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Understanding the Rice Value Chain in Cambodia:

Defining the Way Forward for Rice Fortification

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“Understanding the Rice Value Chain in Cambodia: Defining the Way Forward for Rice Fortification”

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Executive Summary

Despite the fact that Cambodia is experiencing steady economic growth, the country is burdened with a high prevalence of micronutrient deficiencies (MNDs). Rice is the main staple of the Cambodian population. Around 75 percent of the population consumes rice in the country. The domestic as well as the export market for fortified rice is untapped and therefore rice is increasingly seen as an important fortification vehicle.

To facilitate local production and improve the nutritional health of the population, the Government is putting immense efforts into the scale-up of rice, as elaborated below:

1. In 2010, the Royal Government of Cambodia (RGC) took a keen interest in rice fortification. Since then, the World Food Programme (WFP) has been a constant supporting partner to the RGC on the country's rice fortification initiatives. Based on the results of the FORISCA (Fortified Rice for School Children in Cambodia) trials in 2013, the Ministry of Education, Youth and Sports, with support from WFP, conducted the pilot-scale distribution of fortified rice in the country's Home-Grown School Feeding Programme (HGSFP) in 2016.
2. In addition to the HGSFP, under the Workplace Nutrition Project, a trial project was implemented by the Reproductive and Child Health Alliance (RACHA) and International Life Sciences Institute Japan in 2018.

3. Until 2018, fortified rice was imported by the RGC. However, in 2019, WFP in partnership with the Green Trade Company (GTC) executed the blending of fortified rice kernels (FRK) with regular rice in the country. This successful initiative paved the way for the current efforts of WFP in supporting the local rice millers to take on the blending process.

Cambodia is currently in the process of laying down the standards for rice fortification to scale up fortified rice. The RGC is supporting the development of blending facilities in the country, with support from WFP. Thus, continuous efforts of the RGC, WFP, and the SUN Business Network Cambodia will be crucial to scale up the rice fortification programme in Cambodia.

Based on discussions with the government stakeholders, it is evident that they are interested in scaling up rice fortification processes in the country, and are aware of the health benefits of consuming fortified rice. Key inputs received during these discussions can be summarized as follows:

1. Absence of food safety standards for fortified rice poses a hindrance. To introduce these standards, strengthening coordination among government entities and the Institute of Standards of Cambodia (ISC) is crucial.
2. WFP and the National Sub-Committee for Food Fortification (NSCFF) have already conducted a pilot study through the school feeding programme in 2019; however a

push from WFP is needed to implement the programme on a bigger scale.

3. Millers are hesitant to invest in rice fortification because there is no demand in the market. Thus, creating consumer acceptance for fortified rice is essential.
4. When the demand for fortified rice increases, it will be vital to tackle the barriers in the domestic rice industry with respect to inefficient technologies and high costs of production. Local production of FRK and fortificant premix is necessary to minimize the cost of production.

During discussions with millers, two issues were highlighted by all of them: 1) the need to create demand, and 2) the profits they might expect. Important inputs received during these discussions are summarized as follows:

1. Most leading millers primarily cater to the rice demand of the export market. Thus, it is difficult to expect these millers to consider investing in rice fortification.

2. Consumer demand for fortified rice may be negligible if its price is higher than regular rice. They would be hesitant to buy it given their lack of knowledge about fortification.
3. There are misconceptions about plastic being added to the fortified rice. The awareness activities should be undertaken from the community level such as rice agricultural cooperatives, rice producer groups, and school parents and women's groups. Awareness should be raised within these communities before promoting it in the urban area.
4. It is important to disseminate more information about the health benefits to consumers through relevant ministries such as the Ministry of Health. Additionally, the Government should provide financial and technical support to the millers in terms of subsidized electricity, loans and tax exemption, etc.

The table below provides a summary of the barriers to rice fortification scale-up and their corresponding recommendations:

SN	Barriers	Recommendations
1	Relatively low priority given to budgetary allocation for rice fortification	<p>Advocacy with government decision makers</p> <p>Conduct meetings with the government entities to put rice fortification as a priority in the budgetary allocation process..</p>
2	Lack of comprehensive food safety standards for fortified rice and FRK	<p>Development of a regulatory environment and an effective monitoring and enforcement framework</p> <p>WFP must sensitise ISC on the need to develop a comprehensive set of standards for rice fortification.</p> <p>Development of an effective monitoring and enforcement framework</p> <p>Provide technical assistance to the Ministry of Industry, Science, Technology and Innovation (MISTI) and the Consumer Protection Competition and Fraud Repression Directorate-General (CCF) to support the development and implementation of a quality assurance and quality control (QA/QC) system for rice fortification.</p>
3	Lack of awareness of the health benefits of rice fortification among rice millers	<p>Advocacy with millers</p> <p>Conduct periodic workshops and individual meetings with the rice millers and relevant government entities to educate them about rice fortification, its health and economic benefits and the technical processes involved.</p>
4	Limited awareness among millers about the production techniques, costs involved, and suppliers of raw materials and machinery required for rice fortification	<p>NSCF can set up a technical personnel team to explain the technical processes involved in rice fortification.</p>

5	Perceived low return on investment in fortified rice production due to uncertain consumer demand and lack of awareness of costs	<p>Business model return on investment</p> <p>Create and disseminate technical document for millers outlining the technical know-how of rice fortification processes, the costs involved and the economic returns in selling fortified rice.</p>
6	Supply chain constraints due to multiple middlemen	<p>Demand creation</p> <p>To create a demand for fortified rice in the market, invite tenders from millers to supply fortified rice to schoolchildren and garment factory workers</p>
7	Unviability of partnering with leading mills due to the export-oriented nature of their business	Source funding for the scale-up of the rice fortification programme
8	Unviability of partnering with small and commune millers for the rice fortification programme due to their fragmented nature and inefficient milling capacities	Assist millers in installation of blending machinery and procurement of FRK
9	Lack of awareness among the population about fortified rice and its benefits	<p>Awareness creation campaigns</p> <p>Undertake campaigns to raise awareness through the social safety net programmes and run campaigns for the public across media with the help of NSCFF.</p>

Given the reluctance of the private sector to invest without support from the Government, the scale-up of rice fortification would require immense efforts from the Government along with WFP, other development partners and donor agencies. The success will depend on continuing advocacy and awareness building, business model development, restructuring of the mandatory fortification legislation and implementing a regulatory framework, and demand creation. Appropriate advocacy could bring a change, given the Government's positive actions regarding the fortification of other foods and the desire to reduce the incidence of MNDs.





Introduction

Background

Southeast Asian countries are weighed down by the triple burden of malnutrition: high stunting and wasting rates, growing incidence of obesity and widespread micronutrient deficiencies (MNDs) (1). Cambodia grapples with the persistent problem of MNDs. Anaemia and vitamin D, vitamin B, zinc and iodine deficiencies disproportionately affect women and children. These MNDs are contributors to poor growth, cognitive impairments and increased risk of morbidity and mortality (2).

Looking at the Cambodia figures, 49 percent of children (6–59 months) and 47 percent of women of reproductive age (WRA) were anaemic in 2019 according to data released by the World Bank (3) (4). Anaemia emerged as a “severe” public health problem among children and women, based on the World Health Organization (WHO) cut-off values for public health significance (5). According to the Cambodia Demographic and Health Survey (CDHS) (2014), zinc deficiency emerged as a massive problem affecting more than 70 percent of children and 63 percent of WRA. Iodine deficiency affected 66 percent of children (6–59 months), 17 percent of school-aged children and 78 percent of WRA (2).

The country faces the twin problems of malnourishment: low dietary diversity and undernourishment. This can be seen from the food consumption pattern, which is less than ideal. Their diet predominantly consists of carbohydrates, with insufficient consumption of fruits and vegetables. Their daily intake of nutrient-dense

food such as vegetables, fruits, milk and milk products, and meat and meat products is lower than the intake recommended by WHO (6) (7).

Based on WFP Cambodia’s 2017 Fill the Nutrient Gap report, the dietary diversity among women is low. This is due to the low consumption of iron-rich food. Additionally, the feeding practices for infants are suboptimal. This includes low dietary diversity of complementary feeding and delayed initiation of breastfeeding; 21 percent of the population is also unable to access an inexpensive nutritious diet. Although the market access to nutritious food throughout the country is adequate, the economic access is varied. For example, the economic access (affordability of nutritious diet) is lowest in Monduliri and Ratanakiri and highest in Pursat and Siem Reap regions (6).

Food diversification and intake of a balanced diet are the best ways to tackle MNDs. However, its adoption is difficult for social, economic and food security reasons in the country. This results in an absolute necessity for large-scale nutrition intervention programmes. The Royal Government of Cambodia (RGC) is implementing multiple strategies such as supplementation, fortification and diet diversification among its different population groups. The existing interventions target the vulnerable population groups in the country.

Among the basket of interventions being implemented to address MNDs, Large Scale Food Fortification (LSFF) initiatives play a crucial role. These interventions reduce the cost of healthy diets and complement the gaps

in supplementation programmes. The RGC has been implementing food fortification initiatives focusing primarily on salt iodization and soy and fish sauce fortification.

As part of its fortification initiative, Cambodia has approved mandatory legislation on salt iodization and soy and fish sauce fortification (6). With support from development partners (Global Alliance for Improved Nutrition (GAIN) and United Nations Children's Fund (UNICEF)), the RGC has made fortified soy and fish sauce available through the commercial market to target MNDs in the general population (8). However, the fortification implementation has not been entirely successful due to lack of consumer awareness and effective monitoring. As a result, the majority of soy sauce and fish sauce products available in markets are still non-fortified. Adding to these issues, currently there is a lack of strong support from the development partners.

In the last few years, there has been a significant interest in rice fortification. Cambodia is primarily a rice-consuming country with a daily average consumption of 390 g per person (6). The country produces a sizeable amount of rice. In 2021, the total paddy production was 9.4 million metric tons (MMT) and total milled production was 5.8 million MT (i.e. 61 percent of paddy production) (9) (10).

For more than a decade, the United Nations World Food Programme (WFP) has been working with governments, the private sector and technical partners across countries in Asia and Pacific (Pakistan, India, Bangladesh, Nepal, Sri Lanka, Myanmar, Cambodia, Indonesia, Laos, Timor Leste, Bhutan and the Philippines) in making rice more nutritious through post-harvest fortification. Primarily, WFP provides technical assistance on policy and regulatory frameworks, advocacy, analysis and evidence generation, programming, and consumer awareness.

WFP conducted a landscape analysis in December 2018 on rice fortification in Cambodia through which the challenges and opportunities in initiating rice fortification in the country were laid out. Cambodia is currently in the process of laying down the standards for rice fortification to scale up fortified rice and there is a need to generate greater awareness on rice fortification as a strategy to address MNDs among the government and private sector stakeholders.

Fortified rice needs to be widely available and accessible through two main platforms, the social safety net programmes and the commercial retail channels. These two platforms will help reach populations that are nutritionally vulnerable and in urgent need of micronutrient interventions. Ultimately, this will help rice fortification in a sustainable manner and adequate scale-up.

Therefore, to effectively introduce fortified rice through social safety net programmes and commercial retail channels, it's important to gain deeper insight into the rice milling landscape along with key stakeholders.

Objectives of the Study

The study 'Understanding the Rice Value Chain in Cambodia: Defining the Way Forward for Rice Fortification' aims to understand the potential of rice fortification in the country.

The overall objectives of this study are as follows:

1. Undertake a detailed landscape analysis to identify and map the key players across the rice value chain in Cambodia.
2. Identify and analyse the demand and supply challenges across the rice value chain in Cambodia and identify opportunities for introducing fortified rice through commercial channels and government social safety nets.

Specific objectives: Landscape analysis

- Identify, map and document the key players across the rice value chain that include the rice milling industry; blending and extrusion equipment manufacturers; fortified rice kernels (FRK) manufacturers and suppliers of vitamins and minerals/multi-micronutrient premixes; private food safety and quality testing laboratories; and retail organizations (including cooperatives, where these exist) in Cambodia.
- Map all the rice value chain players and identify the rice value chain players that follow good manufacturing practices and are adhering to national/international food safety and quality standards for processed foods in those countries.
- Study and illustrate the rice value chain and identify value chain engagement points/opportunities for potential rice fortification programme support.
- Identify and document the demand and supply challenges faced by the key players across the rice value chain (infrastructural, capital availability, regulatory, supply chain, import/export regulations/policy, taxation, policy and political environment) and identify opportunities for introduction and scale-up of fortified rice through commercial channels and government social safety nets.
- Map the supply chain and trading of rice (including cost mark-ups along the chain).

- Study and recommend potential options for strengthening the supply side for scaling up rice fortification through commercial channels at the regional level including the feasibility of a regional hub of suppliers to cater to the fortified rice demand of the region and beyond.
- Collect and document information on opportunities and challenges for a range of rice fortification options.
- Review and hold consultations with relevant government and private sector stakeholders to identify potential private sector players that can be engaged to introduce fortified rice through commercial channels and government social safety nets.
- Based on the consultation and analysis of the private sector players, identify selected private sector players in each country for potential partnership with WFP to introduce and scale up fortified rice through commercial channels and government social safety nets.
- Identify key factors that could enable and contribute to the scaling-up of fortified rice through commercial markets and government social safety nets.

