SAVING LIVES
CHANGING LIVES

Rice Fortification in Senegal

Landscape Analysis

WFP
World Food Programme

NUTRITION INTERNATIONAL
Nourish Life

2019

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The conclusions given in this report are considered appropriate at the time of its preparation. They may be modified in the light of knowledge gained at subsequent stages of the project.

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Preface

Globally, more than two billion people are affected by micronutrient deficiencies, or hidden hunger. These deficiencies, defined as the lack of one or more of the essential vitamins and minerals required for healthy growth, development, and functioning, affect all ages and socio-economic groups.

Hidden hunger impacts socio-economic development at household as well as national level, and its short- and long-term consequences include maternal and child mortality, increased illness, mental retardation, and poor cognitive and physical development. All of these negatively impact a country's GDP. As affirmed by the 2008 and 2013 Lancet Series on Maternal and Child Nutrition, the 2012 Copenhagen Consensus and the global Scaling Up Nutrition (SUN) Movement, multi-micronutrient fortification is among the most cost-effective strategies to reduce malnutrition.

Rice is a staple food for more than three billion people across the globe where it can contribute up to as much as 70 percent of daily energy intake in some countries. This presents a nutritional problem: milled rice is a good source of energy, but a poor source of micronutrients. Where rice is a staple food, making it more nutritious through fortification with essential vitamins and minerals is a proven and cost-effective intervention to increase micronutrient intake among the general population. Consumption of fortified rice increases micronutrient intake without requiring consumers to change their buying, preparation or cooking practices.

Several programmes have been implemented in Senegal to address micronutrient deficiencies (MNDs), including mandatory fortification of wheat flour, cooking oil and salt, vitamin and mineral supplementation, home fortification using micronutrient powder, and promotion of dietary diversity at household level. MNDs, however, have persisted and more needs to be done to overcome the issue in Senegal.

In Senegal, rice fortification has a great potential to reduce the prevalence of iron deficiency and other MNDs since rice is the most widely consumed cereal, with consumption estimated at 198g[1] per person per day. Recognizing the potential of rice as a vehicle for fortification, World Food Programme is considering rice fortification as one strategy to prevent and control MNDs of its beneficiaries and is therefore taking steps to assess the feasibility and acceptability of including fortified rice as part of its food basket.

This landscape analysis builds on the 2016 analysis supported by the Food Fortification Initiative (FFI) and the Global Alliance for Improved Nutrition (GAIN) by presenting the most up-to-date data and information from recent interviews undertaken in Senegal in October and November 2018. This analysis aims to provide decision-makers with a comprehensive understanding of the factors that will influence the feasibility and sustainability of rice fortification as an intervention to improve the Senegalese population's micronutrient status. It provides a data refresh on the current status of malnutrition in the country and a detailed value analysis of the Senegalese rice value chain. This landscape assesses different delivery options and ways to integrate rice fortification into the Senegalese rice supply chain while estimating the potential public health impact of such intervention.

This report is a joint collaboration between the World Food Programme (WFP) and Nutrition International (NI) and is intended to inform the government, the private sector and the civil society of the potential of introducing rice fortification as a public health strategy to prevent MNDs in Senegal.

1 FAO Food Balance Sheet.

Executive summary

Map of Senegal[2]

In Senegal, micronutrient deficiencies remain a major public health problem, with anemia rates of 66 percent for children, and 50 percent for women of childbearing age[3] and vitamin A deficiency rate of 40 percent in children. To cope with this problem, the Government of Senegal has included fortification as a major strategy in its Multisectoral Strategic Plan on Nutrition (PSMN) 2017-2021. By 2025, this plan aims to reduce the prevalence of anemia by 25 percent among vulnerable groups and by at least 20 percent the prevalence of deficiencies in the vulnerable groups for other micronutrients (iodine, zinc and vitamin A).

Ten years after the launch of the mandatory wheat flour and cooking oil fortification programmes and nearly twenty years after salt fortification became mandatory, Senegal is entering an evaluation and consolidation phase. The focus is now to assess the degree to which it has achieved its nutritional goals and to identify the potential gaps.

The Government of Senegal has made food autonomy, and in particular self-sufficiency in rice, a major priority for the nation. In 2014, the National Rice Self-Sufficiency Program (PNAR) was launched under the supervision of the Ministry of Agriculture to strengthen the promotion and development of the local rice sector. The objective was to increase the cultivated areas, modernize production and processing, and professionalize all actors to improve food security and contribute to the fight against poverty. Currently, there are 8 mills with a total capacity of 5+MT/h in the country. At full scale, these mills represent a total potential capacity of 144'000 MT per year i.e. enough to reach nearly 2 million beneficiaries i.e. 12 percent of the population

Rice is by far the most daily consumed cereal across all age groups in Senegal. It is estimated that on average Senegalese consume 198g of rice every day and as such, rice constitutes a great alternative or addition to current national fortification programmes.

In October/November 2018, World Food Programme conducted a situational analysis to build upon the World Food Programme previous rice fortification landscape analysis conducted by the GAIN / FFI in 2015. The objective of the analysis was to understand the current fortification situation in Senegal, the opportunities, constraints, technical feasibility and challenges linked to the potential introduction of rice fortification, as well as to evaluate different systems or combination of systems for possible introduction of rice fortification.

The information in this report was compiled from primary and secondary sources collected in the last quarter of 2018 and has been used to formulate a general situational analysis and develop projections and scenarios for rice fortification in Senegal.

In 2013, GAIN conducted a national fortification assessment coverage toolkit (FACT) in Senegal and found compliance and coverage of fortifiable flour and oil to be high. However, the extent to which they significantly contribute to adequate intake of micronutrients needs to be further assessed. To that end, in 2018, the Food Technology Institute (ITA) and the Senegalese Committee for the Fortification of Foods in Micronutrients (COSFAM) have started an end line survey to provide the latest data on the status of micronutrient deficiencies in the country. The results of this survey, which should be available during the course of 2019, will provide policy-makers with additional, up-to-date information to make informed, evidence-based decisions on the next steps of food fortification programmes.

A recent Fill the Nutrient Gap (FNG) study showed that, on average, fortified rice alone can provide about 1/3 iron recommended nutrient intake (RNI) across all age groups in West Africa. Fortified rice being just one of the sources in the diet, and considering that other staples are fortified, the opportunity to reach 30 percent RNI for iron through rice only represents a great opportunity.

2 https://www.nationsonline.org/oneworld/map/senegal-map.htm

3 UNICEF, 2016 Global Nutrition Report https://data.unicef.org/resources/2016-global-nutrition-report/ (accessed 21 February.

With high nutritional needs, high rice consumption and broad population coverage, Senegal is a very attractive market for rice fortification. Although considerations for fortification remain due to the cultural perception of rice and price sensitivity of Senegalese households, the current political environment is favourable.

To progress rice fortification in Senegal, the analysis highlights 5 key programmatic areas for immediate intervention:

1. **Social safety net programmes** that provide food assistance should be utilized as a first step to introduce fortified rice in Senegal. Both school meal programmes operated under World Food Programme and the Government of Senegal distribute rice as part of their daily ration. Further discussions with the Division of School Canteens should be held to ascertain how non-fortified rice could be substituted for fortified rice in the short and medium run. Piloting introduction of fortified rice through World Food Programme school meals using non-fortified rice sourced locally and imported FK is a concrete step that should be investigated to serve as proof-of-concept.
2. **Mandatory fortification** of all locally produced and imported rice is may be impractical at this stage in Senegal given the fragmentation of the milling industry where around 87 percent of rice is still milled through small-scale mills.
3. **Voluntary fortification of rice** should be encouraged, in particular amongst the largest local rice mills. Growing concentration of the rice milling industry coupled with the strategic and political will to improve the rice sector and reach self-sufficiency in rice, has prompted significant investments in the domestic rice value chain in recent years. The largest mills are favourable entry points to perform voluntary fortification and should therefore be incentivized to pursue voluntary fortification.
4. **Fortifying imported rice** represents the biggest, immediate opportunity in Senegal where 60-70 percent of rice consumed is imported. Fortifying imports of rice could drive significant nutrition impact with a relatively limited investment or modification of the current rice supply chains. Fortification of imported rice directly at country of origin constitutes the quickest and easiest opportunity for rapid implementation. To rapidly explore this opportunity, discussions must hold between Ministry of Health and Commerce to assess whether and how a mandate for imported rice can be implemented.
5. **Advocacy, communication and social marketing** will be essential to strengthen and reinforce the messages conveyed through past campaigns. Rice being such a sensitive commodity in Senegal, it will also be important to confront possible misconceptions amongst key stakeholders and the general public towards fortified rice. Awareness, information dissemination and behavioural change campaigns promoting rice fortification will be paramount to ensure credibility of programmes, projects and voluntary initiatives.

Acknowledgements

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The authors are grateful for the contributions of the following reviewers: Ms Clemence Maurin and Ms Dora Panagides from the World Food Programme and Ms Manpreet Chadha and Mr Philip Randall from NI.

Special thanks to Senegal Ministry of Health (MSAS), Ministry of Agriculture (MAER), Ministry of Education (MEN), Cellule de Lutte contre la Malnutrition (CLM), Ministry of Trade and all key stakeholders that participated in the fieldwork data collection conducted between 08-19 October 2018.

CHAPTER 1

1. Objectives of the landscape analysis

1.1 BACKGROUND

Senegal is a pioneer in food fortification in West Africa. Fortification of wheat flour and vegetable oil has been mandatory for nearly a decade while salt iodization was mandated as early as 2000.

Despite the success of policies in place, MNDs remain a major public health problem with anemia rates of 66 percent for children, and 50 percent for women of childbearing age3 and vitamin A deficiency rate of 40 percent in children.

The consumption patterns of wheat flour and cooking oil, the quantities consumed, the regional disparities, as well as the necessary improvements required in terms of compliance do not yet make it possible to fill the nutrient gaps of the Senegalese population.

