing strategy aimed at long term market adoption –*** The social marketing strategy to support the introduction and adoption of fortified rice in Nigeria should be designed to achieve successful near-term acceptance of fortified rice in the limited markets which the recommended demand side mandate will create, and a long-term market-based approach towards a sustainable market for rice fortification in Nigeria. This will entail a significant investment in market research on consumer attitudes and practices, as well as the tracking of key demand and consumer metrics before and after execution of the social marketing campaign. Effective advocacy, underpinned by deep multi-stakeholder engagement between the public and social sectors will be a critical component of this strategy. Lessons from countries like Brazil and other Latin American countries where market-based approaches have been complimented by strong social marketing campaigns will be very relevant in this context.

9 APPENDIX

9.1 LIST OF STAKEHOLDERS IDENTIFIED

Sn	Input suppliers (across all rice fortification techniques)	Location
1.	Crown Flour Mill Vitamin Premix facility	Nigeria
2	Pristine Organics Private Limited	India
3	K.J Foods	India

Sn	Rice farmers (producers of rice paddy) ≈ 12 million farmers	Location
1.	Rice Farmers Association of Nigeria (RIFAN)	Nigeria
2	Rice Growers Association of Nigeria (RGAN)	Ogun
3	Olam Farms	Nasarawa
4	Keresuk Rice Farms	Nasarawa
5	Dangote Rice Farms	Nasarawa

Sn	Small scale rice millers/processors >68	Location
1.	Medium and Small scale rice millers Association of Nigeria	Sokoto
2	National Rice Millers Association of Nigeria (NRMAN)	
3	Agrotek Value Chains Agent Limited	Edo
4	Alhamsad Rice Mill	Kano
5	Anambra Rice Mill	Anambra
6	Jewesi Rice Milling/Processing Factory	Taraba
7	Mmunachimso Rice Enterprise	Ebonyi
8	SS Rice Mills Nigeria Limited	Kano
9	Tim Tai Rice Mills Limited	Plateau
10	Timkatponsak Ventures Nigeria	Plateau

Sn	Large scale rice millers/processors	Location
1.	Rice Farmers Association of Nigeria (RIFAN)	National
2	Dangote Rice Mills	Jigawa, Kebbi, Sokoto
3	WACOT Rice Limited	Kebbi
4	Stallion Group	Lagos
5	Olam Nigeria Limited	Lagos
6	Onyx Rice Mill	Niger
7	Mama's Pride Premium Nigeria	Lagos
8	Integrated Grain Processors (Nig) Ltd	Enugu
9	Igbemo Rice Processing Company	Ekiti
10	Quarra Rice Mill	Kwara
11	Labana Rice Mills Ltd	Kebbi

Sn	Wholesale rice traders (paddy aggregators and rice traders)	Location
1.	Rice Millers, Importers, Distributors Association of Nigeria (RIMIDAN)	
2	Rice Farmers Association of Nigeria (RIFAN)	
3	Dangote Rice Mills	Jigawa, Kebbi, Sokoto
4	WACOT Rice Limited	Kebbi
5	Stallion Group	Lagos
6	Olam Nigeria Limited	Lagos
7	Onyx Rice Mill	Niger
8	Mama's Pride Premium Nigeria	Lagos
9	Integrated Grain Processors (Nig) Ltd	Enugu
10	Igbemo Rice Processing Company	Ekiti
11	Quarra Rice Mill	Kwara

12	Labana Rice Mills Ltd	Kebbi
13	Babban Gona	Jigawa

Sn	Institutional consumers (of processed rice)	Location
1.	Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development	National
2	World Food Program (WFP)	International

Sn	Research institutes (involved in grains and cereals)	Location
1.	Institute for Agricultural Research (IAR)	National
2	National Cereals Research Institute (NCRI)	National
3	National Seed Service	National
4	International Institute of Tropical Agriculture (IITA)	National

Sn	Food safety and control agencies/authorities	Location
1.	Federal Ministry of Agriculture and Rural Development (FMARD)	National
2	The National Agency for Food and Drugs Administration and Control (NAFDAC)	National
3	The Standards Organisation of Nigeria (SON)	National
4	The National Agricultural Seed Council (NASC)	National

Sn	Policy making organizations	Location
1	Presidential Taskforce on Rice	National
2	Federal Ministry of Agriculture and Rural Development (FMARD)	National
3	Federal Ministry of Health	National
4	Rice Farmers Association of Nigeria (RIFAN)	National

Sn	Rice value chain financiers	Location
1.	Central Bank of Nigeria (CBN)	National

2	Federal Ministry of Finance	National
3	Bank of Industry (BOI)	National
4	African Development Bank (AfDB)	National
5	Food Agriculture Organisation (FAO)	National

Sn	Advocacy organizations (for rice fortification and nutrition)	Location
1.	Global Alliance for Improved Nutrition (GAIN)	International
2	Bill and Melinda Gates Foundation (BMGF)	International
3	World Health Organisation (WHO)	International
4	United Nations Children's Fund (UNICEF)	International

Sn	Business Accountability Mechanisms (relevant to Rice)	Location
1.	Scaling Up Nutrition (SUN) Business Network, SBN	International
2	New Alliance for Food Security and Nutrition	International

Sn	Rice importers (including countries of origin for imported rice)	Location
1.	Informal Smuggling Groups	--

9.2 BRIEF DESCRIPTIONS OF SOME RICE SECTOR ASSOCIATIONS

- ***Rice Farmers Association of Nigeria (RIFAN) -*** RIFAN is the global advocate for all segments of the Nigerian rice industry with a mission to promote the interests of its members. Its primary focus is ensuring that the Nigerian rice production meets its local demand which is about 5 million tons annually. It is recognized by the government of Nigeria and works closely with Federal ministries, state governments, foreign governments and academic research institutions. It has over 12.2 million members involved in rice farming, milling, storage and management, trading and marketing, export, research and training, and training allied businesses.
- ***Rice Growers Association of Nigeria (RGAN) –*** RGAN is coordinated by an executive committee, which constitute the indigenous institutional arrangement. They encourage rice farmers to form clusters and increase production, creating a platform through which rice growers could leverage to facilitate access to inputs and technical support, and gaining of visibility and market access to enhance returns on their farming endeavors.
- ***Rice Millers, Importers, Distributors Association of Nigeria (RIMIDAN)*** – Import control and combating smuggling.
- ***National Producers, Processors, Millers and Marketers Association of Nigeria (NARPPMMAN):*** NARPPMMAN helps to coordinate and streamline the activities of all rice value chain players from producers to aggregators to millers and to marketers. In the hope to create specialty among actors, make operational structure seamless and create access to sustainable funding, structured market, fair pricing and guaranteed offtake.
- ***Paddy Rice Dealers Association of Nigeria (PRIDAN)***
- ***Rice Distributors Association of Nigeria (RIDAN)***
- ***Rice Millers Association of Nigeria (RIMAN)***
- ***Rice Processors Association of Nigeria (RIPAN)***
- ***Small and Medium Scale Millers Association (SMSMA)***

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