WFP has engaged with ValueNotes Strategic Intelligence, India to conduct this study.

The next section talks about the research methodology used for this study.

Research Methodology

This study followed a structured research process, as described below:

1. Project Setup and Plan

- Project kick-off and discussions with WFP stakeholders to better understand context, objectives and expectations.
- Knowledge share by WFP based on prior research and experience in rice fortification initiatives in various countries.
- Preparation of project plan.

2. Secondary Research and Primary Research Design

- Intensive desk research on several topics, including:
 - Nutrition deficiencies in Cambodia's population
 - Past experience in food fortification
 - The rice industry in Cambodia: size, exports, domestic consumption, etc.
 - The supply chain for rice in Cambodia

- Key stakeholders in the supply chain, from a fortification perspective
- Status of rice fortification initiatives and barriers to adoption and scale-up

- Sources used include the following:

- Available literature comprising research papers, development partners' reports, and project reports from previous pilots such as those from Global Alliance for Improved Nutrition (GAIN), WFP, and the Programme for Appropriate Technology in Health (PATH).
- Reports and statistics such as those from the Government of Indonesia, United States Department of Agriculture (USDA) and the Food and Agriculture Organization of the United Nations (FAO).
- A complete list of publications is provided in the References section.

- The initial secondary research helped to identify information gaps and key stakeholders that could provide valuable inputs.

- For each type of respondent, whether industry stakeholders or government/regulatory bodies, an appropriate discussion guide was developed.

- During this process, the ValueNotes team had several discussions with WFP stakeholders to fine-tune the list of likely respondents and discussion points/focus information relevant to each of them.

3. Primary Research

- The list of entities and the respondents were identified by an iterative process.
 - The reports and available literature used in secondary research helped to identify the important stakeholders in the Government as well as the rice industry in Cambodia.
 - The websites of multiple millers were mined to find important details such as their milling capacity and their production levels. Accordingly, the millers were classified based on their production capacities.
 - After the development of a list of relevant stakeholders, the names of the relevant people in these organizations were found through additional desk research.
 - Then, appointments were made with these important stakeholders and detailed discussions were held. To obtain a diversity of opinions, stakeholders from the Government as well as the private sector

were contacted. This ensured equitable representation of views.

- Additionally, a few experts were referred by respondents of the initial interviews. Accordingly, these people were also contacted.
 - Some of the stakeholders were contacted a second time to get more clarity on some of the points discussed.
 - The WFP team is gratefully acknowledged for facilitating interviews with key decision makers within the government entities and regulatory bodies.
- The discussions helped to:
- » Identify and analyse the gaps in understanding of the industry, ecosystem, and level of fragmentation existing in the industry.
 - » Get on-the-ground inputs from stakeholders on barriers to large-scale rice fortifications.
 - » Understand the constraints of different stakeholders and possible future actions that might help reduce or remove some of the barriers.

A list of respondents is provided below.

4. Analysis and Report Writing

- All the above inputs were collated, analysed and distilled to create this report.
- In some cases, clarification of certain points was required from the respondents.
- The analysis and report were discussed with the WFP team (including in Cambodia) and their inputs and feedback were incorporated in subsequent versions.

Type of entity	Name of entities	Designation
Large rice millers and exporters	Green Trade Company (GTC)	GTC and WFP coordinating person
	Hak Se Company	Director
	Golden Rice	Vice President
	Siv Lay Rice Mill	Owner
	Chhun Thom Rice Mill	Owner
	Amru Rice	Vice President
Rice associations	Federation of Cambodian Farmer Organizations for Development (FCFD)	Chairman
Government entities	National Sub-Committee for Food Fortification (NSCFF)	Vice Chairman
	Institute of Standards of Cambodia (ISC)	General Executive
Social sector	Reproductive and Child Health Alliance (RACHA)	Director
	Cambodia Rice Federation (CRF)	Secretary General

Report Structure

The report is divided into eight chapters, each focused on a particular aspect, as discussed below:

Chapter	Title	Details
1	Nutrition Profile of Cambodia	The first chapter focuses on the diet composition, the current undernourishment levels and the MNDs in the Cambodian population. <i>Helps understand the scale of the problem, and the need and urgency for improving nutrition inputs in Cambodia.</i>
2	Food Fortification in Cambodia	This chapter gives a background of the existing food fortification programmes in Cambodia. The chapter also assesses past experience in fortification, difficulties faced while scaling up, and success stories of food fortification (if any). <i>Provides an understanding of institutional experience, and learnings from earlier initiatives with other food items.</i>
3	Rice Overview in Cambodia	The third chapter elaborates on the rice industry details (historical trend of production, consumption, export- import , production clusters, millers' capacities, rice varieties in demand, etc.). <i>This data improves our understanding of the size and scale of the rice ecosystem in Cambodia, and its implications for rice fortification scale-up.</i>
4	Rice Supply Chain	This section details the existing rice supply chain in the country. <i>Provides an understanding of institutional experience, and lessons learnt from earlier initiatives with other food items.</i>
5	Key Stakeholders in Rice Fortification	This chapter provides further details of critical stakeholders and their respective roles. <i>Improves our understanding of which government entities, regulatory bodies, non-government and private players are important in order to scale up rice fortification in Cambodia.</i>
6	Discussion and Analyses	This chapter focuses on the barriers faced by various stakeholders, when scaling up rice fortification efforts. <i>Helps to understand which government entities, regulatory bodies, and non-government and private players, are important to scale up rice fortification in Cambodia.</i>
7	Recommendations for Scaling up Rice Fortification	The last chapter synthesizes the findings from earlier chapters and suggests specific recommendations to address or mitigate the barriers to scale-up. It also identifies the key stakeholders that need to be brought on board to address different issues. <i>It provides a detailed roadmap for the successful implementation of scaling up rice fortification in a measured and comprehensive manner. There is also a concluding segment which presents a possible roadmap to successfully commercialise rice fortification.</i>
8	Annex	Supplementary information and relevant statistics <i>This section provides essential information to support the analyses throughout the report, including:</i> <ul style="list-style-type: none"> - Government Initiatives to Reduce Anaemia - Hierarchy of Legal Framework for Food Fortification in Cambodia - Home Grown School Feeding Programme - Workplace Nutrition Project in Cambodia (2018–2019) - Food Summit Dialogues - SUN Business Network - Key Seasons for Rice Production and Harvest - Rice Importing Countries - Varieties of Rice Produced - Key Rice Brands Operating in Cambodia - Role of Different Entities in the Rice Supply Chain - Value addition in the Rice Value Chain - Export Regulations/Policies - Technologies for Rice Fortification

1. Nutrition Profile of Cambodia



Rice is the main staple of the Cambodian population. Other staple foods include fish and morning glory (three servings per week) (6). Although the country is experiencing steady economic growth, Cambodia is also suffering from persistently high rates of stunted growth and a tendency towards obesity (11).

Based on the WFP Cambodia's 2017 Fill the Nutrient Gap report, the food consumption pattern of the population is less than ideal. Carbohydrates dominate the food intake of the majority of the population. In an average week, rice alone contributes 40 percent to the total daily caloric intake, followed by fish (18 percent) and vegetables (12 percent). The consumption of vegetables, fruits, milk and milk products, meat and meat products is considerably lower than the dietary intake recommended by WHO (6) (7).

Consequently, Cambodia is burdened with a high prevalence of micronutrient deficiencies (MNDs). Iron deficiency anaemia affects the most vulnerable groups of the population. Genetic haemoglobin disorders further burden the prevalence of anaemia among WRA and children (aged 6–59 months). The effects of MNDs also result in a high level of stunting among children (aged 6–59 months) (2).

Diversifying food production is essential to support nutritional improvement towards more balanced diets in Cambodia. To understand how fortification of food items, particularly rice, can aid in meeting the dietary guidelines for better nutrition in the population, it is essential to understand the status of MNDs and their effects.

1.1 Micronutrient Deficiencies

Despite some progress, the Cambodian population still faces high levels of stunting, anaemia and micronutrient malnutrition. The widespread prevalence of MNDs has resulted in the following effects in the most vulnerable groups in the population of Cambodia:

- Anaemia is highly prevalent in women of reproductive age (15–49 years) (WRA) at 47 percent, in pregnant women at 52 percent, and among children at 49 percent (3) (4). Although the anaemia levels have reduced significantly

over the past decade, it is still categorized as a “severe” public health problem according to WHO estimates (5).

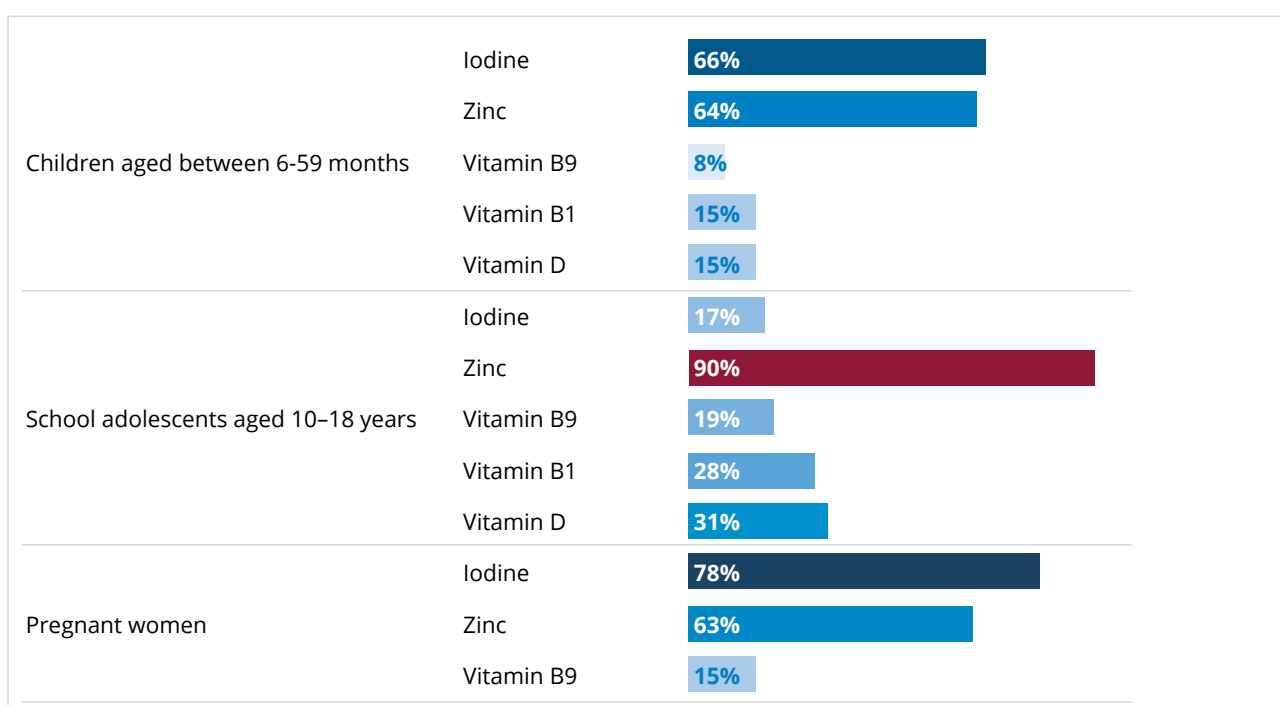
- A study on women of reproductive age in Rural Prey Veng, Cambodia conducted in 2015 indicated that:
 - Out of a sample of 450 WRA, 54 percent of the women had genetic haemoglobin disorder.
 - Prevalence of iron deficiency anaemia (IDA) was 14.2 percent and 1.5 percent in those with and without haemoglobin disorders, respectively (12).
- The prevalence of stunting is 32 percent (2014) among children under 5 years of age. This indicates a steady decline from the early 2000s when the prevalence of stunting was higher than 50 percent (13).
- During the period (2015 to 2019), the prevalence of undernourishment declined from 8.9 percent to 6.2 percent (14).

According to the 2014 Cambodia Demographic and Health Survey (CDHS) and 2016 Whitfield study, iron, vitamin D, vitamin B1, iodine and zinc are the crucial MNDs present among women, children and adolescents (table 1).

The RGC is implementing multiple strategies such as supplementation, fortification and diet diversification among its different population groups as mentioned below.

- The Second National Strategy for Food Security and Nutrition (2019–2023) aims to reduce rates of:
 - Child stunting by at least 7 percentage points
 - Child wasting by at least 2 percentage points
 - Overweight and obesity for children under 5 and women of reproductive age
- The objectives of the above strategy are as follows:
 - Strengthen the food environment and consumer behaviour to enable healthier food choices, particularly for the first 1,000 days.
 - Improve nutrient absorption and reduce disease among children, pregnant and lactating women, and adolescents; strengthen community-led nutrition through coordination and implementation of nutrition programmes at the community level.