Experience in Asia and Latin America have shown that rice fortification is an option to address micronutrient deficiencies and it has been proven to be sustainable, safe and economical. Building on the success of the policies in place in Senegal and given rice is widely consumed and in large quantities, World Food Programme and NI are looking into the feasibility of fortifying rice as an additional vehicle to improve the country's nutritional situation.

1.2 OBJECTIVES

In October/November 2018, the World Food Programme conducted a situational analysis to revise the previous analysis conducted by GAIN/FFI in 2015 and provide up-to-date data. The objective of the analysis is to understand current fortification situation in Senegal, the opportunities, constraints, technical feasibility and challenges linked to the potential introduction of rice fortification, as well as to evaluate different systems or combination of systems for possible introduction of rice fortification.

Specifically, the analysis generates scenarios for introduction of rice fortification through social safety nets, voluntary fortification and mandatory fortification while estimating the impact of each intervention as a means to reach and improve the micronutrient health of the population.

1.3 SUGGESTED USE OF RESULTS OF THE LANDSCAPE ANALYSIS

The preliminary results of the landscape analysis were presented at a Rice Fortification Workshop held in St Louis, Senegal on December 10-11, 2018. The workshop brought together public and private sector actors of the rice value chain and aimed to start discussions and build consensus on next steps for rice fortification.

This report includes the latest information and data presented at the workshop and serves as basis to guide future national discussions and designing of programmes and/or pilots aiming at introducing rice fortification in Senegal.

CHAPTER 2

2. Methodology

The information in this report was compiled from primary and secondary sources collected in the last quarter of 2018. A complete list of organizations interviewed as part of the in-country data gathering exercise is provided in Annex 2.

The data presented in this report are largely collected from secondary sources and reports and has been used to formulate a general situational analysis and develop projections and scenarios.

CHAPTER 3

3. Nutrition situation analysis

3.1 MALNUTRITION AND MICRONUTRIENT DEFICIENCIES IN SENEGAL

Between 2010 and 2016, the nutritional situation in Senegal has improved overall, but remains generally precarious with fluctuating prevalence at the national level (Figure 1) and large regional disparities. The regions of Saint Louis, and in particular the department of Matam (Figure 2), are in a critical situation and are among the most affected with a prevalence of global acute malnutrition exceeding 15 percent and severe acute malnutrition greater than 2 percent[4].

FIGURE 1 : PREVALENCE OF ACUTE GLOBAL MALNUTRITION IN CHILDREN UNDER 5 YEARS[5]

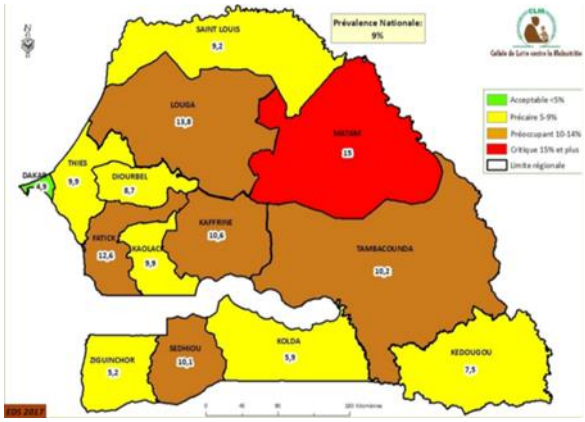
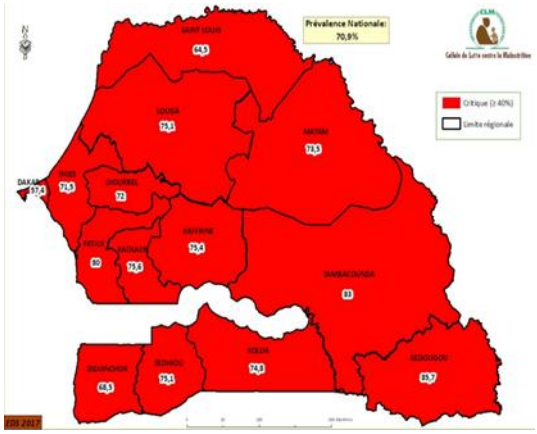


FIGURE 2 : PREVALENCE OF ANEMIA IN CHILDREN 6 TO 59 MONTHS[6]



The prevalence of micronutrient deficiencies still poses a real public health problem which is observed in conjunction with issues related to over nutrition such as the prevalence of overweight (15.8 percent) and obesity (6.4 percent)[7].

Anaemia

Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, height, smoking, and pregnancy status. Iron deficiency is thought to be the most common cause of anaemia globally, although other conditions, such as folate, vitamin B12 and vitamin A deficiencies, chronic inflammation, parasitic infections, and inherited disorders can all cause anaemia. The prevalence of anaemia in Senegal remains above the critical threshold defined by WHO (40 percent).

Iodine deficiency

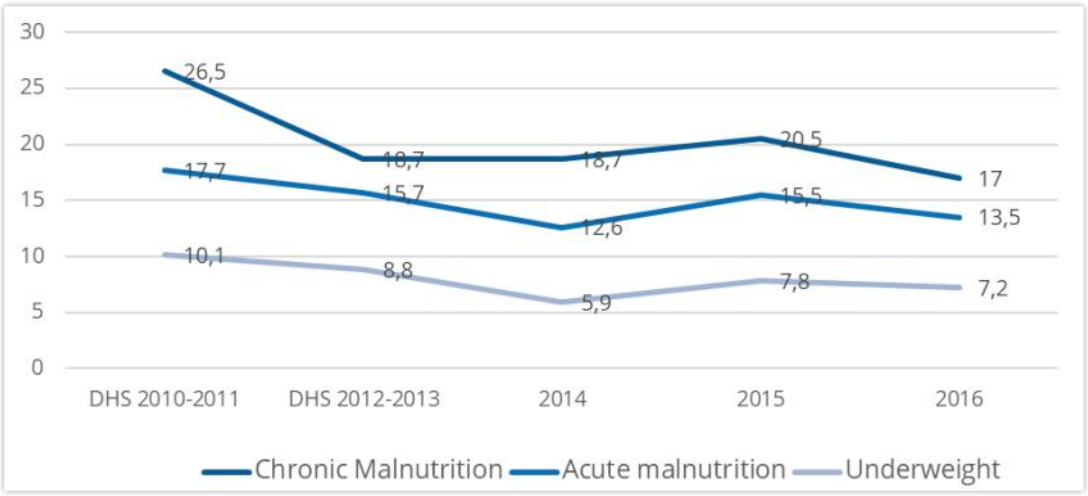
Iodine deficiency disorders (IDD), which can start before birth, jeopardize children's mental health and often their very survival. Serious iodine deficiency during pregnancy can result in stillbirth, spontaneous abortion, and congenital abnormalities. However, of far greater significance is IDD's less visible, yet pervasive, mental impairment that reduces intellectual capacity at home, in school and at work. Iodine deficiency affects 28.3 percent of women of reproductive age and 30.9 percent[8] of pregnant women in Senegal. The situation is particularly critical in salt producing areas where the rate of household -level iodized salt consumption is only 11 percent against that of 37.7 percent at the national level, which is well below the target of 90 percent defined by the State of Senegal.

Vitamin A deficiency

Vitamin A deficiency is the leading cause of preventable childhood blindness. Vitamin A deficiency affects 17.7 percent[9] of children under 5 years of age. In women of childbearing age, 1.9 percent are deficient and 14.2 percent have low vitamin A reserves.

4 Multisectoral Strategic Plan of Nutrition of Senegal, 2017-2021.
5 Demographic and Health Survey 2017.
6 Demographic and Health Survey 2017.
7 Survey STEPS 2015.
8 Study on the use of iodized salt and bouillons by households on the iodine status of pregnant women and women of reproductive age (CLM / MI / GAIN / UNICEF) IPDSR 2014.
9 COSFAM 2010.

GRAPH 1: EVOLUTION OF THE NUTRITIONAL SITUATION IN SENEGAL[10]



Zinc deficiency

Zinc deficiency affects the skin and gastrointestinal tract; brain and central nervous system, immune, skeletal, and reproductive systems. Zinc deficiency is a public health problem in Senegal. It affects 58 percent of women and 42.8 percent of children[11].

3.2 OUTCOMES OF CURRENT MANDATORY FOOD FORTIFICATION PROGRAMMES

Ten years after the launch of the flour and oil fortification programs, the end line survey is ongoing and needs be finalized to assess programme effectiveness and inform future programmatic directions.

FACT surveys have been conducted in different countries to measure the current effective coverage of fortified foods on the market, as well as to explore the potential of other industry-manufactured foods for fortification based on market penetration, industry/trade production patterns, and consumption patterns[12].

In December 2013, GAIN completed a national FACT survey in Senegal to assess whether women of reproductive age (WRA), especially those at high risk of micronutrient deficiency, received a meaningful iron and vitamin A recommended nutrient intake (RNI) benefit from fortified wheat flour and oil, respectively. GAIN defined meaningful contribution as greater than or equal to 10 percent RNI.

The survey found that 55 percent and 68 percent of poor women of reproductive age consume sufficient flour and oil respectively to meet 10 percent of the RNI[13].

While compliance and coverage of fortifiable flour and oil were found to be high, the extent to which they significantly contribute to adequate intake of micronutrients needs to be further assessed.

To that end, in May 2018, ITA/COSFAM decided to conduct the end line survey and collected around 5'000 blood samples throughout the country using the same methodology as the baseline survey with a view to obtain accurate data on micronutrient status (vitamin A, folate and iron) and assess the effectiveness of the fortification programmes conducted since 2010.

At the time of the field visit, ITA/COSFAM were mobilizing resources to undertake the analysis, interpretation and dissemination of the results. The outcomes of this survey will be critical in informing the future direction of current fortification programs and development of potential new initiatives such as mandatory large-scale rice fortification in terms of target micronutrients and fortification levels.

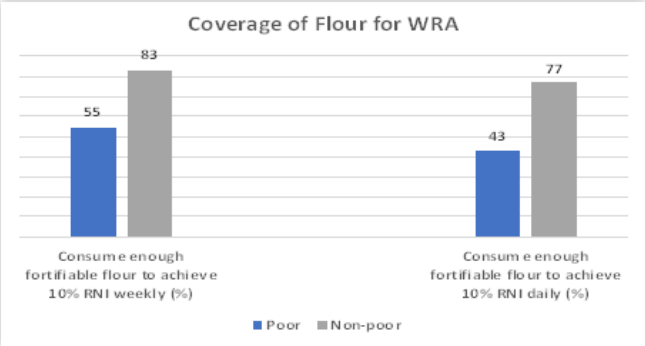
10 Senegal FACT Survey.

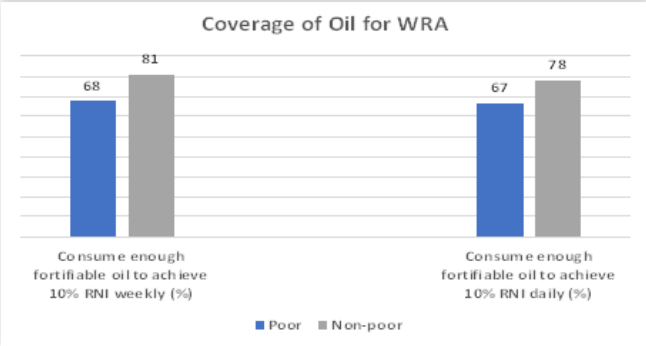
11 COSFAM 2010.

12 Aaron GJ., Friesen VM, Jungjohann S, Garrett GS, Neufeld LM, Myatt M. 2017. Coverage of large-scale food fortification of edible oil, wheat and maize flours varies greatly by vehicle and country but is consistently lower among the most vulnerable: results from coverage surveys in eight countries. Journal of Nutrition April 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5404213/pdf/jn245753.pdf (consulté le 21 février 2019).

13 Senegal FACT Briefing Note, January 2014.

GRAPH 2-3: COVERAGE AND CONSUMPTION OF FLOUR AND OIL BY WOMEN OF REPRODUCTIVE AGE IN SENEGAL[14]





3.3 CONSUMPTION OF STAPLE FOODS

Rice is the number one staple in Senegal. As shown in Table 1, the daily consumption of rice was nearly double of that of wheat flour and triple of that of maize in 2013.

In addition, looking across all age groups (Graph 4), rice has the biggest potential of all cereals to reach the Senegalese populations.

Senegalese consume on average about 100'000 MT of rice monthly which places rice, in terms of consumption, well above any other cereals regularly consumed. Rice is consumed across all age groups and in particular by adolescent girls and WRA, which constitute key target groups.

3.4 GOVERNMENT'S FORTIFICATION POLICIES AND STRATEGIES

The Senegalese government is strongly committed to addressing public health problems related to nutrition. Fortification of salt with iodine, cooking oil with vitamin A and wheat flour with iron and folic acid are mandatory in Senegal, which helps to create a beneficial enabling environment to fortify and reach the majority of the population.

Food fortification is one of the interventions recommended for scaling up in the Multisectoral Strategic Plan of Nutrition of Senegal 2017-2021 (PSMN) to effectively address micronutrient deficiencies along with the promotion of dietary diversification, vitamin and mineral supplementation and nutrition education.

The 2017-20121 PSMN defines the following interventions pertaining to food fortification as priority areas for strengthening and scale up in the fight against malnutrition:

- For iron deficiency and anemia, home fortification of food for children aged 6-23 months and large-scale fortification with iron / folic acid, zinc, iodine, of staple foods (flour, salt, oil…) are the two interventions that will be strengthened and implemented especially in very critical regions (central and southern regions with prevalence of more than 70 percent).
- With regards to iodine deficiency, industrialization of iodized salt production, adaptation and enforcement of salt iodization regulations, strengthening of quality control and promotion of iodized salt households and within the education system will be implemented.
- For vitamin A deficiency, the reinforcement of routine vitamin A supplementation and the continued enrichment of refined oils with vitamin A are key measures highlighted that will help to improve the vitamin A status of the populations.
- Zinc introduction interventions in micronutrient food fortification regulation is envisaged as one of the means to reduce the prevalence of zinc deficiency in populations.

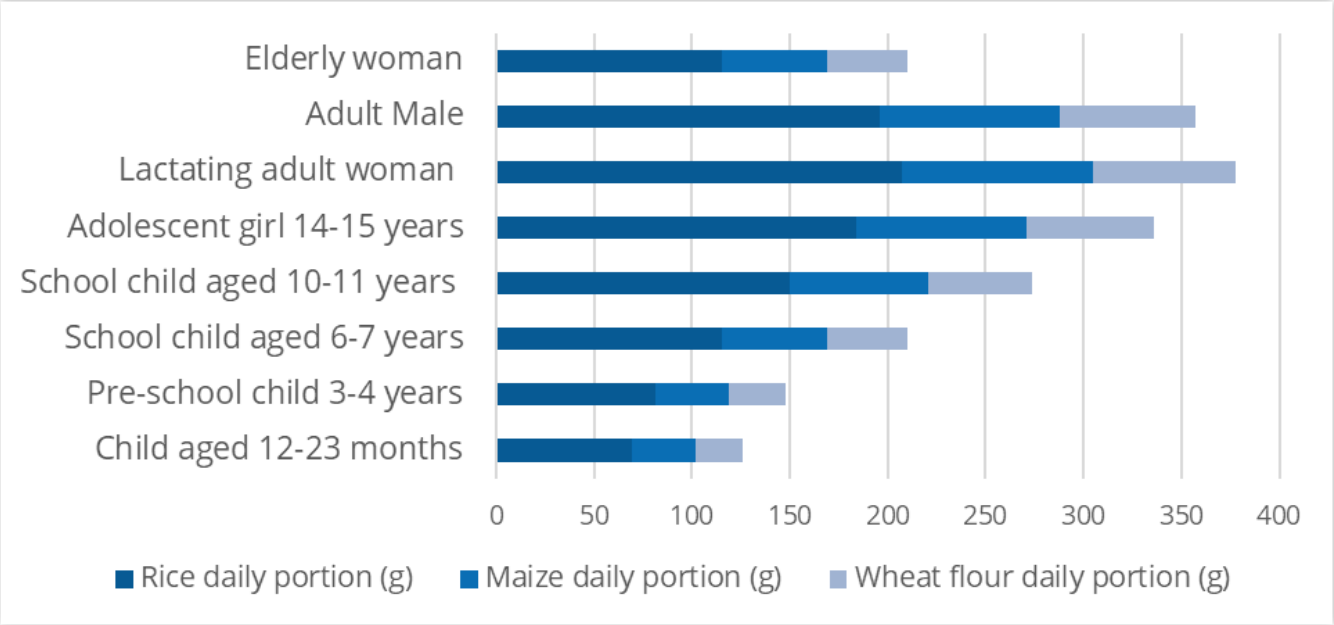
Nutritional education is a part of these actions and is an important element in the fight against micronutrient deficiencies. It will be done through its integration into the training curricula carried by the different sectors as well as the promotion of the consumption of micronutrient rich foods for a better use.

14 Senegal FACT Survey.

TABLE 1: CEREAL GRAINS CONSUMPTION IN SENEGAL[15]

	FAO 2003 g/p/j	FAO 2013 g/p/j
Wheat	77	102
Maize	34	71
Rice	199	198
Sorghum	**39**	**29**
Millet	88	81

GRAPH 4: DAILY CONSUMPTION OF RICE, MAIZE AND WHEAT FLOUR IN SENEGAL[16]



15 FAO Food Balance Sheet.

16 Assessing the impact of rice fortification on nutrient intakes and cost of a nutritious diet, Fill the Nutrient Gap.

CHAPTER 4

4. Rice landscape analysis

4.1 RICE SUPPLY AND RICE DEMAND

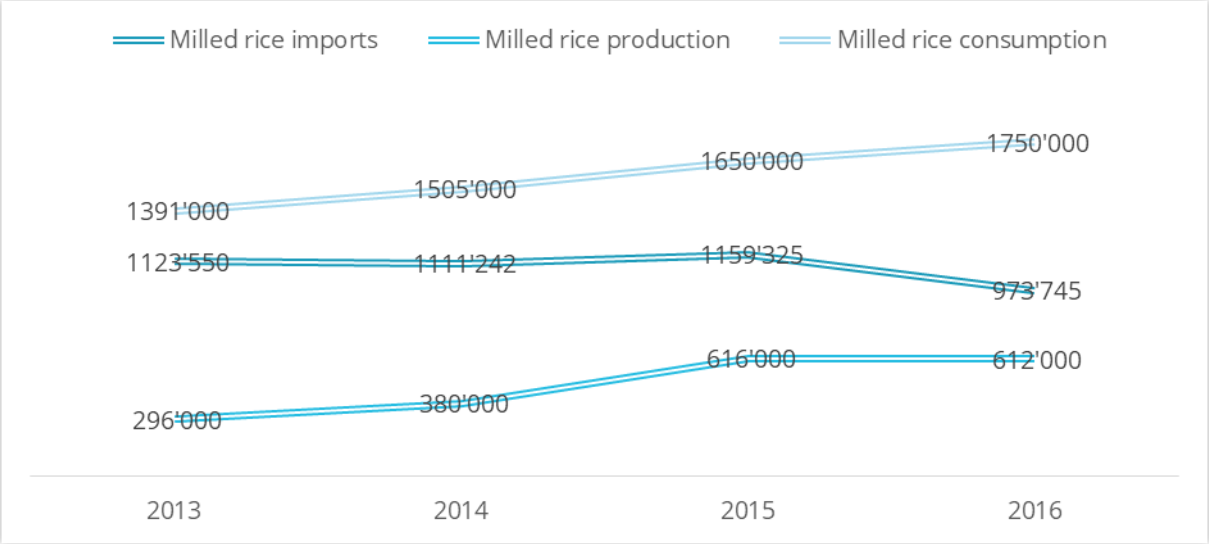
Paddy rice production was only 300'000 MT in 2009 and nearly tripled in less than 10 years to reach 885'000 MT in 2016 which corresponds to approximately 612'000 MT of white rice.