Figure 1: MNDs (%) among the vulnerable population groups in Cambodia



Source: CDHS 2014, Whitfield 2016

1 [SEBAKO Programme](#)

- Reduce remaining inequalities in accessing sufficient, nutritious and diverse food; and enhance effective governance arrangements for all food security and nutrition at the national- and sub-national level (16).
- To prevent anaemia, iron supplements are provided daily to pregnant women, and weekly to non-pregnant women, under the National Fast Track Road Map for Improving Nutrition (2014–2020) programme (17).
- Micronutrient supplements including iron-folic acid are supplied to pregnant women, post-partum women and WRA (15).
- Vitamin A supplements are provided to children aged 6–59 months.
 - In 2007, the Ministry of Health (MoH) published National Vitamin A Policy Guidelines. The guidelines stated that the supplements are to be distributed through outreach activities and at health centres, national and referral hospitals (18).
- Micronutrient-dense food which includes Ready-to-Use Therapeutic Food (RUTF) for severe acute malnutrition (SAM) is supplied to the vulnerable population of Cambodia (15).
 - In 2011, National Interim Guidelines for the Management of Acute Malnutrition were published. As per the guidelines, treatment for acutely malnourished children is to be provided at many decentralized sites instead of a few centrally located inpatient facilities (19).
- Ready-to-Use Supplementary Food (RUSF) is provided to prevent malnutrition among pregnant and lactating women and children aged 6–59 months (15).
- As part of its fortification initiative, Cambodia has approved mandatory legislation on salt iodization and iron fortification of soy sauce and fish sauce (6).

- Adding to the fortification initiative, rice is seen as a potential fortification vehicle in Cambodia as it is the most-consumed staple by its population.

Although the country has taken several steps to reduce the prevalence of MNDs, progress has been hindered by the following barriers:

- Genetic conditions: The current initiatives are unlikely to improve the anaemic situation in people who have a genetic condition/ haemoglobin disorder and among children with low bioavailability of iron.
- Low awareness among consumers: Consumers have insufficient knowledge about nutrition. Their low level of awareness about the benefits of consuming supplements and maintaining a diverse diet acts as a major hindrance to the success of the various government initiatives in addressing MNDs (20) (21).
- Lack of dietary diversity: 21 percent of households in Cambodia are unable to afford nutritious diets. There is a strong association between the lack of dietary diversity (during the complementary feeding period) and stunting and wasting among children (22).
- Supply chain issues: There are transportation constraints related to the distribution and procurement of supplements due to Cambodia's mountainous terrain (23) (24).
- Inadequate supply of iron folic acid (IFA) tablets: IFA tablets are provided free of cost to pregnant women through health services in Cambodia. However, the supply of the required 180 tablets per woman is inadequate (22).

Despite significant efforts towards supplementation and diet diversification programmes, the Government is unable to meet its goal of addressing MNDs in the population of Cambodia. Thus, it is essential to explore and expand the fortification of food items.

A detailed review of current food fortification initiatives is elaborated in the next chapter.

2. Food Fortification in Cambodia

Fortification was introduced in Cambodia in the early 2000s with the iodization of salt. Following that, soy sauce and fish sauce were considered for fortification (6). RGC also attempted to introduce standards on vegetable oil fortification with Vitamin A. But the plans were aborted as vegetable oil is not produced in the country.

Rice fortification trials were conducted in the late 2000s by development partners (such as WFP, the Programme for Appropriate Technology in Health (PATH), International Life Sciences Institute (ILSI) Japan) along with NSCFF.

Legislation –

Food safety standards are set by the Institution of Standards Cambodia (ISC). Cambodia has mandatory legislation for fortification of salt and soy sauce and fish sauce (6). Rice and oil are not subject to any legislation yet.¹

In April 2022, the Council of Ministers (the Cabinet) unanimously passed a draft law on food safety. The law sets new standards for food safety and hygiene, aiming to make all food products good quality and safe for consumption.

Table 2 elaborates on the presence of legislation on the fortification of different food items in Cambodia (25) (26).

Salt fortification –

Salt iodization was initiated in 2003. The programme was successfully implemented during 2003 to 2011 with about 67 percent of the salt produced being iodized. This was facilitated by the financial and technical support provided by UNICEF. The initial success of the programme could be attributed to the effective monitoring and funding provided by UNICEF (27).

However, in 2017, the percentage of salt that was fortified dropped to 55 percent (27). The Government took remedial steps to regularize the market and, as a result, the levels of iodized salt increased to 69 percent in 2019 (28). However, they were unable to establish a proper monitoring and enforcement framework. Thus, a refined control mechanism is required to ensure 100 percent salt iodization in the country. Additionally, not enough iodine is added to the salt.

Soy sauce and fish sauce fortification –

The Reproductive and Children’s Health Alliance (RACHA) began fortifying soy sauce and fish sauce in 2005. Over the next two years, they conducted trial studies in the provinces of Siem Reap (Sen Ry Plant) and Phnom Penh (Thai Hong Keat Plant). The study was then expanded in 2012 to include more regions. The project was executed

Table 1: Fortification of food items in Cambodia

Food Item	Mandatory Legislation	Year of mandatory legislation	Micronutrients added
Salt	✓	2003	Iodine
Soy sauce and fish sauce	✓	2015	Iron
Rice	×	-	Vitamin A, zinc, iron and folic acid

Source: Fill the Nutrient Gap (WFP), Ministry of Planning

¹ [Hierarchy of legal framework for food fortification in Cambodia](#)

in collaboration with the National Sub-Committee for Food Fortification (NSCFF), private sector participants, development partners such as GAIN and UNICEF and International Life Sciences Institute (ILSI) Japan (29).

In 2018, RACHA conducted educational campaigns to inform soy and fish producers about the ease of producing fortified soy and fish sauce. Consumers too were informed about the health benefits of consuming fortified products (29). Despite these initiatives, multiple barriers have hindered the success of the programme. The major barriers are elaborated below:

- **Many producers are still unaware of the mandatory legislation.** Thus, those producers are still offering non-fortified sauces.
- **There is lack of monitoring and enforcement** by the relevant government entities – Ministry of Industry, Science, Technology and Innovation (MISTI) and MoH. Consequently, the complete onus for monitoring lies with NSCFF. However, due to lack of resources, even NSCFF is unable to develop a stringent monitoring and enforcement mechanism.
- The **lack of support** from development partners is impeding the implementation of the fortification programme.
- The **unavailability of raw materials** such as micronutrient powder, iodine and iron poses a challenge. This is a barrier as the materials are imported.
- A case study on the quality of iron fortification of fish and soy sauce in Cambodia conducted in 2015 found that the cost of a 3.2 kg bag of iron premix needed for 1,000 litres of fish or soy sauce was USD 8.7. This is very expensive for the producers, obstructing the fortification of soy and fish sauce (30).

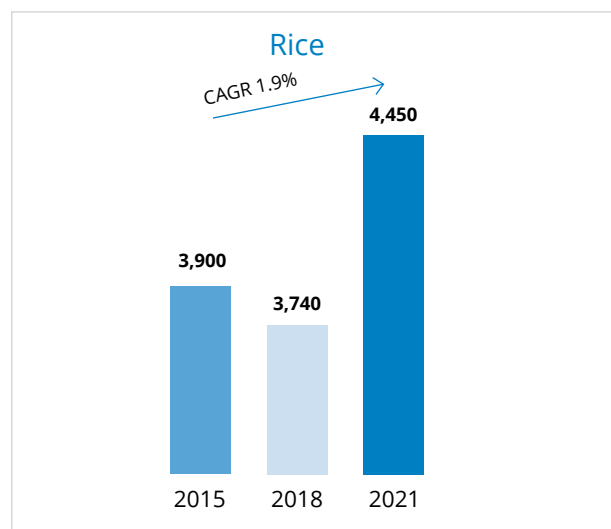
There is low awareness among consumers about the benefits of consuming fortified soy sauce and fish sauce. Consumers are also unaware of the fortification logo created by the RGC. Hence, they do not know whether they are buying fortified or non-fortified soy sauce and fish sauce. According to RACHA and ISC, a price increase of KHR 100 per bottle of soy and fish sauce acts as a major barrier for people on low incomes.

Fortification of these items alone is insufficient to improve the overall nutrition status of Cambodia. The inclusion of rice as a fortification vehicle can be a promising step towards better nutrition in the country given its status as the most consumed staple by its population. The rice fortification status is expanded in section 2.2

2.1 Consumption of Key Cereals in Cambodia

Rice is the most consumed cereal in Cambodia, with average daily consumption of 390 g per person. Almost 75 percent of the population consumes rice in the country (6).

Figure 1: Consumption of key cereals in Cambodia ('000 MT)



Source: USDA

Note: CAGR stands for compound annual growth rate over a given period

Apart from rice, wheat is consumed in Cambodia to some extent. According to the World Bank's World Integrated Trade Solution data, they imported around 90 MT of wheat in 2019 (31). Cambodia also imports wheat flour which is consumed in the form of bread, muffins, biscuits and fresh pasta (noodles) (32).

As the primary staple cereal, rice remains an excellent food vehicle for fortification to improve the nutrition status across all strata of the population.

2.2 Rice Fortification Status in Cambodia

The RGC took a keen interest in rice fortification in 2010. Since then, WFP has been a constant supporting partner to the RGC on the country's rice fortification initiatives (33).

In 2010, WFP and Institut de Recherche pour le Développement (IRD) conducted acceptability studies for fortified rice. The studies exhibited that teachers and parents, as well as schoolchildren around the country liked fortified rice. For this study, fortified rice was imported (34).

In 2012, the Green Trade Company (GTC), a state-owned enterprise, tried blending FRK with regular rice by hand; for this reason the proportions were incorrect. This was not successful due to lack of technical knowledge. Hence, they did not initiate blending operations in the country and continued importing fortified rice for the subsequent trials and studies.

During 2012-2013, a randomized control trial (Fortified Rice for School Children in Cambodia (FORISCA) trial) was undertaken by the RGC, with support from WFP, PATH, IRD and Royal DSM N.V.(DSM) (35). The consumption of fortified rice improved the health and cognitive performance of more than 9,000 schoolchildren in rural districts. The positive impact of fortified rice was apparent from the study.

Based on the results of this trial, the Ministry of Education, Youth and Sports, with support from WFP, conducted the pilot-scale distribution of fortified rice in the country's Home Grown School Feeding Programme (HGSFP) in 2016. The distribution under HGSFP was expanded to 57,000 students during 2017-2018 (36) (37).

In addition to the HGSFP, under the Workplace Nutrition Project, a trial was implemented by RACHA and ILSI Japan in 2018. The aim of the project was to introduce fortified rice to lunch menus in workplaces which could improve the nutritional status of women at workplaces.

Currently, they are in the process of entering the second phase of the project in the country and submitting the research for publication. Based on the results, the second phase will be implemented (38) (39).

Fortified rice was imported by the RGC until 2018. However, in 2019, WFP in partnership with the GTC executed the blending of FRK with regular rice in the country for the first time. This successful initiative paved the way for the current efforts of WFP in supporting the local rice millers to take on the blending process (40).

In 2021, fortified rice was provided to 130,000 students across five provinces under the school meal programme. The WFP in Cambodia is planning to expand the distribution of fortified rice to almost 250,000 children across the country (41).

In 2021, WFP Cambodia participated in the Food Summit Dialogues pertaining to food fortification. Particularly for rice fortification, WFP participated in the dialogue, "In-depth exploration for food fortification – Operational Environment" (42). WFP Cambodia also launched the SUN Business Network Cambodia (SBN) in July 2021, to accelerate progress in nutrition. They facilitated the development of the SBN five-year strategy. The plan involves developing a strong SBN brand by increasing nutrition awareness and increasing the supply of nutritious foods and fortified products (43).

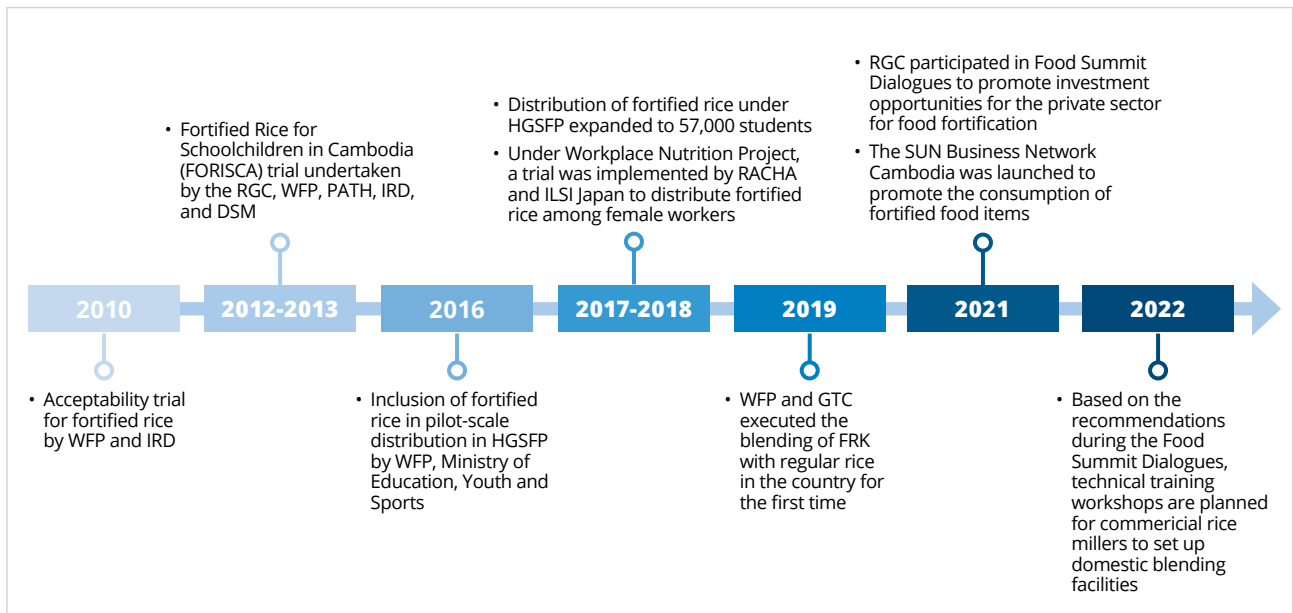
Based on the recommendations of the 2021 Food Systems Dialogue on commercializing fortified foods, WFP, in partnership with GTC and the Cambodia Rice Federation (CRF), organized a technical training workshop on rice fortification with 15 commercial rice millers in May 2022. The aim was to support the development of domestic fortification capacity. This training supports the national agenda on food fortification (33).