In 2014, Senegal produced around 20 percent of its national consumption and only 4 processing units were vertically integrated (husk, grade and clean the rice). Two years later, in 2016, national production of milled rice represented 35 percent of total consumption. The milling ratio has increased from 55 percent to over 65 percent and the share of whole-grain rice from 30 to 60 percent.

Despite these progresses, the objective of rice self-sufficiency remains a medium-term objective. Paddy availability and capacity of the local milling industry are currently the main limiting growth factors. In 2015, the Feed the Future/Naatal Mbay study showed that nearly 77 percent of production was still processed by hullers that were not sufficiently equipped to put quality rice on the local market. The few modern rice mills that respected quality standards failed to produce on large scale due to limited availability of paddy.

The trend and scale of domestic investments however demonstrates a clear commitment from all actors across the value chain from producers (farmers) to rice millers to continue scaling-up local production of rice.

GRAPH 5: MILLED RICE DEMAND VERSUS SUPPLY (IN METRIC TONS)[17]



4.2 IMPORTS / EXPORTS

Senegal is still a net importer of rice (Table 2), with exports of milled rice representing circa 10 percent of the total volume imported between 2012 and 2016. The share of exports marginally increased in 2016 but at the time of the report write-up, up-to-date data wasn't available to verify whether this was an ad-hoc increase or a reflection of an upward trend for 2017 and 2018.

The bulk of imports comes in the form of broken rice (99.7 percent in 2016) and is mainly imported from India (60 percent), Thailand (20 percent) and Brazil 10 percent). Imports are handled by about 13 large trading houses who buy about 80 percent of total rice imports.

17 FAO Trade.

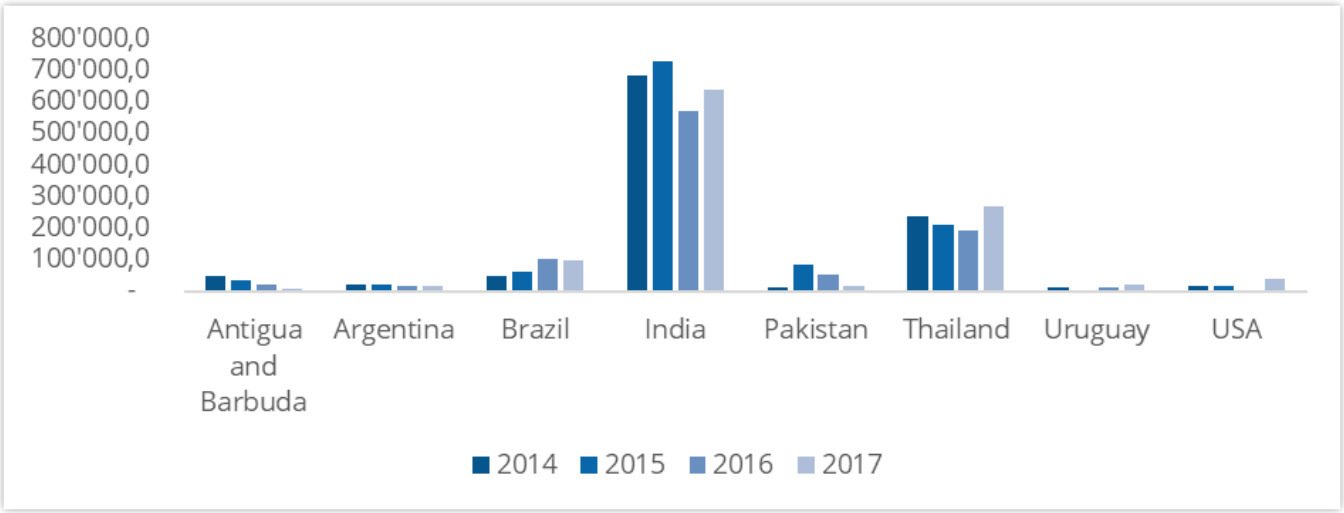
TABLE 2: IMPORTS VERSUS EXPORTS OF MILLED RICE[18]

	2012	2013	2014	2015	2016
Export	**96'181**	**88'174**	**111'374**	**111'502**	**138'908**
Import	1'040'799	1'123'550	**1'111'242**	1'159'325	973'745
Share of Exports relative to imports	**9%**	**8%**	**10%**	**10%**	**14%**
Net Imports	944'618	1'035'376	999'868	1'047'823	834'837

On average, 1.1 million MT of broken rice were imported between 2013 and 2017 (Graph 6). The purchasing price of imported broken rice in 2014 was 225.6 FCFA/kg at importer level. The traditional value chains[19] is able to compete since *banabanas*[20] sell broken rice to traders at 223 FCFA/kg. However, modern mills suffered from competition with imports prior to state intervention as they provided broken rice of a quality similar to the imported one at a higher price (232 FCFA/kg)[21]. To enable the marketing of domestic industrial rice, the State of Senegal tried to intervene by constraining importers to purchase 30'000 MT of whole-grain rice from local rice millers[22] annually. Whether this policy was ever truly implemented though was questioned by many of the stakeholders met during the field interviews.

The final retail price of broken rice is higher for the modern value chains (284.7 FCFA/kg) than the traditional one (270.3 FCFA/kg), and whole grain is more expensive (332.5 FCFA/kg) than either of them. The price of ordinary broken imported rice ranged in 2014 between 260 and 275 FCFA/kg, and the one of imported fragrant whole grain rice ranged between 300 and 350 FCFA/kg[23].

GRAPH 6: BROKEN RICE IMPORTS IN MT[24]



18 FAO Trade.

19 Soullier 2017. Modernization of domestic food chains in developing countries: what effects on small-scale farmers? The rice value chain in Senegal: traditional and modern value chains are identified by Soullier in terms of processing techniques and type of coordination mechanism.

20 Word used to describe Senegalese street vendors.

21 Soullier 2017.

22 SAED (2015a). Protocole d'accord sur la commercialisation du riz Sénégalais. Dakar: Société d'Aménagement et d'Exploitation du Delta.

23 Hathie and Ndiaye, 2015; François et al., 2014.

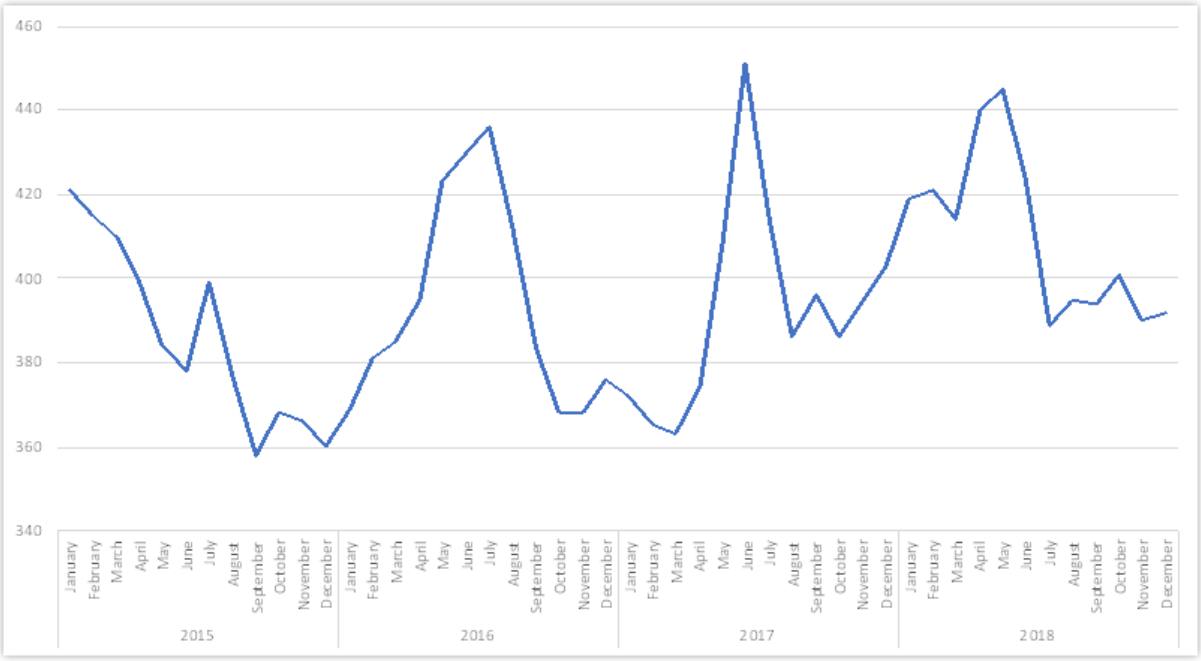
24 UN Comtrade.

4.3 PRICE, SEASONAL VARIABILITY

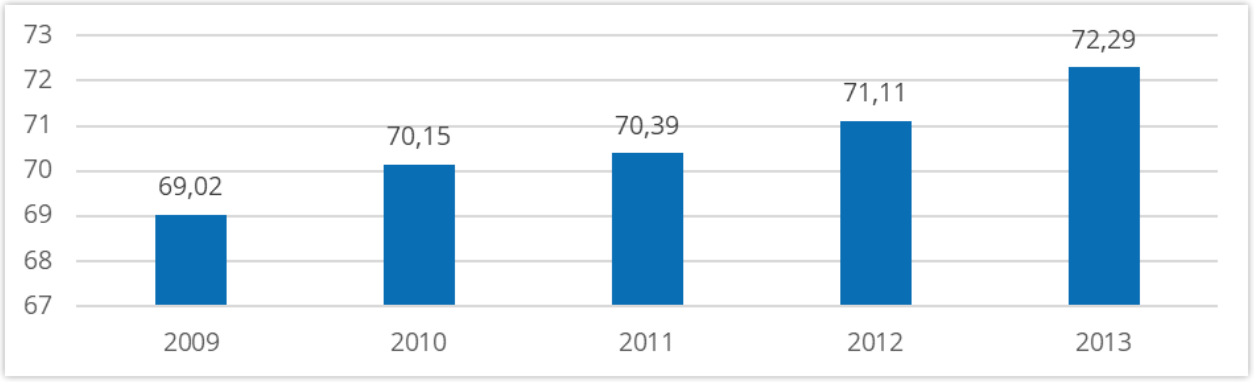
Rice prices on international markets vary significantly month on month, regardless of the type of rice traded. Looking at the price of Thai 100 percent broken rice (Graph 7) over the past 4 years as a benchmark for broken rice globally shows sharp variations within the same year. In 2018, the price difference between the highest and lowest monthly price points shows a 14 percent difference while a similar comparison in 2017 shows a 24 percent between June and March prices.