The timeline of these events can be seen in figure 2.²



² Home Grown School Feeding Programme; Workplace Nutrition Project in Cambodia (2018 – 2019); Food Summit Dialogues; SUN Business Network

Figure 2: Timeline for rice fortification in Cambodia



Source: WFP Cambodia Country Brief (2019), Nutrition Japan Public Private Platform (NJPPP)

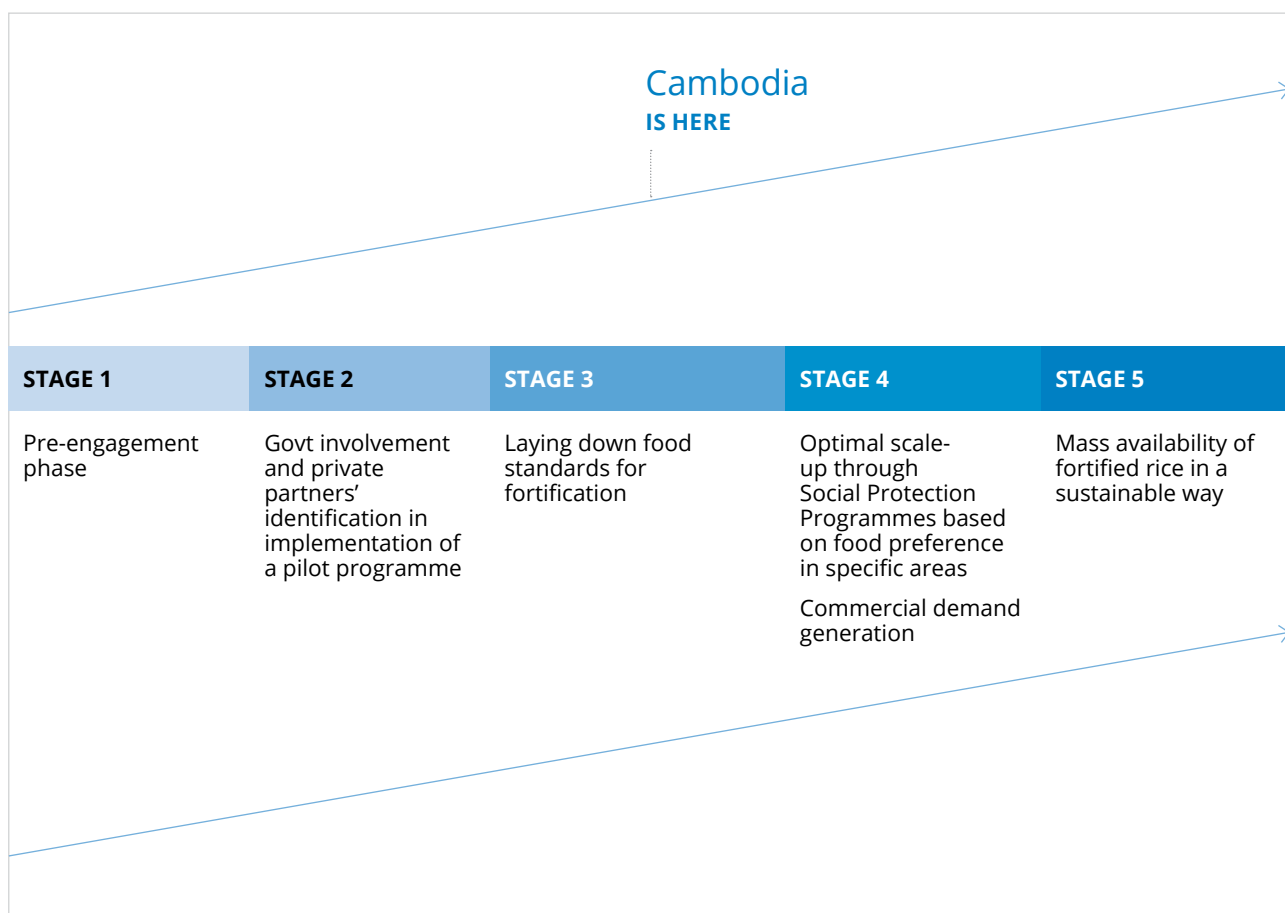


As depicted in figure 3, there are no food safety standards for fortified rice and fortified rice kernels (FRK) in Cambodia. To scale up the rice fortification programmes, there is a need to develop a proper monitoring and enforcement environment for rice fortification.

To scale up rice fortification in Cambodia, it is essential to have participation from both the Government and private sector. Currently, the RGC is supporting the development of blending facilities in the country, with support from WFP. As discussed in the timeline of rice fortification shown in figure 3, continuous efforts of the RGC, WFP and the SBN will be crucial to scale up the rice fortification programme in Cambodia.

To enable mass fortification of rice in Cambodia, it is crucial to understand in detail the rice industry, the rice processing capacity, roles of the various stakeholders, the supply chain and barriers faced in fortification. The next chapter talks about the size and scale of rice production, consumption and exports in Cambodia.

Figure 3: Stages of rice fortification scale-up: Cambodia



Source: ValueNotes analysis

3. Rice Overview in Cambodia

This chapter provides details on rice production and consumption data, industry structure (rice mills) and the market segmentation of rice by distribution channel.

3.1 Rice Producing Clusters

In Cambodia, there are four rice production zones: Tonle Sap Lake, Plain, Coastal and Plateau & Mountain. Each zone is further divided into provinces.

As depicted in the figure 4, Tonle Sap Lake Zone accounts for 44 percent of the total rice production, while Plain Zone accounts for 34 percent. The remaining 22 percent is contributed by the Coastal and Plateau & Mountain Zones (44) (45).

Tonle Sap Lake Zone and Plain Zone are the major rice clusters.³ Therefore, rice millers operating in both these

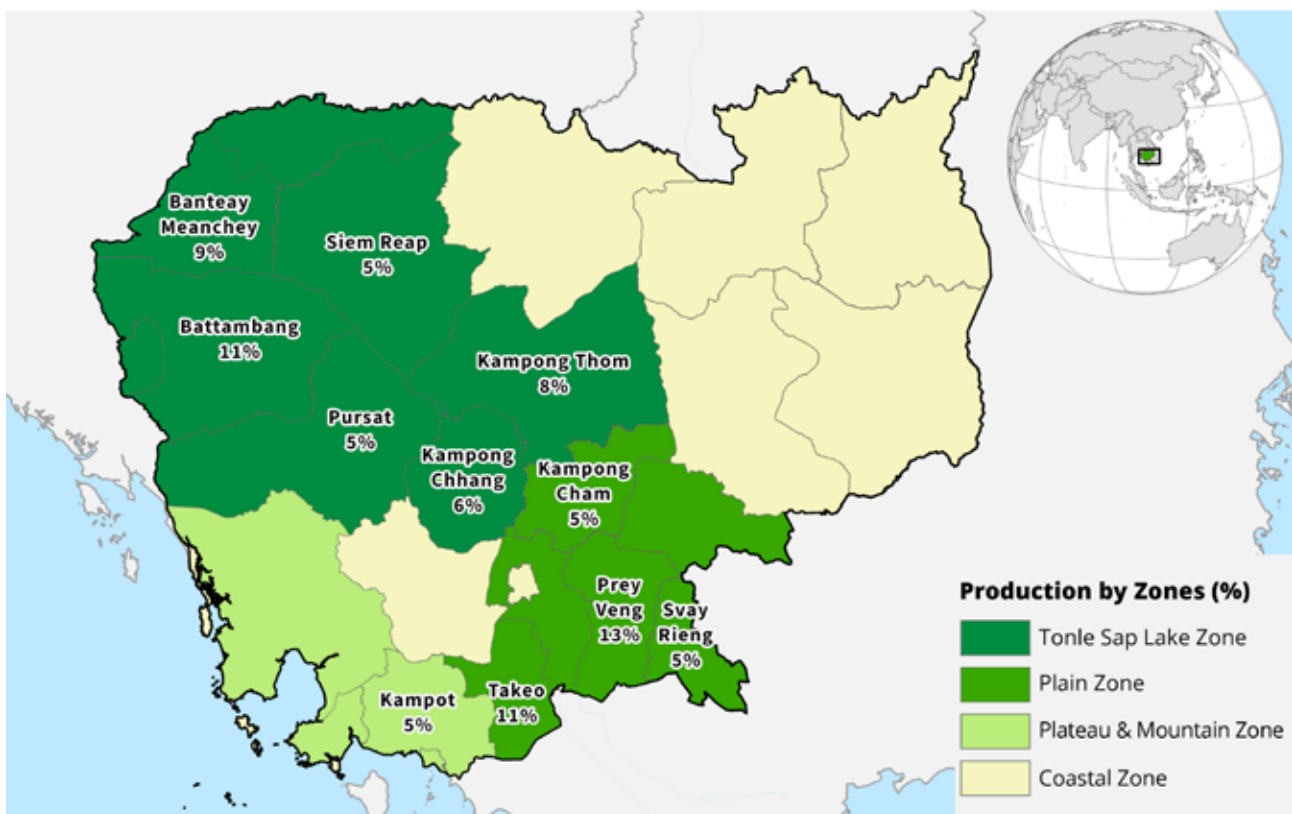
zones will be critical in developing the fortified rice supply chain.

3.2 Classification of Rice Mills

Rice millers are the most critical link in the supply chain for rice fortification. There are about 800 modern rice mills operating in Cambodia. They can be classified as leading, large, mid and small scale based on their capacity per hour.

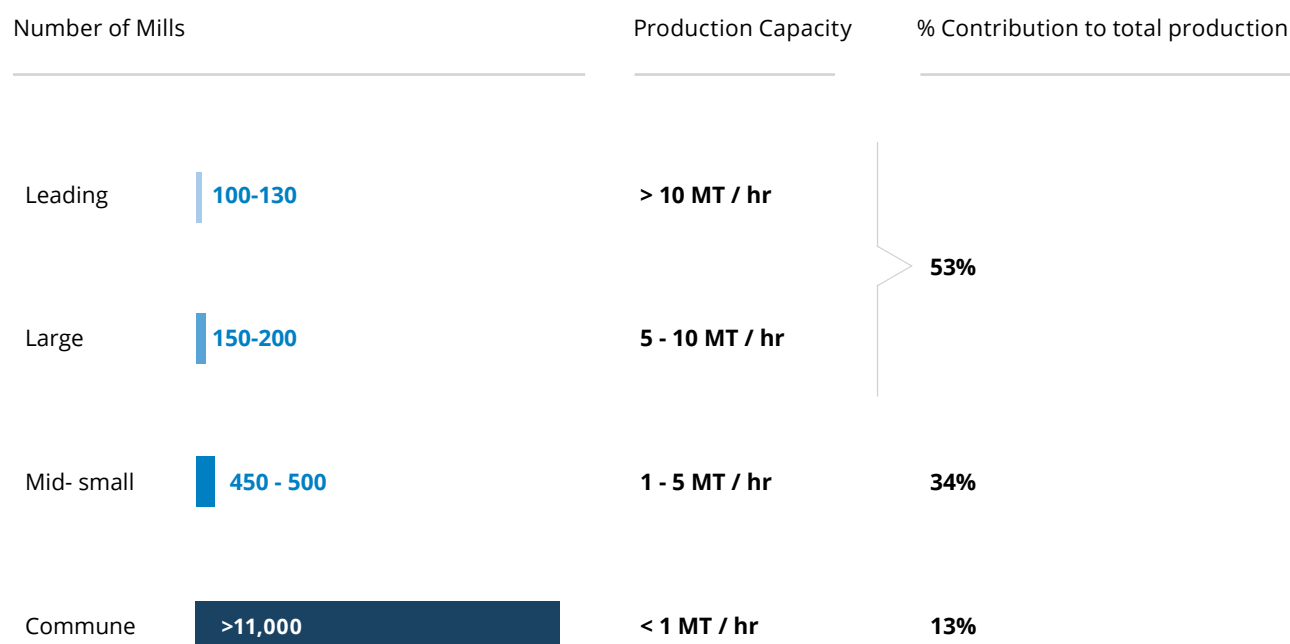
Apart from these modern mills, there are several traditional mills across Cambodia. According to the World Bank (2018) report, there are more than 12,000 traditional mills. These mills primarily mill the rice for the farmer's own consumption (46).