Such monthly price differences help put in perspective the 5 percent price increase attributed to fortification in Mali where the World Food Programme implemented a small-scale rice fortification project in 2017. Seasonality and timing of non-fortified rice purchases are therefore critical elements that can help absorb the cost of fortification and avoid consumers to equate a price rise to fortification.

GRAPH 7: THAI 100 PERCENT BROKEN PRICE EVALUATION[26]



GRAPH 8: MILLED RICE FOOD SUPPLY IN SENEGAL IN MT[27]



25 Guyondet et al.: Mali case Study: Generating Evidence for New Operative Model. Scaling up.
26 http://www.infoarroz.org/portal/uploadfiles/20190114132427_14_world_prices.htm
Rice Fortification in West Africa. Sight and Life / World Food Programme, 2018.
27 FAO Food Balance Sheet.

4.4 RICE CONSUMPTION AND CONSUMER PREFERENCES

In 2013, the consumption of rice in Senegal reached 72.29kg per person per day i.e. a daily consumption of 198g of rice per capita per day which places it as one of the largest consumers of rice in West Africa.

Interviews conducted in October 2018 in the Senegal River Valley (SRV) and Dakar have revealed that consumers' perception of the quality of rice produced in the valley has increased in recent years while it has traditionally been considered of inferior quality compared to imported rice.

It was recently demonstrated that local rice can compete with imported rice if its quality is adapted to the preferences of consumers, these preferences being aroma, homogeneity, purity of the grains, branding, and labelling[28].

Investments in the local milling infrastructure coupled with marketing efforts from the largest rice mills that have developed their own brands of rice, have contributed to upgradation of locally produced rice.

4.5 RICE MILLING

In 2015, the Naatal Mbay project of Feed the Future Senegal conducted a comprehensive inventory of paddy rice husking units in the departments of Dagana, Podor, Matam and Kaneldes (in SRV). The study listed a total of 570 units, of which 294 were "jet pearler" type (52 percent), 139 "Engelberg" (24 percent), 10 "one pass" type (2 percent) and 27 "artisanal", (22 percent).

The dehulling units listed in the Saint Louis and Matam regions were 87 percent owned by individuals and 13

percent by legal entities. The latter mainly consist of Economic Interest Groups (EIG), private or collective. GIE either act as contract-millers for farmers or mill their own rice depending on their structure, capacity and size.

The rice industry is concentrating both from a geographical as well as capacity stand points. The SRV supplies 80 percent of national production while Casamance, in the South, supplies the remaining 20 percent.

Senegal is witnessing a rapid increase in the number of processing units and their capacity (Table 3). The potential for transformation is in constant progression and superior to current production levels. Between 1965 and 2011 there were 26 industrial rice mills and 258 village hullers, while an additional 10 industrial mills and 200 village-level hullers were added between 2012 and 2016.

Delta Water Management Company (SAED) projections show that by 2018, there should be a total of 63 industrial mills and 519 village-level huskers in Senegal, thereby confirming consolidation and modernization of the Senegalese rice milling industry.

SRV, in particular, is host to significant investments in large modern mills. According to the Feed the Future/Naatal Mbay review, in SRV in 2017 there were 8 mills with a capacity >5 MT of paddy per hour, about 20 mills with a capacity of 2-5 MT/hour and 38 mills with a capacity <2 MT/h. The companies VITAL and CASL, two of the largest mills in SRV, are equipped with state-of-the-art milling lines of 5 MT/hour and 8 MT/hour capacity respectively.

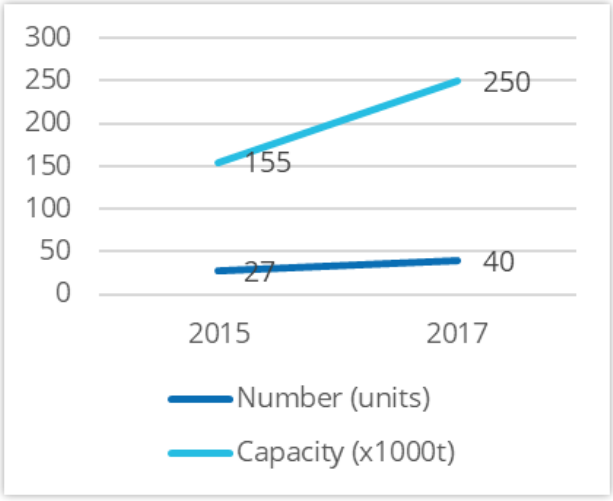
Paddy availability is currently their main limiting factor for expansion, with shortages observed during the lean seasons between March and June and October to December.

28 Demont and Ndour, 2015 ; Demont et al., 2013.

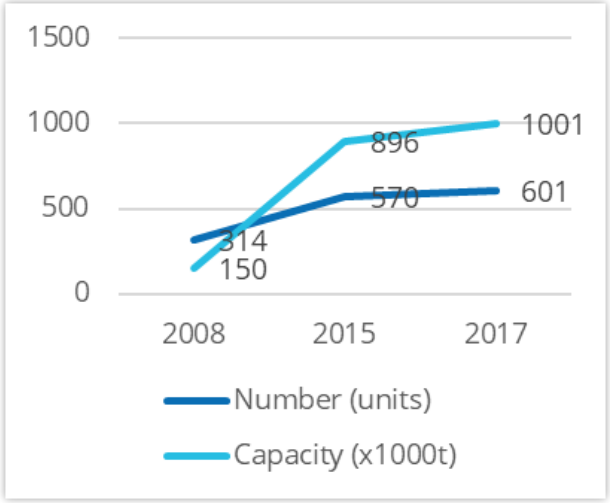
TABLE 3: NUMBER OF RICE PROCESSING UNITS IN SENEGAL[29]

Période	Industrial Rice Mills	Village-level Huskers	Total
1965-2011	**26**	**258**	**284**
2012-2016	10	200	210
Total in 2016	**36**	**458**	**494**
New units - 2017-2018 projections	27	61	88
Expected potential	**63**	**519**	**582**

GRAPH 9: EVOLUTION OF THE NUMBER AND CAPACITY OF MODERN RICE MILLS IN SRV FROM 2015 TO 2017



GRAPH 10: EVOLUTION OF THE NUMBER AND PROCESSING CAPACITY OF ARTISANAL HULLING UNITS IN SRV FROM 2008 TO 2017



29 SAED 2018.

CHAPTER 5

5. Rice fortification in Senegal

5.1 POINT OF FORTIFICATION

From a technical perspective, fortification of rice can take place at various locations where non-fortified white rice is blended with fortified kernels (FK). Options include - but are not limited to - large-scale rice mills, exporters' warehouses, importers warehouses or public rice depots.

Large-scale, vertically integrated mills that can easily incorporate continuous blending equipment offer the perfect entry point for domestic fortification. Small-scale units offer a different setting where batch blending would appear to be the most suitable fortification method.

Today, imports of rice represent approximately 60 percent of the total volume of rice consumed in Senegal and therefore would drive significant nutrition impact if fortified. For imports, and given rice is mostly imported into Senegal in 50 kg bags, not in bulk, fortification of imported rice directly at country of origin constitutes a simpler logistical solution. Fortification upon arrival in Senegal would add another production step (empty bag, fortify, refill bag) thereby significantly increasing handling, bagging and overall fortification costs.

5.2 POTENTIAL DELIVERY OPTIONS

From a programmatic stand point, the choice of fortification intervention should be tailored to national and local circumstances, potential nutritional impact and technical feasibility.

An option to consider for Senegal would consist of implementing rice fortification in sequence: 1) through initial introduction via safety net programs to prove that it is technically possible to produce fortified rice locally that mimics local rice and is accepted by all beneficiaries, 2) by supporting interested rice millers to voluntarily fortify their rice and 3) in parallel, to build the enabling environment conducive to mass fortification through a national and/or regional mandate. These options are explored in further details in the following sections.

Social safety nets

Social safety net programs offer an opportunity to rapidly reach the beneficiaries most in need while at the same time allowing to test several program-entry scenarios for fortified rice in large-scale operations.

In Senegal, school meals are the biggest of such programmes run nationally with the help of four key partners: the State of Senegal, Counterpart International, World Food Programme and USDA. In total, 24 percent of elementary schools (students aged 6-11 years old) received food aid in 2018 and by 2035, the aim of the national school feeding program is to reach 50 percent of elementary schools.

In 2017-2018, 821 elementary schools were supported by the World Food Programme, 1,050 by the State of Senegal and 204 by Counterpart International. In addition, 417 middle and high schools received support from the State for food procurement.

Similar to the project implemented by World Food Programme in Mali[30], fortification of rice could be performed locally using white, non-fortified rice sourced locally and imported FK. Such a scenario offers a double advantage of speed to implementation and real conditions trial while also validating the supply chain and consumer acceptance.

The aim is to simultaneously introduce fortified rice in other social safety nets run by the World Food Programme (Food for Assets (FFA), Targeted Food Assistance (TFA)), where cash-based transfers (CBT) are distributed to beneficiaries. The partnering retailers where beneficiaries are able to use their vouchers would only distribute fortified rice and no-longer non-fortified white rice. As a reference, 1'872 MT of rice was bought at partner retailers in 2018 through CBT programmes in Matam and Podor regions alone.

The national school feeding program run by the Senegalese Division of School Canteens provides funds directly to schools once a year who are in charge to manage monthly procurement of foods. The food basket includes a recommendation of 150g of cereals, 99 percent of which is rice according to the information gathered during interviews. Further discussions need to be held with the Division of School Canteens to ascertain how non-fortified rice could be substituted by fortified rice in the medium and long run.