Figure 4: Rice producing zones and share of rice production in Cambodia (2021)



³ [Key Seasons for Rice Plantation and Harvest](#)

Figure 6: Classification of rice mills by tonnage capacity



Source: World Bank (2015), ADB (2021), ValueNotes Analysis

While small and commune millers in the country are predominantly involved in producing non-aromatic rice, mid- and large-scale millers produce all rice varieties. The various rice varieties produced by these millers are discussed in the subsequent section.

While small and commune millers in the country are predominantly involved in producing non-aromatic rice, mid- and large-scale millers produce all rice varieties. The various rice varieties produced by these millers are discussed in the subsequent section.

Rice can be milled using modern and traditional machinery, split between the millers as follows:

- ~70 percent of the large and leading mills use modern machinery
- 95 percent of the small and commune mills operate traditional machinery

Leading millers account for about 30 percent of the production and export the majority of their produce. In Cambodia, rice exports contribute to 22 percent of total production. Based on these figures, 80 percent of the rice produced by these leading millers is exported and 20 percent is consumed in the domestic market.

Given that many large millers may not have a significant domestic presence, it makes sense to work with both large and mid-sized millers, who are catering to the domestic market. These mills are better positioned to be the pioneers in rice fortification given their higher production capacity and availability of financial resources to invest. Most of these millers have the capacity to invest in rice fortification. However, they are not willing to invest due to lack of clarity on the available market for fortified rice (elaborated in section 6.3). Consequently, millers are hesitant to invest in this initiative. At present, they expect a guaranteed demand from the Government to consider venturing into rice fortification.

To develop an efficient fortified rice supply chain, however, millers will need technical and financial support from the Government and development sector partners.

3.3 Varieties of Rice Produced

Rice Production –

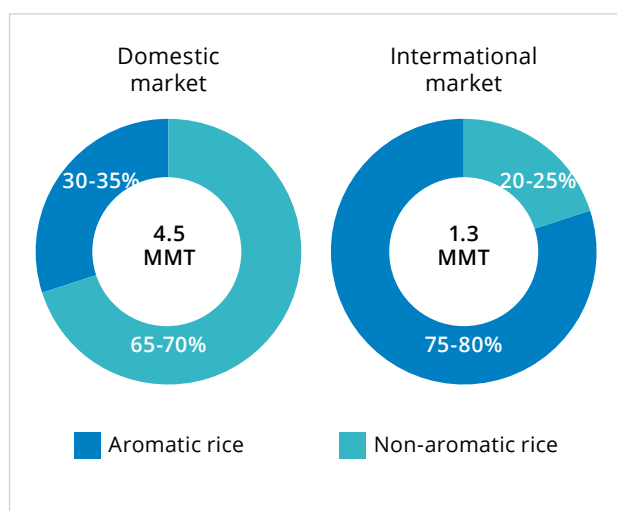
In Cambodia, rice is commonly classified into two varieties, aromatic and non-aromatic.⁴

- Non-aromatic rice is popular among the low- and middle-income groups. It accounts for 60–65 percent (i.e. 2,700–2,900 million MT) of total demand. The popular sub-varieties are Phka Knhey, Neang Khon and Neang Minh.
- The aromatic variety of rice is consumed by the upper-middle- and high-income groups. It accounts for 35–40 percent (i.e. 1,500–1,800 million MT) of total demand. The sub-varieties include Malis and Sen Kra Ob.

The low- and middle-income groups of the Cambodian population that consume non- aromatic rice are price sensitive (47). To make fortified rice available to the low- and middle-income groups, the price will have to be at par with normal rice.

Based on the discussion with different stakeholders, it was found that the price difference needs to be less than 10 percent to ensure that it is affordable by the vulnerable groups. Further studies need to be conducted to understand the acceptability of fortified rice, price acceptance and price elasticity.

Figure 6: Percentage share of rice varieties consumed in the domestic and international (export) market (2021)



Source: Asian Development Bank Report (export market splits), ValueNotes Analysis



4 Varieties of Rice Produced

3.4 Domestic Rice Production, Imports and Exports

In the past five years (2017-2021), total paddy production in Cambodia has increased from 8.6 million MT-9.5 million MT. The average yield on 2.9 million hectares under rice production is 1.8 MT/ha (9).

One of the biggest weak points of the Cambodia rice industry is the higher milling costs, which are 30 percent higher than the costs in Vietnam and Thailand. The reasons for this are lack of proper rice storage facilities, drying infrastructure and limited access to crop technology (especially on small farms) (45).

In 2021, 61 percent of the total paddy production was milled during rice processing (45). The post-harvest loss, seed retention and animal feed contributed to the remaining 39 percent (30).

Imports –

Over the years, imports have been negligible. They accounted for less than 1 percent of domestic consumption in 2021.

Exports –

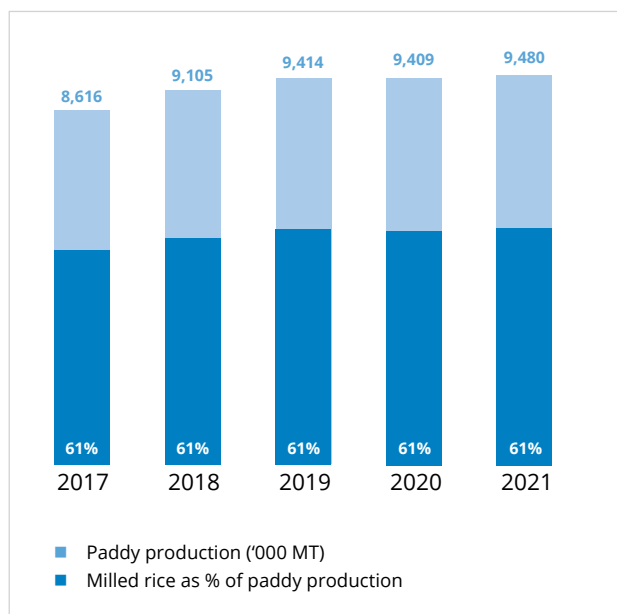
Rice production has been growing as a result of increasing land under cultivation, mechanization of rice farming, access to irrigation schemes and availability of credit. This led to higher exports in absolute terms (compound annual growth rate (CAGR) 3 percent) (9). However, the issues related to the supply chain still persist, which affects productivity. Additionally, the fragmented rice industry and the number of intermediaries increase the final cost.

In 2021, 78 percent of the milled rice produced in Cambodia was consumed in the domestic market, while the rest was exported (9).

China (38 percent) and France (12 percent) are the key export regions for Cambodia. Other export markets include Gabon, Malaysia, the Netherlands and Australia ⁵ (10).

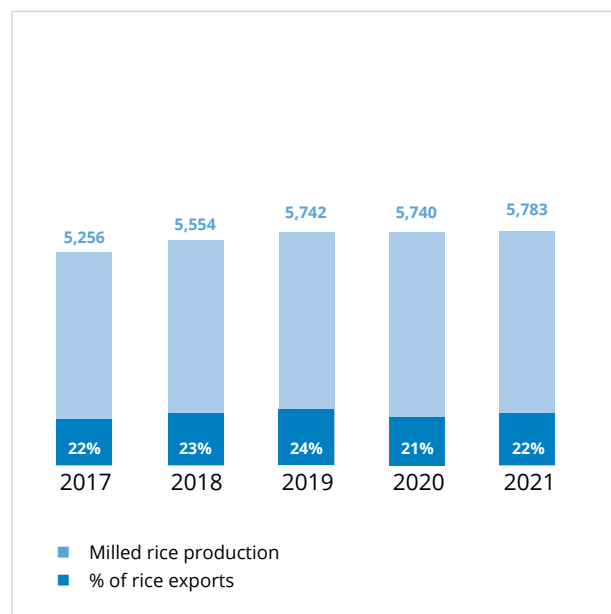
The next section explains the supply chain of rice in the country to understand the important stakeholders and the potential for developing the fortified rice supply chain.

Figure 7: Share of milled rice out of total paddy production ('000 MT) (2017–2021)



Source: USDA

Figure 8: Milled rice production and exports ('000 MT) in Cambodia (2017–2021)



Source: USDA

5 [Rice importing countries](#)

4. Rice Supply Chain

The rice value chain in Cambodia is dominated by millers, collectors and retailers.⁶

The rice value chain is depicted in figure 9

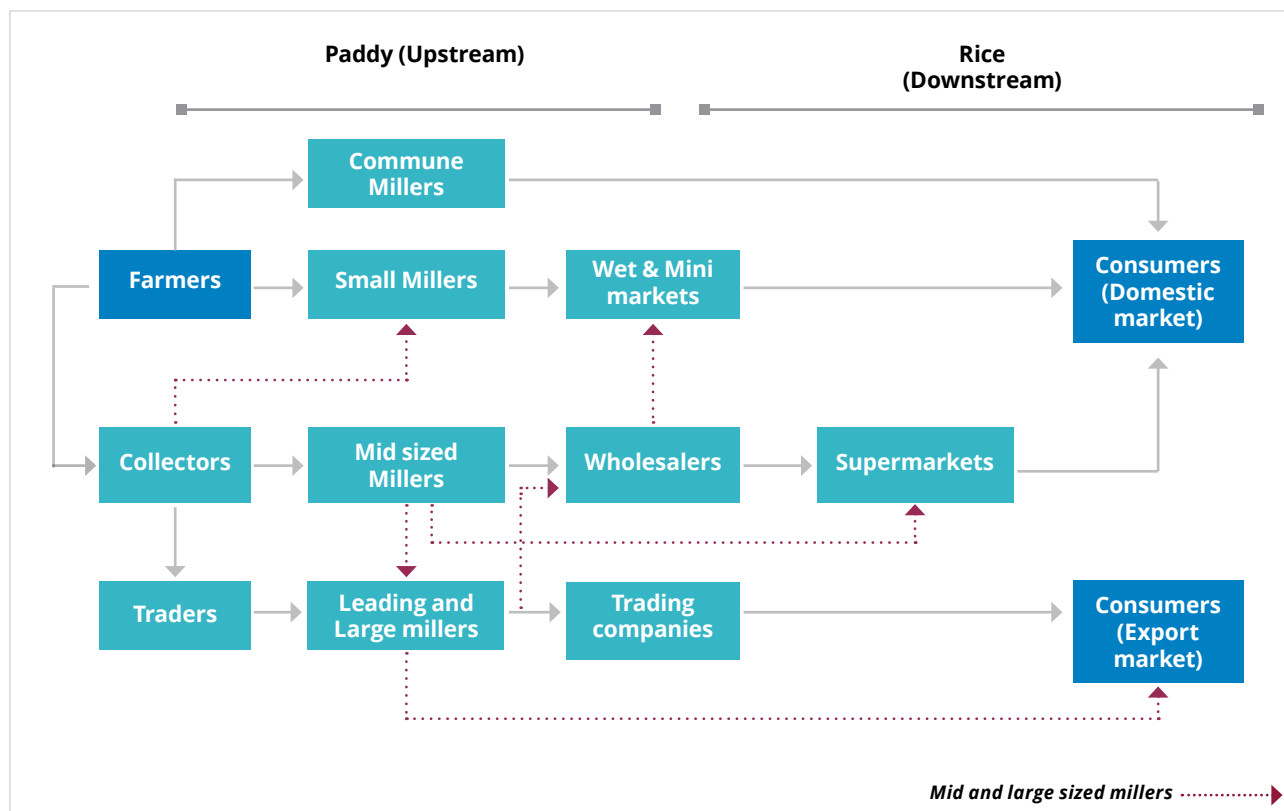
Most of the rice mills in Cambodia are operated by private players. The small millers typically supply rice to local markets, while the large millers supply nationally – including to urban markets.

The value chain involves multiple intermediaries, making the supply chain inefficient. There is also lack of coordination among the players.

Currently, a fortified rice supply chain doesn't exist in Cambodia. There are no domestic suppliers of FRK and machinery, i.e. blenders and extruders. Initially, FRK and machinery will need to be imported from other countries.

For the development of a sustainable ecosystem for rice fortification, a robust domestic supply chain is essential. This supply chain must feed into the value chain described above. Naturally, this will involve collaboration with a variety of important stakeholders, whose roles are discussed in detail in the following chapter.

Figure 9: Rice value chain in Cambodia



Source: ValueNotes analysis

Note: A wet market provides fresh fruits, vegetables, seafood, meats and home supplies. A supermarket is a large self-service store that sells groceries, medication, household goods, clothing, etc.; whereas a mini market is a small supermarket, usually selling food and sometimes other goods.

⁶ Role of Different Entities in the Rice Supply Chain ; Value addition in Rice Value Chain

5. Key Stakeholders in Rice Fortification

here are multiple stakeholders involved in rice fortification in Cambodia:

1. Current fortified rice manufacturers
2. Government entities/ministries
3. Other stakeholders

5.1 Current Fortified Rice Manufacturers

Currently, fortified rice is supplied only by the state-owned Green Trade Company (GTC) for distribution in the school feeding programme on a pilot-scale. The entity produced 500 MT of fortified rice for this programme. However, it does not cater to the commercial market currently.