30 Guyondet et al. Mali Case Study: Generating Evidence for New Operative Model. Scaling up. Rice Fortification in West Africa. Sight and Life / World Food Programme, 2018.

Voluntary fortification

Allowing and supporting large-scale mills in SRV to fortify their rice on a voluntary basis, following specified regulations, will help gradually build in-country capacity.

There are currently 8 mills with a total capacity of 5+MT/h in the country (Table 4). At full scale, and assuming that local paddy production continues to scale-up to the point where these mills are able to procure paddy on a continuous basis, and that they would work 12 hours a day for 300 days, this represents a total potential capacity of 144'000 MT of paddy per year i.e. around 86'000MT of milled rice equivalent, enough to reach nearly 1.2 million beneficiaries consuming 72.29kg of fortified rice yearly i.e. 8 percent of the population[31].

Having standards to cover voluntary interventions is essential to ensure that industries have adequate guidance and recommendations with regards to the types of micronutrients used, levels of fortification and overall guidance on safety and effectiveness.

Mandatory fortification

Mandatory fortification suggests that fortification of a particular food vehicle would be imposed by law on all imports and local production of the given food vehicle. A number of critical steps need to be performed ahead of a mandate, including but not limited to, building the legislative and regulatory environment, technical optimization, industry modernization, and consumers' awareness and education. However, quick wins could be achieved through for instance mandated fortification of imported rice.

Looking at 2016 (Table 2), if the total net imports of 834'837 MT had been fortified, at a consumption rate of 72.29 kg/p/year, 11.5 million Senegalese could have consumed fortified rice, i.e. about 70 percent of the population.

Senegal primarily imports rice from India and Thailand, two countries where FK are already being produced on a large-scale. This constitutes an option that can therefore technically rapidly be implemented. Key considerations to operationalize such mandate include the need to rapidly develop national standard for fortified rice & protocols for quality control of imported fortified rice, and an update of national policies to reflect fortification of rice.

TABLE 4: RICE MILLING INDUSTRY CENSUS[32]

Capacity	# Mills	% Share
<2t/h	38	58%
2-5t/h	19	29%
>5t/h	8	12%

31 United Nations Department of Economic and Social Affairs, Population Division (2018): https://population.un.org/wup/Download/ (consulted 2019 February 21st). The total estimated population in 2018 in Senegal is 16.3 million.

32 USAID Feed the Future Naatal Mbay.

5.3 FORTIFIED KERNELS SUPPLY

The milling sector in Senegal is modernizing but the majority of rice milling in the country is still not done on an industrial level. Modernized mills only process 12.5 percent[32] of the milled rice. Given the circumstances, importation of FK as opposed to immediate investment in local capacity to produce FK in-country seems like a more reasonable approach. FK constitute on average 1-2 percent of fortified rice, and importation and blending of 1 percent FK with local rice would likely be the most economical solution if one is looking at fortification of industrially-milled rice. Relatively low levels of investment and simplicity of the blending process make local blending a feasible option.

In Mali, in 2017, FK were imported by World Food Programme from Thailand and blended with local Malian white rice as a means to introduce fortified rice through World Food Programme supported school meal programme. After one year of program implementation, this pilot project found that it is technically possible to fortify rice in Africa using imported FK and blending them with local milled rice. Once cooked, the fortified rice mimicked local rice and was accepted by all beneficiaries. The cost of fortification represented a 5 percent increase compared to cleaned local non-fortified rice[33].

In Senegal, 3 main grades of rice are traditionally produced and consumed: 100 percent broken rice, "*fine brisure*" (25 percent or so broken rice) and "*moindre brisure*" (50 percent or so broken rice). FK produced with an extruder can mimic any type and grade of rice, from 100 percent broken rice to whole-grain rice. The main challenge revolves around consumer acceptance particularly for FK produced through cold extrusion or coating technology which can be slightly opaque when uncooked. As in the Mali case, pilot trial is a good way to alleviate these barriers in real conditions.

An important consideration of any blending operation for Senegal must ensure there is minimal additional handling and transportation of the rice with which the fortified kernels need to be blended. Transportation costs rapidly become a major contributor to the overall price of rice, especially given the irregular and at times poor transport infrastructure in the country. Analysis in other countries has highlighted the importance of optimal supply chains for FK, and fortified and non-fortified rice in order to minimize costs[34].

5.4 POLICIES FOR FORTIFICATION

The mission of elaboration of the National Standards is entrusted to the Senegalese Association of Normalization (ASN). The method used by ASN is the "technical committee method". A technical committee is made up of sub-committees and working groups which elaborate and adopt at different stages the preliminary projects and draft standards. The process of developing a standard is composed of 3 basic phases:

- **Preparatory phase:** needs assessment with all partners of the standardization body (industries, service companies, scientific institutions, development institutions, laboratories, consumers, administrations, etc.)
- **Technical phase:** collecting all relevant technical documentation: regulations, foreign or international standards that will be used to develop the first draft that will be submitted to the technical committee for evaluation as many times as necessary in order to reach a consensus.
- **Validation phase:** once the text is finalized, the standardization body implements the approval procedures defined by its statutes and the regulations governing standardization.

The future National Standard will support voluntary efforts and promote adequate fortification of rice. The Standard should be developed so that it builds upon the latest research and evidence in terms of types and levels of micronutrients to be added, as shown in Table 5.

32 Soullier 2017.

33 Guyondet et al.: Mali case Study: Generating Evidence for New Operative Model, 2018.

34 A Landscape Analysis of Rice Fortification in Sri Lanka, World Food Programme / FFI.

TABLE 5: NUTRIENT LEVELS PROPOSED FOR FORTIFIED RICE AT MOMENT OF CONSUMPTION (MG/100 G)[35]

Nutrient	Compound	<75 g/d	75-149 g/d	150-300 g/d	EAR	EAR
Iron	Micronized ferric pyrophosphate	12	12	7	7	
	Ferric pyrophos-phate	7	7	4	4	
Folic Acid (B9)	Folic acid	0,50	0,26	0,13	0,10	0,192
Cobalamin (b12)	Cyanocobalamin	0,004	0,002	0,001	0,0008	0,002
Vitamin A	Vitamin A palmitate	0,59	0,3	0,15	0,1	0,357 (f) 0,429 (m)
Zinc	Zinc oxide	9,5	8	6	5	8,2 (f) 11,7 (m)
Thiamin (b1)	Thiamine mono-nitrate	2,00	1,00	0,50	0,35	0,9 (f) 1,0 (m)
Niacin (B3)	Niacin amide	26	13	7	4	11 (f) 12 (m)
Pyridoxin (B6)	Pyridoxine hydro-chloride	2,40	1,2	0,6	0,4	1,10

5.5 CONSUMER AWARENESS AND ACCEPTANCE

The results of a study of consumer behaviour towards fortified rice in Senegal were presented at the St Louis workshop on 11 December 2018[36]. A total of 1,559 face-to-face interviews were conducted, which looked into consumers' perception vis-à-vis 3 key elements: context and awareness, rice consumption in Senegal and attitudes towards fortified rice.

Context and awareness

- 91 percent of respondents believe that vitamins and minerals are generally good for health and wellbeing
- 69 percent think they get enough vitamins and minerals through their diet...
- ... and yet 93 percent agree that vitamins and minerals need to be added to staple foods

Rice consumption in Senegal

- 93 percent of respondents consume rice at least once a day, with a higher rate of penetration in rural areas
- 80 percent have bought packaged rice, mostly branded
- the decision to buy branded rice was influenced by: 1) quality, 2) taste and texture, 3) the content of vitamins and minerals

35 De Pee et al: Standards and Specifications for Fortified Rice. Scaling up Rice Fortification in West Africa. Sight and Life / World Food Programme, 2018.
36 DSM: Consumer behavior towards fortified rice in Senegal, December 2018.

Attitudes towards fortified rice

- 88 percent of people surveyed would be more interested in purchasing a brand of rice containing added vitamins and minerals
- 63 percent would be willing to pay more for a brand of rice that adds vitamins and minerals

In terms of key messaging and learning, the survey showed that the perception of consumers is that the micronutrient food intake can be improved. Rice consumption is high in Senegal and it is encouraging to see that respondents are ready to buy fortified rice and pay a premium for it.

5.6 POTENTIAL IMPACT OF FORTIFIED RICE

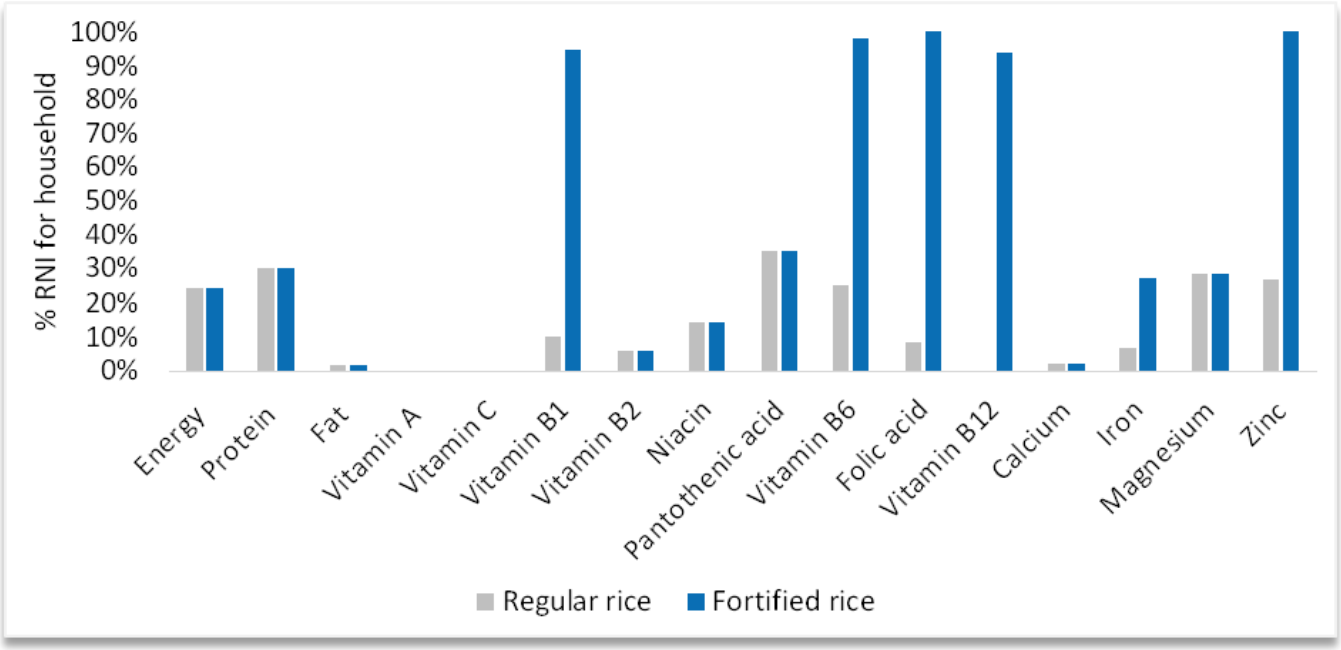
The recently published WHO guideline 'Fortification of rice with vitamins and minerals as a public health strategy' supports rice fortification. Micronutrient levels should be set such that the intake of the micronutrient in the general population, from all sources, is above the EAR and below the tolerable upper limit (UL) for almost everyone. Where intake is not well known and dietary deficiencies are likely, it is a good approach to set the micronutrient level of fortified rice such that, at prevailing consumption levels, it provides the EAR for adults[37,38].