GTC is a food company based in Phnom Penh, Cambodia. Established in 1998 as a state-owned enterprise, it falls under the technical supervision of the Ministry of Commerce and the financial supervision of the Ministry of Economy and Finance. The company aims to provide food security and stable marketing prices for the Government (48).

In 2019, GTC, with support from RGC and WFP, executed the blending of FRK with regular rice in the country for the first time through a pilot study. The blending machinery and FRK was provided by WFP. GTC followed WFP's guidelines on rice fortification.

In the future, GTC is willing to invest in scaling up fortified rice production, provided there is assured demand from the market.



5.2 Government Entities

Multiple government entities are involved across functions such as production, standardization, regulation, sale and distribution of fortified rice. The scale-up of rice fortification will require efficient coordination among them and the private sector.

The roles of such entities are detailed in table 3.

Table 3: Government entities involved in scaling up rice fortification in Cambodia

Authority	Role
Ministry of Planning	<ul style="list-style-type: none"> - Responsible for implementing the rice fortification programme - Responsible for coordination among various entities under NSCFF
National Sub-committee for Food Fortification (NSCFF)	<ul style="list-style-type: none"> - An inter-ministerial committee chaired by the Undersecretary of State of the Ministry of Planning - Comprises eight ministries (Ministry of Industry, Science, Technology and Innovation (MISTI), Ministry of Health, Ministry of Commerce, Ministry of Planning, Ministry of Rural Development, Ministry of Women’s Affairs, Ministry of Education, Youth and Sport and Ministry of Information) and includes participation from development partners (WFP, UNICEF, WHO) and the private sector (Helen Keller International and RACHA) - Coordinates the food fortification programmes in Cambodia - Monitors the compliance of regulations by producers of fortified food items - Disseminates information and educates the public about the health benefits of consuming fortified food items
Ministry of Industry, Science, Technology and Innovation (formerly known as Ministry of Industry and Handicraft), Ministry of Health	<ul style="list-style-type: none"> - Regulatory authority for the food industry including product standards, producer inspection, awarding business licences, product registration and oversight - Responsible for giving approvals for the manufacture of fortified food items
Institute of Standards of Cambodia (ISC)	<ul style="list-style-type: none"> - The institute is housed under the MISTI - Develops national standards for products (including food products such as fortified rice) and promotes the adoption of such standards - Maintains laboratories for the purpose of standardization and quality assurance of products - Provides certificates to ensure that products for local consumption or exports meet the food safety standards - The Department of Regulations (under ISC) is responsible for registering products and making sure they meet the standards
Consumer Protection Competition and Fraud Repression Directorate-General (CCF) (under the Ministry of Commerce)	<ul style="list-style-type: none"> - CCF (earlier known as CamControl) is responsible for: <ul style="list-style-type: none"> • regulation and inspection of imported goods, including FRK • issuing certificates on the basis of food testing to ensure the quality and specifications of the product are safe for consumption - They have their own laboratories (including mobile labs) for food testing
Ministry of Health (MoH)	<ul style="list-style-type: none"> - Implements and manages the regulatory and institutional framework of food safety and hygiene issues - Responsible for guiding the public, through NSCFF, on the benefit of consuming fortified rice - MoH also provides the company registration necessary for food fortification - Department of Planning under the MoH provides the approval to use micronutrients required for fortification. This includes approval for advertising and packaging of the micronutrients
Council of Agriculture for Rural development (CARD)	<ul style="list-style-type: none"> - Promotes food security and nutrition in Cambodia - Coordinates with other non-governmental entities working on food security and nutrition
Ministry of Environment	<ul style="list-style-type: none"> - Provides the approval for the factory/warehouse required to store fortified products.

In addition to the above-mentioned government entities, the private sector has an essential role in developing the fortified rice supply chain in the country. The roles of the relevant private sector stakeholders are elaborated in the next section.

5.3 Other Stakeholders

Rice fortification through the process of extrusion requires FRK, blending machinery and extrusion machinery (if FRK is produced by the millers themselves).⁷ Additionally, the role of rice associations is critical in disseminating information to millers. The roles of these stakeholders are discussed in detail in table 4.

Table 4: Other stakeholders in Cambodia

Authority	Role
FRK suppliers	<ul style="list-style-type: none"> - FRK was imported from the Philippines by ILSI Japan for the Workplace Nutrition Project (RACHA), and from the United States by GTC for WFP's school feeding project. - Other supplying countries include China and Thailand (in 2021). - Expected role: <ul style="list-style-type: none"> • FRK can be imported from international suppliers such as DSM and BASF Foods. • In the long run, these kernels need to be produced locally. For that, the local producers will have to engage with international premix suppliers and extrusion machinery suppliers.
Blending machinery suppliers	<ul style="list-style-type: none"> - Blending machinery is not produced locally in Cambodia. - In 2019, WFP provided GTC with blending machinery (imported from India) for the school feeding project, which was used to blend FRK with normal rice at their mill premises. - In case of the RACHA project, ILSI Japan blended the FRK with the regular rice. - Expected role: <ul style="list-style-type: none"> • Millers can import blending machinery from China, Vietnam and India. • Private millers can modify their existing machinery to blend FRK with regular rice at lower costs without investing in expensive machinery.
Extrusion machinery suppliers	<ul style="list-style-type: none"> - There are no suppliers of extrusion machinery in Cambodia. - Expected role: <ul style="list-style-type: none"> • It could be sourced from other countries by distributors (such as China). • Some of the international companies supplying machinery include BUHLER and Satake.
Rice associations: Cambodia Rice Federation (CRF)	<ul style="list-style-type: none"> - CRF is non-profit organization that represents the rice industry, and works with government agencies and development partners. - CRF aims to promote Cambodian rice in the domestic and international markets. It works with farmers to buy their products, with millers to smoothen the process of exporting, and with Ministry of Commerce to get approval for trading. - There are currently 234 members, consisting of farmer cooperatives, millers, exporters, banks, logistics and inspection companies and other stakeholders. - The organization protects the reputation and sustainability of rice brands in Cambodia.
Federation of Cambodian Farmer Organizations for Development (FCFD)	<ul style="list-style-type: none"> - FCFD was founded on 20 December 2010 with 40 farmers' organizations as founding members and officially register with the Ministry of Interior on 19 January 2011. - The goal of the federation is to contribute to strengthening and motivating the farmers' organizations in target areas to: <ul style="list-style-type: none"> • come forward with creative ideas • initiate activities to make income • ensure food security
Development and technical partners	<ul style="list-style-type: none"> - WFP, PATH, and other potential development partners are essential in advising stakeholders in the Government of Cambodia to initiate the rice fortification programme. - WFP's role is essential in coordinating with potential funding partners such as the International Financial Corporation (IFC), World Bank and the United States Agency for International Development (USAID) to implement the rice fortification.

The next chapter provides analysis of the barriers to large-scale fortification, and how these affect different types of stakeholders.

⁷ [Technologies for Rice Fortification](#)

6. Discussion and Analyses

6.1 Stakeholder Discussion: Summary of Findings

As explained in the Introduction, detailed discussions were held with key decision makers in the Government and relevant stakeholders in the rice value chain. The barriers and recommendations mentioned in the next section are based on the discussions with the various stakeholders.

Discussion with government stakeholders –

From the discussions it was evident that government stakeholders are interested in scaling up rice fortification in the country. The focus of discussion with government stakeholders was on the need for standards, insufficient financial support and the need for demand generation to incentivize millers to consider investment in rice fortification. Their key suggestions included conducting mass campaigns and providing technical support to the millers.

The highlights of the discussions with the government entities are provided in table 5 along with a summary of some of the key inputs received during these discussions.

Table 5: Summary of discussions with government stakeholders

Discussion points	Entity name	Details
Government interest in scaling up rice fortification	NSCFF, ISC and GTC	<ul style="list-style-type: none"> The Government is aware of the numerous health benefits and the long-term advantages of consuming balanced diets.
	ISC	<ul style="list-style-type: none"> ISC was unaware of fortified rice being offered in the country. They were also unaware of the involvement of GTC in the school feeding programme. There has been no dialogue between the government entities and ISC on introducing standards for producing fortified rice.
Past fortification efforts	NSCFF	<ul style="list-style-type: none"> Efforts were made in the past to fortify salt and soy and fish sauce. Iodine and vitamin B1 was added to salt while iron was added to fish and soy sauce. Although the programmes have been going on for a long time, the awareness levels are still low. People continue to buy non-fortified products. Fortified rice is provided to schoolchildren in five provinces. But, not all the students receive this rice, only students from about 50 percent of the schools receive fortified rice.
	ISC	<ul style="list-style-type: none"> Soy and fish sauce fortification is mandatory, yet only 10–15 percent of the producers add iron to their fish/soy sauce. If it was voluntary, then only 0.1 percent of the producers would fortify. From the consumers' side, people continue to buy normal sauce because of the price difference of 50 riels. This difference is very high for the people in the low-income category.
Pilot programme (School feeding programme)	NSCFF	<ul style="list-style-type: none"> WFP and NSCFF conducted a pilot study through the school feeding programme in 2019. A push from WFP is needed to implement the programme on a bigger scale. The pilot programme was successful as vitamin A and zinc levels improved in the schoolchildren while malnutrition levels declined.

Regulatory and financial barriers to scaling up	NSCFF	<ul style="list-style-type: none"> The main barrier is the lack of financial resources. The programme receives financial support from WFP, but there is no budget allocated by the Government. Because of the lack of funds, NSCFF is unable to implement the programme as a social safety net programme. Currently there are no standards for the production of fortified rice. To ensure that the rice fortification programme is well implemented, NSCFF would like to conduct a study tour to a country where rice fortification has been implemented successfully.
Challenges faced by the millers	ISC	<ul style="list-style-type: none"> Millers would need to arrange their production line to produce this rice and install new technology. Millers need to be educated on how to maintain the stock of this fortified rice to ensure that its nutrients are in good quality. When the millers distribute the rice in the market, they need to ensure that the quality is the same as the rice at the factory. If millers claim that their rice contains a variety of vitamins when actually it does not, it would mean fraud. The millers also need to make sure that they have enough micronutrients to add. Currently, the micronutrient powder for salt does not contain enough iodine. Similarly, the fish sauce premix does not contain enough iron.
Target audience and pricing	ISC and GTC	<ul style="list-style-type: none"> The price of fortified rice should be such that it is affordable for the low-income groups. A difference of 50–100 riels is a lot for the low-income groups. If the price difference is high, they will continue to purchase non-fortified rice.
Challenges faced by GTC in increasing production	GTC	<ul style="list-style-type: none"> The current blending machine is small and is sufficient for the current demand. When the demand increases, additional blending machinery will be required. Thus, to blend fortified rice with FRK domestically, the local availability of blending facilities will have to be created.
No investment by millers due to lack of demand	GTC and ISC	<ul style="list-style-type: none"> As the consumers are unaware of the benefits of consuming fortified rice, the millers will not invest if there is no demand for the product.
Support expected from the Government and/or WFP	GTC	<ul style="list-style-type: none"> There is a need for support on technology, storage management and machinery usage. In case the fortified rice has to be promoted by the private millers, then support will be needed in terms of promoting this rice in the market.
Awareness of consumers and millers	NSCFF and GTC	<ul style="list-style-type: none"> It takes a very long time to educate the people to make them aware of the benefits of fortified rice. Mass scale awareness campaigns are needed to disseminate information to the people across Cambodia.
	NSCFF	<ul style="list-style-type: none"> Added to the challenge, it is difficult to promote and raise awareness about fortified rice without having a product in the market. Even the millers are unaware of the benefits of consuming fortified rice. Currently, the Government does not have the budget to work with the millers, so the low awareness level is a given.

Discussion with millers -

Among the stakeholders in the rice value chain, particularly millers, only a few large millers were aware of rice fortification and its health benefits. The discussion with all the millers tended to centre on understanding two key variables: the expected demand for fortified rice and the profits. They showed hesitation

to invest as they were not adequately aware of these key business variables. They were also unaware of the production techniques involved, the costs and expected profitability, and the raw materials and machinery used.

A summary of some of the key inputs received during these discussions is provided in table 6.