The review of current micronutrients added to existing and planned fortified commodities shows that currently only four micronutrients are added to food staple and condiments, including iron and folic acid in wheat flour, vitamin A in cooking oil, and iodine in salt in Senegal. Nutrients such as vitamin B12 and Zinc are currently missing from the national fortification standards.

These nutrients, along with a complete set of B vitamins, can easily be added to fortified rice. For West Africa, a 2018 Fill the Nutrient Gap (FNG) study evaluated the potential impact of rice fortified with a full range of vitamins and minerals on household nutrient intake as illustrated in Graph 11.

On average, the FNG study showed that fortified rice alone can provide about 1/3 iron RNI across all age groups (Table 6). Fortified rice being just one of the sources in the diet, and considering that other staples are fortified, the opportunity to reach 30% RNI for iron through rice only represents a good opportunity.

GRAPH 11: IMPACT OF FORTIFIED RICE ON HOUSEHOLD NUTRIENT INTAKE[39]



37 Allen L, de Benoist B, Dary O, et al, eds. Guidelines on food fortification with micronutrients. Geneva: World Health Organization/Food and Agriculture Organization; 2006

38 de Pee S, Tsang B, Zimmermann S, et al. Rice fortification. In: Mannar V, Hurrell R, eds. Food fortification in a globalized world (2018). London: Elsevier Academic Press; 2018:131–142.

39 Fill the Nutrient Gap, November 2018.

TABLE 6: IRON REQUIREMENTS PER INDIVIDUAL AND CONTRIBUTION OF THE FORTIFIED RICE TO MEET THE NEEDS[40]

	Iron absorbed requirement (mg)	Iron RNI provided by fortified rice (%)
Child aged 12-23 months	0,6	33,3%
Pre-school child 3-4 years	0,6	39,1%
School child aged 6-7 years	0,6	51,1%
School child aged 10-11 years	1,4	29,4%
Adolescent girl 14-15 years	3,1	16,6%
Lactating adult woman	2,9	19,7%
Adult male	1,4	40,1%
Elderly woman	1,1	37,2%

40 Fill the Nutrient Gap, November 2018.

CHAPTER 6

6. Findings and recommendations for rice fortification

Fortifying locally-milled rice would contribute not only to the valorisation efforts of the local rice sector but also participate to positioning Senegal as a leader in fortification in the region. This study and the workshop held subsequently in St Louis in late 2018, constituted the first milestone towards mobilizing and sensitizing public and private sector partners towards the unique, additional means that fortified rice offers to reach all Senegalese every day with additional nutrients.

Although considerations for fortification remain due to the cultural perception of rice and price sensitivity of Senegalese households, the current political environment is favourable. In addition, substantial investments have been made in recent years by the private sector to develop the local rice value chain which represents an opportunity for introducing rice fortification and further enhance the Senegal rice sector.

Senegal is a very attractive market for rice fortification (high nutritional need, high rice consumption, broad population coverage), where industry is starting to concentrate and with a unique setting whereby the bulk of rice needs are still, to date, met though imports (>60 percent).

The key recommended next steps to progressing rice fortification could include, but are not limited to:

6.1 POLICY FRAMEWORK AND COORDINATION

The data update for MNDs initiated by ITA and COSFAM must be finalized to inform future programmatic interventions and confirm the role that fortified rice can play in the fortification component of the National Nutrition Development Policy (NNDP). Building on the outcomes of the wheat flour and oil fortification end line survey, next steps should include:

- Undertake an assessment of current programmes' micronutrient gaps and consider introducing rice in the mix of food vehicles to be fortified
- Support the Senegalese Association of Normalization (ASN) in the development of a National Standard for fortified rice and fortified kernels that contribute to filling nutrient gaps identified through the survey
- The future National Standard, that will support voluntary efforts and promote adequate fortification of rice, should be developed so that it builds upon the latest research and evidence in terms of types and levels of micronutrients to be added, in particular the recently published WHO Rice Fortification guidelines
- Develop quality control and monitoring protocols as well as guidelines for labelling and claims to support voluntary initiatives

6.2 SOCIAL SAFETY NETS

Social safety net programmes that provide food assistance should be utilized as a first step to introduce fortified rice in Senegal. Both school meal programmes operated under the World Food Programme and the Government of Senegal distribute rice as part of their daily ration. The food basket of the National School Feeding Programme includes 150g of cereals, 99 percent of which is rice. In total, 24 percent of elementary schools received food aid in 2018 and by 2035, the aim of the national school feeding program is to reach 50 percent of elementary schools.

There is an additional opportunity to introduce fortified rice in other social safety nets run by the World Food Programme such as Food for Assets (FFA) or Targeted Food Assistance (TFA), where cash-based transfers (CBT) are distributed to beneficiaries. The partnering retailers, where beneficiaries are able to use their vouchers, would only distribute fortified rice and no-longer non-fortified white rice. A total 1'872 MT of rice was bought at partner retailers in 2018 through CBT programmes in Matam and Podor regions alone. In order to implement these recommendations specific next steps would be:

- Hold further discussions with the Division of School Canteens to ascertain how non-fortified rice could be substituted for fortified rice in the short and medium run
- Build on the experience the World Food Programme gained in Mali in 2017 to introduce fortified rice through World Food Programme school meals using non-fortified rice sourced locally and imported FK
- Undertake a detailed review of the World Food Programme FFA and TFA systems to evaluate whether and how these could be adapted to introduce fortified rice.

6.3 VOLUNTARY FORTIFICATION

Voluntary fortification of rice should be encouraged, in particular amongst the largest local rice mills. Concentration of the rice milling industry coupled with the strategic will to improve the rice sector and reach self-

sufficiency in rice, has prompted significant investments in the domestic rice value chain in recent years. This trend offers a unique opportunity to integrate rice fortification as part of the effort to promote locally produced and milled rice.

Mandatory fortification of both locally produced and imported rice is generally a preferred option to ensure maximum public health impacts however, it may be impractical at this stage in Senegal given that the milling industry is still very fragmented with around 87 percent of rice milled through small-scale mills. Such a fragmented industry makes it difficult to implement and regulate mandatory fortification which could therefore be explored at a later stage once the industry is more concentrated.

Currently, there are 8 mills with a total capacity of 5+MT/h in the country. At full scale, and assuming that local paddy production continues to scale-up to the point where these mills are able to procure paddy on a continuous basis, these mills represent a total potential capacity of 86'000 MT per year i.e. enough to reach nearly 1.2 million beneficiaries i.e. 8 percent of the population. The largest mills are favourable entry points to perform voluntary fortification but might not reach vulnerable households that would benefit from fortification the most. Specific next steps are to:

- Continue discussions initiated with the largest rice mills who have expressed interest in embarking on rice fortification
- Explore the opportunity to adapt the legislative framework to enable a phased approach to fortification that will allow the local rice milling industries to grow e.g. enforcement of mandatory legislation on large mills only
- Monitor changes in the rice value chain that may improve feasibility for mandatory fortification.

6.4 FORTIFICATION OF IMPORTED RICE

Fortifying imported rice represents the biggest, immediate opportunity in a country where 60 to 70 percent of rice consumed is imported. Fortifying imports of rice could drive significant nutrition impact with a relatively limited investment or modification of the current rice supply chains. The bulk of imports stems from 3 countries, India (60 percent), Thailand (20 percent) and Brazil (10 percent), where, coincidentally, FK are already being produced at large scale. Given rice is mostly imported into Senegal in 50kg bags, fortification of imported rice directly at country of origin therefore constitutes a unique opportunity for rapid implementation. Fortification upon arrival in Senegal would add another production step (empty bag, fortify, refill bag) thereby increasing handling, bagging and overall fortification costs but can however but envisaged if this forms part of a long-term strategy of building capacity for internal fortification of rice.

To tap on the potential that imports represents to drive nutritional impact, next should steps include:

- Discussions with and between Ministry of Health and Commerce to assess whether and how a mandate for imported rice can be implemented
- Investigate whether lower import duties, faster clearance, cheaper access to foreign currency could be granted to incentivize traders to import fortified rice on a purely commercial basis
- Engage with private-sector stakeholders to gage their interest in investing in a FK production line to supply the 10'000MT FK needed annually to fortify the entire volume of imported rice.

6.5 ADVOCACY AND COMMUNICATION

Advocacy, communication and social marketing will be essential to strengthen and reinforce the messages conveyed through past campaigns. Rice being such a sensitive commodity for Senegalese, it will also be important to confront possible misconceptions amongst key stakeholders and the general public towards fortified rice. To that end, specific steps include:

- Following the end line survey and national assessment of past fortification projects, advocate to reinforce benefits and needs of fortification
- Develop awareness, information dissemination and behavioural change campaigns promoting rice fortification
- Support the use of the "Enrichi" logo on all fortification initiatives, provided they comply with National Standards developed as detailed in section 6.1.