Table 6: Summary of discussions with millers

Discussion points	Details
Health benefits	<ul style="list-style-type: none"> - Most of the large millers have basic awareness about fortified rice that it helps in better nutrition. However, the awareness level reduces as the capacity levels reduce.
Millers target market	<ul style="list-style-type: none"> - Millers such as Siv Lay Rice Mill and AMRU Rice export 100 percent of their product. Golden Rice also exports a part of its production. Chhun Thom Rice Mill exports 50 percent of its produce. - Amru Rice Mill offers rice to schoolchildren as a part of its corporate social responsibility activity. - The other millers apart from the leading millers are serving the domestic market.
Classification of rice millers	<ul style="list-style-type: none"> - There are 100–200 registered medium and large millers with the rice federation. - Only those millers who graduated from the Institute of Technology of Cambodia are aware of the fortified rice and the health benefits.
Lack of demand from the consumers	<ul style="list-style-type: none"> - At present, the biggest challenge in introducing fortified rice in the open market is the lack of demand. - Efforts need to be made to increase awareness before launching the product in the market.
Target audience and pricing	<ul style="list-style-type: none"> - The pricing of the rice will depend on the target consumers. More research is needed on target consumers – whether they are the low-, medium- or high-income consumers? - If the price of normal rice is 3,000 riel per kilogram, then the price of fortified rice cannot be higher than 3,500 riel. That would be the accepted ideal price range. - Ideally, the fortified rice can be priced 10–15 percent higher than normal rice. This will make the rice affordable to those who have average income and above. - For low-income groups: those people first will need to be given this rice for free by the NGO programme or government programme before they can shift their rice consumption habit from normal rice to fortified rice and start looking to purchase it.
Concerns raised by the millers related to the opportunity and expected profits	<ul style="list-style-type: none"> - The millers are interested in producing fortified rice as long as there is market demand and the opportunity to make profit from producing this type of rice. - If the millers launched the fortified rice, it would have to be sold only in the premium category. In that case, the demand would be extremely low and it wouldn't justify the investment. Nor would it help in reducing malnutrition as the product would not reach the target poorer sections of the population. This vulnerable group should ideally consume the fortified rice. - The millers are completely unaware of the cost of premix, sources of FRK, machinery costs, technique of producing fortified rice and finally the price at which fortified rice will be accepted in the market. - As they are unaware of these points, they couldn't comment on any other challenges except that the general consumer was unaware of fortified rice.
Support required to scale up	<ul style="list-style-type: none"> - The Government can also help to disseminate more information about the health benefits to consumers through relevant ministries such as Ministry of Health. - The CRF can help to disseminate information via its Facebook page to promote this rice product. - The millers will require tax exemption from the Government and loans from the Agricultural and Rural Development Bank. The millers also need certificates to prove the quality of the fortified rice. - The millers would also need technical support. - CRF should help to coordinate the provision of subsidized electricity for producing fortified rice as an incentive for their investment. - National workshops can be conducted and the Government can invite relevant people such as private millers to join and get more information about rice fortification.
Need for awareness programmes	<ul style="list-style-type: none"> - There are misconceptions about plastic being added to the fortified rice. - The awareness activities should start from the community level such as rice agricultural cooperatives, rice producer groups, and school parents and women's groups. Awareness should be raised within these communities before promoting it in the urban area. - For higher consumer acceptance, there is a need to prove the quality and benefits of the rice as well. The acceptability will be higher if the fortified rice tastes similar to normal rice. - Mass advertisements can be conducted by Ministry of Agriculture, Forestry and Fisheries, Ministry of Commerce and MISTI.

Discussion with other stakeholders –

Discussions were also held with a rice association, an NGO and a farmers’ organization. The highlights of the discussions are provided in table 7.

Table 7: Summary of discussions with other stakeholders

Discussion points	Entity name	Details
Health benefits	CRF and RACHA	- Aware of benefits of consuming fortified rice to improve the nutritional profile of the country.
	FCFD	- Large millers are generally aware of the basic health benefits (such as providing better nutrition) of consuming fortified rice.
RACHA initiatives	RACHA	- The Government should publicize the benefits of consuming fortified rice among the population. - Traditional and digital media could be used to create awareness among consumers about fortified rice and its health benefits.
Development of standards	FCFD	- Recommended better alignment of roles and functions of the multiple government ministries involved in rice fortification.
Price-related challenges	RACHA and FCFD	- A proper study needs to be conducted to understand the price of rice after adding premix and whether or not people can afford this fortified rice. - The wealthy people would be happy to buy this fortified rice but not poor families.
	RACHA	- In the past, the price increase of fortified fish sauce and soy sauce by KHR 100 per bottle was a barrier for people on low incomes.
	FCFD	- The price of fortified rice shouldn't be more than 10–20 percent higher than that of normal rice. - This price range might be accepted by the middle-income group.
Challenges faced by the millers	CRF, RACHA and FCFD	- The millers will be interested in producing fortified rice only if there is a demand for the products.
	CRF and RACHA	- For these private millers, the most important point is about making profits (and nothing else). Everything else becomes secondary. - They are not particularly concerned about installation of machinery and the investments. If there is an opportunity, they will also make the necessary investments.
	CRF	- There is less market potential for fortified rice, which is why medium and big millers are not interested in investing their money to produce this rice. For the big millers, it is costly for them to switch the production line, machinery and equipment. - The big millers have already made huge investments in their rice production for exporting. - Hence, it will be more feasible to encourage the small millers to produce fortified rice to meet the initial demand. Millers with capacity of 40–50 MT of rice per month can be targeted.

Food habits of the people	CRF	<ul style="list-style-type: none"> - Food fortification has been around for more than 20 years. - The fortification initiatives have not been successful because of the culture and food consumption habits of the people. - The consumers know very little about nutrition.
Lack of demand from the consumers	CRF and RACHA	<ul style="list-style-type: none"> - There is negligible awareness of the benefits of consuming fortified rice by the consumers.
	RACHA	<ul style="list-style-type: none"> - The consumers are unaware of the legislative initiatives taken by the Government. - They are unaware of the rabbit logo and that it represents fortified products. The consumers buy fortified soy sauce and fish sauce without knowing the benefits.
	CRF	<ul style="list-style-type: none"> - Initially, the fortified rice will have to be given for free through NGOs or government programmes, to the vulnerable people. - They won't buy the fortified rice on their own.
Target population	CRF	<ul style="list-style-type: none"> - 80 percent of the Cambodian population live in rural regions. So the fortified rice should start in rural areas and then it should be offered in the urban regions. As small millers are present in each of the villages, they will be in a position to serve these markets well. - The challenge however remains to make the blending machinery and FRK available to all such millers and to train them to produce this rice. - The rich won't consume this rice as they are already having the rice with proper vegetables, meat, etc. and they ideally don't need any further nutrition. Also, if it is advertised as the rice for poor, then it won't be bought by other income groups. - Therefore, the target should ideally be the middle class.
Need for awareness programmes	CRF and FCFD	<ul style="list-style-type: none"> - Mass awareness programmes need to be launched. Large-scale advertisements such as promotion on social media will also help promote fortified rice in Cambodia. TV commercials will also help generate the required awareness.
	CRF	<ul style="list-style-type: none"> - The advertisements should ideally target the average consumer. In this case, the vulnerable consumers will try to increase their food demand to reach the standards of the average consumer.
Support required	FCFD	<ul style="list-style-type: none"> - Millers need support from banks, i.e. agriculture banks in Cambodia.

The successful implementation of rice fortification requires a coordinated effort among the important stakeholders in the fortified rice supply chain and a clear understanding of the difficulties faced on the ground. The subsequent section elaborates on the major barriers in scaling up rice fortification in Cambodia.

6.2 Barriers in Scaling up Rice Fortification

Barrier 1

Relatively low priority given to budgetary allocation for rice fortification

While the Government is keen to address nutrient deficiencies, adequate budgetary allocation to rice fortification is yet to be provided. The relevant government entities in the rice fortification programme such as NSCFF are keen on institutionalizing the use of fortified rice for the school feeding programme. However, they are unable to scale it up as a social protection programme because of lack of funds.

Previously, inadequate budgets also hindered the scale-up of the soy sauce and fish sauce fortification programme. The programme did not get the required traction because of inadequate monitoring and enforcement and insufficient number of workshops. To ensure that the rice fortification programme does not face similar issues, adequate budgetary support is essential. This will be critical in order to make an impact on large-scale rice fortification and, in turn, in improving the nutritional health of the population.

Barrier 2

Lack of comprehensive food safety standards for fortified rice and FRK

The absence of a regulatory environment and well-defined standards is another significant structural impediment.

Impact on consumers: Without standardization, it will be extremely difficult to ensure consistency and quality across all fortified products in the market. Food products must be safe for human consumption, and without standards and compliance, it will not be possible to guarantee safety.

Impact on producers (millers): Without standards, millers will be reluctant to invest, as their products may not meet standards set in future. Hence, the creation of well-defined standards will reduce risk for the millers.

Hence, the regulatory body, ISC, needs to establish and lay down the food safety standards for producing and distributing fortified rice and FRK in Cambodia.

Barrier 3

Lack of awareness of the health benefits of rice fortification among rice millers

The vast majority of rice millers in Cambodia are not aware of rice fortification and its health benefits. However, typically millers who are graduates from the

Institute of Technology of Cambodia (a higher education institution that trains students in science, technology and engineering) are aware of rice fortification.

If millers themselves are not aware of the health benefits of fortification, it will be difficult for them to convince consumers to purchase fortified rice. Thus, it is imperative that the millers are made aware of the basic health benefits to enable them to pass on that knowledge to the wholesalers, retailers and finally the consumers.

Barrier 4

Limited awareness among millers about the production techniques, costs involved, and suppliers of raw materials and machinery required for rice fortification

Most of the millers are unaware of the technical processes involved in rice fortification. They are also not aware of the raw materials such as premixes and FRK that are required, or their likely costs. Nor do they know about the machinery (blending/extrusion) needed for rice fortification.

Addressing such knowledge gaps is an essential step in establishing a sustainable and efficient supply chain for fortified rice in Cambodia. This will require coordinated efforts from international agencies such as WFP, donors, government entities and stakeholders in the rice industry.

As seen in the earlier sections, WFP and a few other development agencies such as RACHA have taken several initiatives to improve the awareness levels but more such sustained efforts are necessary.

Barrier 5

Perceived low return on investment in fortified rice production due to lack of awareness of costs and uncertain consumer demand

Given the limited knowledge of production processes as discussed earlier, millers are unable to assess the quantum of investment needed, and the likely returns on this. Most prominent millers believed that the required investment in machinery as well as increased costs would be substantial, even though they were unable to quantify this.

Added to this, the lack of significant demand and the absence of government support make them very reluctant to make investments in rice fortification. They believe that due to such high investments and low demand they would have to operate on wafer-thin margins making rice fortification an unviable business.

It is important to educate millers on likely costs and investments, as this will provide a framework for them to seriously evaluate the option.

Barrier 6

Supply chain constraints due to multiple intermediaries

The rice supply chain in Cambodia consists of multiple intermediaries, making the supply chain inefficient. This could pose a significant problem in introducing fortified rice. It will be difficult to regulate the market efficiently.

Barrier 7

Unviability of partnering with leading mills due to the export-oriented nature of their business

Most leading millers in Cambodia primarily cater to the rice demand of the export market. It is difficult to expect these millers to consider investing in modification of their machinery to produce fortified rice.

For instance, leading rice mills such as AMRU Rice Mill and Siv Lay Rice Mill mainly supply the milled rice to the export market. These millers have already invested in rice production for the export market. Based on the current market potential, it is costly for them to modify the production line, machinery and equipment to cater to the domestic market. Thus, it doesn't seem feasible to engage with these millers for scaling up the rice fortification programme in the country.

It would be appropriate to engage with leading millers if their share of domestic market sales of rice were sufficiently high.

Barrier 8

Unviability of partnering with small and commune millers for the rice fortification programme due to their fragmented nature and inefficient milling capacities

It is extremely difficult to incorporate small and commune mills in the rice fortification programme in the early stage of the programme. There are more than 11,000 small and commune mills spread across the country (30). The initiation of fortification would create barriers in the transportation of imported FRK to the widely distributed mills across the country.

In fact, these mills might not even have the funds needed to invest in a blending machine or to modify their existing machinery. It will be unviable to provide blending machinery to these smaller mills as they have low milling capacities and mostly use traditional machinery. In most cases, these small mills meet the rice requirement of only their nearby localities.

Furthermore, it will be difficult to monitor their output and ensure that the product meets the set standards.

Thus, small and commune rice mills may not be the most appropriate partners to introduce and scale up rice fortification in the initial stages.

Barrier 9

Lack of awareness among the population about fortified rice and its benefits

Although WFP, and organizations like RACHA, have conducted pilot programmes to promote fortified rice, they have been confined to certain pockets in the country. As a result, there is still a lack of awareness among consumers. Fortified rice is not commercially available to the consumers. Without a product, it is difficult to raise awareness. Given the chicken and egg situation, as long as consumers remain unaware of fortified rice and its benefits, demand creation will be very difficult.

The above-mentioned impediments need to be addressed by a series of interventions, coordination between different entities across the value chain, and sustained over a period of time. The next chapter highlights some recommendations that could be considered to accelerate the scaling up of rice fortification in Cambodia.

6.3 Commercialization by the Private Sector

In conversations with private sector stakeholders, it was clear that the vast majority of the millers and other players were not willing to invest in rice fortification without any clarity on the available market for fortified rice.

The stakeholders require a basic understanding of the return on their investment. At the moment, these players do not believe that the commercial sale of fortified rice would generate any profits. Hence, financial support or guaranteed off-take of fortified rice through government-led procurement programmes is required to provide initial economies of scale to manufacturers.

The leading and the large millers mainly cater to the export market. The domestic market is primarily catered by the mid, small and commune millers. However, the thousands of small and commune millers don't have the capacity to invest. They are also spread out across the country creating supply chain bottlenecks. Additionally, the prospects for consumer-driven market demand are not encouraging due to the price differential between fortified and non-fortified rice and the negative perceptions about plastic being added to fortified rice.

Essentially, this research indicates that commercialization (by private sector) at this stage does not seem very likely or viable.

In the next chapter, recommendations to accelerate the scale-up of rice fortification are highlighted.