6.6 REGIONAL COOPERATION

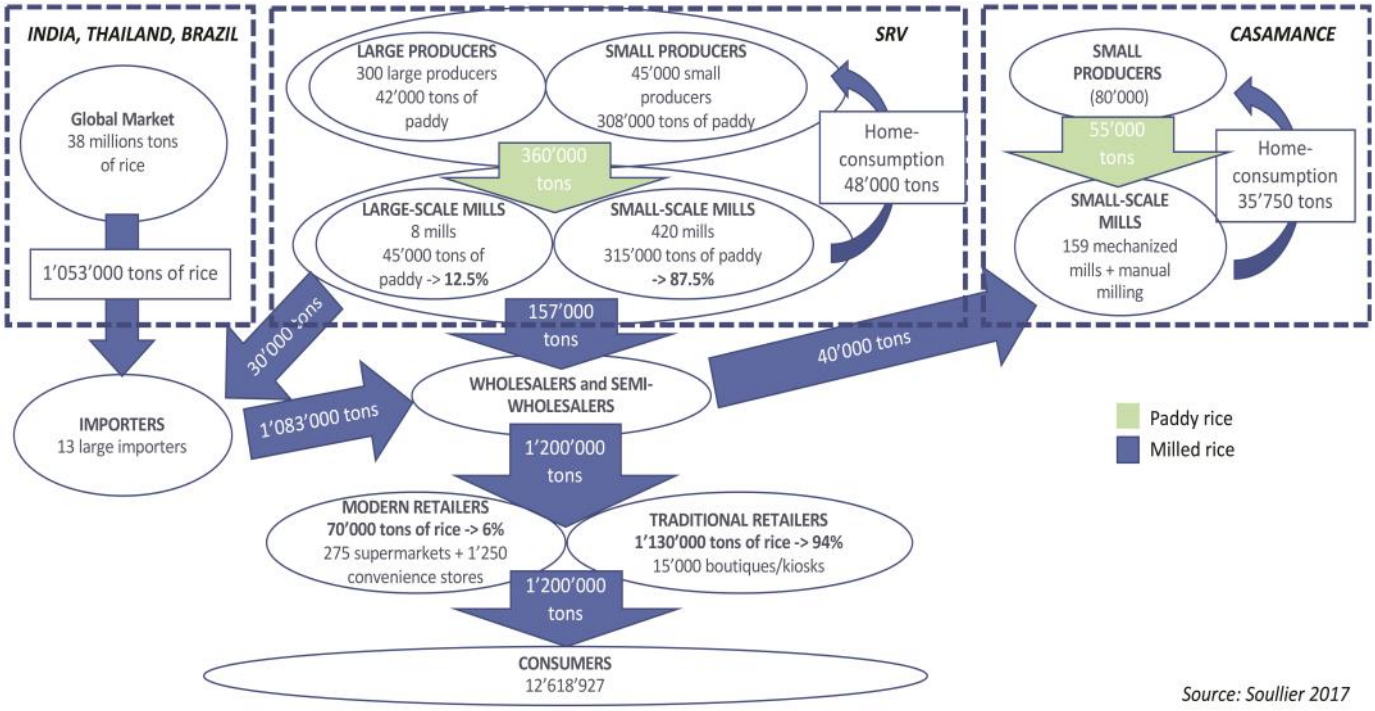
Sustainable investment in rice fortification will require a regional approach to increase demand, leverage volumes and optimize costs. It is estimated that sustainable production of fortified rice would require a minimum demand of 100'000 MT of FK of which Senegal could quickly become a main catalyser for the West African region. To boost regional cooperation, next steps include:

- Initiate cross-regional and multi-sectorial discussions within the West African Economic and Monetary Union (UEMOA) to put in place a common regulatory framework for rice fortification
- Work towards the harmonization of texts and standards for fortified rice in the UEMOA zone
- Train quality control and inspection services on quality control of fortified rice.

Annexes

Annexes	Titre	Type
Annex 1	Senegal rice value chain	Diagram
Annex 2	Contacts	Table

Annex 1



Source: Soullier 2017

Annex 2

Organization	Focal Point	Contact details
AfricaRice	Dr. Karim Taore	k.traore@cgiar.org
Compagnie Agricole de St-Louis	Timothée Larrieu	timothee.larrieu@compagnieagricole.com
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Coumba Nor	M.Diop/M.Sall	suarlcnt@yahoo.fr
Counterpart	Ruben Johnson	rjohnson@counterpart.org
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GIE TAIF	Bassirou Fall	taifgie@gmail.com
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WFP – Head of Programme	Wilfred Nkwambi	wilfred.nkwambi@wfp.org
WFP – National Logistic Officer	Sidou Dia	sidou.dia@wfp.org

Glossary

- **Fortification:** Practice of deliberately increasing the content of essential micronutrient(s), (vitamins, minerals including trace elements), in a food, to improve the nutritional quality of the food supply and provide a public health benefit.
- **Mandatory fortification:** Mandatory and regulated fortification of specific food products by the Government through legislation. All foods covered by the legislation must be fortified according to the prescribed specifications. Quality control measures must be set as well as legal sanctions/penalties in case of non-compliance or incorrect application of the fortification legislation. This is generally recognized as the most effective and sustainable option to implement fortification and reduce the national prevalence of micronutrient deficiencies. Most of the effective universal salt iodization and wheat flour fortification programs have been implemented on a mandatory basis.
- **Voluntary fortification:** A market-driven approach according to which food producers fortify their products without being required to by legislation. The fortified food is marketed as "added value" to the consumer. This approach, which is based on awareness, education, demand and the willingness of customers to pay a little more for the fortified product, does not generally benefit the population at large, unlike mandatory fortification, and is therefore much less likely to reach the most vulnerable populations. However, in the case where the food product is predominantly fortified, voluntary fortification can play a positive role in public health. Voluntary fortification approaches to reduce the risk of micronutrient deficiencies often require Governments' regulations and standards.
- **Fortificant:** A selected essential micronutrient in a particular form to fortify a selected food (e. g. rice, flour, salt).
- **Premix or fortificant mix:** A mixture of one or more fortificants (essential micronutrient) and another ingredient, often of similar nature as the food to be fortified, added to the food carrier.
- **Fortified kernel:** Fortified rice-shaped kernels containing the fortificant mix (extrusion) or whole rice kernels coated with a fortificant mix (coating). Fortified kernels are blended with non-fortified rice in a ratio between 0.5 percent and 2 percent to produce fortified rice.
- **Coating:** Technology to make fortified kernels. Rice kernels are coated with a fortificant mix and ingredients such as waxes and gums. The micronutrients are sprayed onto the rice grain's surface. The coated rice kernels are blended with non-fortified rice in a ratio between 0.5 and 2 percent, as in the case of extrusion technology.
- **Extrusion:** technology to make fortified kernels. Rice-shaped reconstituted kernels are produced by passing rice flour dough, containing a fortificant mix, through an extruder. The extruded kernels, which are made to resemble rice grains, are then blended into non-fortified rice in a ratio between 0.5 and 2 percent, similar to the coating technology. Extrusion allows for the use of broken rice kernels as an input, and may be carried out under hot, warm, or cold temperatures, which influences the appearance of the final fortified kernel.
- **Dusting:** Technology to make fortified rice; polished milled rice kernels are dusted with a fortificant mix in powder form. This technology is only used in the United States and does not allow for washing, pre-cooking or cooking in excess water since this will wash out the micronutrients.
- **Non-fortified rice:** Milled rice without fortification.
- **Fortified rice:** Rice containing essential micronutrients added by coating, extrusion or spraying at a ratio of 0.5 to 2 percent; generally, 1 percent.
- **Paddy rice:** Rice kernels still in their inedible protective hull (raw rice).
- **Brown rice:** Rice from which only the outer, inedible hull has been removed. With the bran (fiber-filled layer) and germ (nutrient-rich core) intact, Brown rice is a source of vitamins B1, B3, B6 and E. Brown rice has a much shorter shelf life than milled rice.
- **Milled rice:** Polished and unfortified rice often called white rice. The outer hull, bran layer and germ have been removed as well as most vitamins.
- **Parboiled rice:** Rice that has been partially boiled in the husk. The three basic steps of parboiling are soaking, steaming and drying. Parboiling makes rice easier to process by hand, boosts its nutritional profile and changes its texture. Parboiling drives water-soluble nutrients from the bran to endosperm, hence parboiled white rice contains roughly half the water-soluble vitamins from brown rice and is more nutritious than regular milled rice. However, even if parboiled rice is more nutritious than non-fortified rice, it may not contain enough nutrients to treat micronutrient deficiencies in the population.

Acronyms

ASN:	Senegalese Association of Normalization
CBT:	Cash-based Transfers
FCFA	Communauté Financière Africaine Franc
COSFAM:	Senegalese Committee for the Fortification of Foods in Micronutrients
EAR:	Estimated Average Requirement
FACT:	Fortification Assessment Coverage Toolkit
FFA:	Food for Assets
FFI:	Food Fortification Initiative
FK:	Fortified Kernels
FNG:	Fill the Nutrient Gap
GAIN:	Global Alliance for Improved Nutrition
GDP	Gross Domestic Product
EIG:	Economic Interest Group
ITA:	Food Technology Institute
Kg	Kilogram
MND:	Micronutrient Deficiencies
MT:	Metric Tons
NI	Nutrition International
PNAR:	National Rice Self-Sufficiency Program
NNDP:	National Nutrition Development Policy
PSMN:	Multisectoral Strategic Plan for Senegalese Nutrition
RBD:	World Food Programme Regional Bureau of Dakar
RNI:	Recommended Nutrient Intake
SAED:	Delta Water Management Company
SRV:	Senegal River Valley
SUN:	Scaling-up Nutrition
TFA:	Targeted Food Assistance
UEMOA:	West African Economic and Monetary Union
UL:	Upper Limit
WFP:	World Food Programme
WRA:	Women of Reproductive Age

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