7. Recommendations for Scaling up Rice Fortification

Cambodia is at the stage of laying down food standards for fortification. In the past, the Government and development partners have conducted acceptability trials and pilot studies through school feeding programmes.

The private sector also engaged in the distribution of fortified rice among the women working in the garment factories to promote “workplace nutrition”. Although the programmes are not distributing fortified rice at present, they show the potential of rice fortification in addressing MNDs in the country. With adequate monetary support and advocacy, the distribution of fortified rice among schoolchildren could be expanded.

The previous sections have highlighted the barriers that need to be surmounted. Similar experiences in different countries at different stages of evolution towards large-scale rice fortification also lend themselves to optimism that a well-designed programme can succeed. Of course, this will require coordinated efforts from all stakeholders along several parameters: continuing advocacy and awareness building, business model development, development of standards and a regulatory framework, and demand creation.

A comprehensive approach is required with the coordination of key decision makers within the Government and the industry leaders in the rice value chain.

The recommendations are elaborated below:

Recommendation 1: Advocacy with government decision makers

Conduct meetings with the government entities to put rice fortification as a priority in the budgetary allocation process

Indicative timeline: short term (ongoing process)

In order to scale up rice fortification in Cambodia, the active participation of government entities is essential. Hence, sustained advocacy with government departments and regulatory authorities is an indispensable step. Development partners such as WFP must conduct meetings with the relevant government

entities (Ministry of Economy and Finance) to increase the budgetary allocation for the rice fortification programme. This will in turn increase the scope of the programme. More schoolchildren will reap the benefits of consuming fortified rice.

Given the current low budgetary priority for rice fortification, such meetings/interactions would be essential to convince government entities about the significant potential for rice fortification in tackling MNDs in the country. This will help spark interest and engagement of important government stakeholders, and provide a big push for fortification efforts.

Recommendation 2: Business model return on investment

Create and disseminate a technical document for millers outlining the technical know-how of rice fortification processes, the costs involved and the economic returns in selling fortified rice

Indicative timeline: short term (ideally to be done within a year)

Millers and rice associations are unaware of the technical know-how of rice fortification processes and the costs involved and economic returns in selling fortified rice. WFP, in collaboration with NSCFF, could share the technical document created in the December 2018 Cambodian Rice Landscape Analysis. This document needs to be shared with the millers, especially the ones who have shown initial interest in rice fortification, to garner interest and to help them understand the business aspects.

The document will provide information about the basic financial variables (cost of raw materials, investment needed for machinery and expected demand), which will help the millers to understand the profitability (return on investment). This will also help to create a business plan which will be essential in securing funds for investment if they sense an opportunity. To scale up rice fortification in Cambodia, the WFP-supported SUN Business Network established a Community of Practice on rice fortification. The group

plans to conduct regular meetings to share views and experiences of the members (which include leading rice millers, exporters and other institutions) (49).

The current technical document can be shared at these meetings. To promote the business case further, WFP is working on a cost-benefit analysis document. This can also be shared with the members. Disseminating such documentation will go a long way in enabling appropriate advocacy efforts with stakeholders.

Recommendation 3: Advocacy with millers

Conduct periodic workshops and individual meetings with the rice millers and relevant government entities to educate them about rice fortification, its health and economic benefits and the technical processes involved

Indicative timeline: medium term (ongoing process – once the technical document is shared)

Given the lack of awareness among millers about the health and economic benefits of rice fortification, NSCFF and WFP can conduct workshops and individual meetings to disseminate information about rice fortification in detail. The technical report (recommendation 2) can be leveraged to disseminate the necessary information.

These workshops/meetings can include discussions on:

- i. Health benefits of consuming fortified rice: The millers are an important link to the consumers. It is essential to educate the millers about the health benefits of consuming fortified rice. If the millers are aware of the health benefits, they can better promote the rice in the market. The 2021 Food Dialogue Summit convened by His Excellency Sok Silo, Secretary General of CARD, further reinforced the possibility of marketing fortified rice as a contributor to good health (50).
- ii. Guidance about the financial viability of producing fortified rice: Creating a detailed business case and expected return on investment.
- iii. Success stories of rice fortification in other countries through existing case studies of WFP.
- iv. Technical processes involved in rice fortification.
- v. Gaining the commitment of the large and mid-size millers catering to the local market for a pilot testing programme for rice fortification.
- vi. Details of the pilot testing programme.

NSCFF can set up a technical personnel team to explain the technical processes involved in rice fortification. The information must be passed on to the millers through technical workshops conducted by the local government units in different provinces and rice associations. The following details must be conveyed to the millers (private mills):

1. Raw materials (FRK) and machinery (blending machinery) used in rice fortification
2. Characteristics of fortified rice and its packaging and storage methods

The millers who graduate from the Institute of Technology Cambodia can be targeted by WFP. These millers are already aware of the benefits of consuming fortified rice and the production techniques. They can be among the millers who first start offering fortified rice. Later, WFP can also look for opportunities to collaborate with the institute.

Target millers for advocacy

The millers could be targeted for the scale-up of the rice fortification programme in phases, as elaborated below:

Phase 1 – The leading and large millers that supply to the domestic market should be targeted. Along with these millers, the millers that have already shown interest in rice fortification and have reached out to WFP could also be involved. These millers know the local as well as the regional market well and can raise awareness about the benefits of consuming fortified rice. An added advantage of these millers is that they are trusted by the locals. The fortified rice produced by these millers will be sufficient to meet the initial demand.

Phase 2 – After the initial demand has been generated, the mid-scale mills could be targeted. These mills are likely to have the relevant machinery and regional market knowledge, similar to the large millers. However, their milling capacities and willingness to invest are expected to be lower than the large millers.

Phase 3 – Based on the points mentioned in barrier 7 in section 6.2, it will be difficult to target the small millers. It is imperative to understand that reaching out to small millers with limited production capacities and traditional machinery is not feasible. Small millers with modern milling machinery, however, can be targeted at a much later stage. A study can be conducted to understand if the blending machinery can be integrated in these mills.

(For more details: Recommendation 6)

Recommendation 4: Development of a regulatory environment

WFP must advocate ISC on developing a comprehensive set of standards for rice fortification

Indicative timeline: medium term (advised to begin within a year)

Effectively, rice fortification could be voluntary initially and, in the long run, made mandatory, as with other food fortification initiatives. One of the first steps would be the development of standards for fortified rice and FRK. This would be followed by the implementation of a quality assurance and quality control (QA/QC) system for rice fortification. Without standards and compliance, there are likely to be a variety of differing products. This will cause concerns about quality and will negatively impact the expected health benefits. Also, without standardization, consumers will not have the required trust in fortified rice products.

Hence the creation of standards is a vital infrastructural enabler, without which promoting rice fortification becomes much more difficult.

To avoid any inconsistency in the quality of fortified rice and the micronutrients added to FRK, it is essential to develop comprehensive food safety standards. WFP must advise ISC to set food safety standards for fortified rice. NSCFF could play a crucial role in recommending appropriate standards based on the detailed micronutrient deficiency analysis of the FORISCA study (conducted in 2012–2013) as well as the pilot studies. The results of these studies have shown the positive impact of consuming fortified rice. Thus, the national standards can be prepared on the basis of such detailed analyses.

The MoH can recommend the composition of micronutrients in premixes for producing FRK, based on the health status of the population.

Along with setting the standards, it is essential that MISTI lays down a monitoring and enforcement framework.

Recommendation 5: Development of an effective monitoring and enforcement framework

Provide technical assistance to MISTI and CCF to support the development and implementation of a QA/QC system for rice fortification

Indicative timeline: short term (advised to begin within a year, along with the development of standards)

After the rice fortification standards are developed, a well-designed monitoring system is required for quality control and assurance. It is essential for the RGC to build an infrastructure for food control and inspection systems based on recommendations from the MISTI and CCF.

WFP, in partnership with ISC, can provide technical assistance to support MISTI and CCF, in the effective integration of a QA/QC plan for rice fortification. This would help in monitoring the quality of fortified rice and, in the long run, monitoring FRK production, if FRK were to be produced locally.

As seen in the case of salt and soy and fish sauce fortification programmes, standardization and compliance are essential for scaling up the programmes. This will also hold true for rice fortification. In the initial period, intensive and sustained support from institutions such as WFP and MISTI will be crucial.



Recommendation 6: Demand creation

The involvement of government entities is crucial to effectively scale up the rice fortification programme in Cambodia. The scale-up requires a phased approach, as discussed below:

Phase 1: Creation of institutional and/or consumer demand for fortified rice to incentivize millers to invest in rice fortification

Phase 2: Sourcing funds for the scale-up of the rice fortification programme

Phase 3: Assistance to millers in installation of blending machinery and procurement of FRK

Phase 4: Development of a domestic supply chain mechanism for FRK

The case study of rice fortification scale-up in India and Bangladesh sheds some light on the efforts of the governments in those countries:

India:

In August 2021, the Indian Prime Minister announced the distribution of fortified rice throughout the Public Distribution System and other government schemes in all States and Union Territories (UTs) by 2024 in a phased manner (51).

In 2022, Food Corporation of India (FCI) in multiple states announced the procurement of fortified rice from private millers. For instance, the procurement of 260,000 MT of fortified rice from private millers was announced in the state of Telangana as a part of 'PM Poshan' (Mid-day meal programme).

The rice would be distributed in pre-primary education centres and then would be further expanded to include distribution of fortified rice among schoolchildren. The Indian Food Ministry advocated for the relevant entities to provide financial assistance to rice millers for installing blending machinery. Currently, 600 out of the 900 major rice mills in the state have installed the required equipment.

To ensure that the millers are provided with FRK, multiple state governments invited tenders from manufacturing companies. Such efforts of the government have led to a significant increase in the availability of FRK suppliers in the country (52) (53) (54).

Bangladesh:

The Government of Bangladesh has integrated the distribution of fortified rice through national social safety net programmes. This has helped the private sector manufacturing companies to get a sustainable market for FRK. The scale-up of domestic production of FRK can be attributed to the unrelenting support of WFP, Nutrition International (NI), Global Alliance for Improved Nutrition (GAIN) and other partners (55).

Initially, FRK was being imported at higher costs; however, with technical support from WFP, three local privately funded FRK facilities were set up in 2019. WFP is also providing technical assistance to the government in establishing a FRK factory (production capacity of 200 kg per hour) and a laboratory facility for kernel testing. More than 50 blending units (rice mills) are operational in Bangladesh (56).

As discussed by the CARD and WFP representatives at the Food Summit Dialogues, the product will be commercially viable when the Government and development partners include fortified products in social assistance programmes, especially if quality standards are maintained.

From both these cases, it is evident that government efforts are essential to efficiently scale up rice fortification.

Thus, the following recommendations are made for the scale-up of production and supply of fortified rice in Cambodia.



6.1 To create a demand for fortified rice in the market, invite tenders from millers to supply fortified rice to schoolchildren and garment factory workers

Indicative timeline: medium–long term (ideally to be started after the budget is approved)

Without creating institutional and/or consumer demand, millers will have no incentive to invest in rice fortification. This requires interventions in institutional procurement as well as creating consumer demand.

To generate an interest among large millers to invest in production machinery, RGC could invite tenders for supplying fortified rice. The procured fortified rice could then be distributed to schoolchildren (through the school feeding programme) and garment factory workers (through the Workplace Nutrition Project).

Schoolchildren: Currently, RGC and WFP are conducting programmes targeting specific regions in the country. The programmes could be expanded to other regions of Cambodia covering all schoolchildren (primary and secondary school level). The current school feeding programme caters to 224,000 students (40). However, the total number of school students is nearly 10 times the current target. Hence, substantial demand can be created by expanding the current programme.

Garment factory workers: The Workplace Nutrition Project was conducted by RACHA and ILSI Japan in 2018–2019. The project targeted the garment industry workers. The industry was selected as it accounts for the largest portion of Cambodia’s manufacturing sector. It employs around 1 million people of which 85 percent are women (57). It is the ideal industry to target as many women do not have a nutrient-dense diet and, thus, lack dietary diversity. This will be especially helpful for WRA as they have higher dietary needs that are not met by the normal diet.

Later, these programmes can be further expanded to target other industrial workforces. This can be achieved by similar collaborations with the private sector like RACHA’s initiative of providing fortified rice to the garment workers. Such initiatives could be undertaken by a development partner or a private sector entity, with support from the Government.

The demand creation programmes can be rolled out in a phased manner as:

- There is a need to find donors who can fund the entire programme (the funding partners can be government entities or external funding partners)
- It will help in gradually building the required production capacity of fortified rice. It will aid in acquiring technical and financial capabilities as well

- The food safety standards which are currently under development can be finalized

An expansion of both the programmes can cater to around 20 percent of the Cambodian population. The demand is expected to be sufficient to create an initial demand for private millers to consider investing in fortified rice production.

6.2 Source funding for the scale-up of the rice fortification programme

Without initial funding support, it will be difficult to persuade millers to participate. Development partners such as IRD, USAID, PATH and WFP could be approached by NSCFF for the feeding programmes. These funds would be used for supply of FRK and blending machinery to the millers, installation of blending machinery in their mills’ premises, as well as training and support.

In addition to the above funding partners, IFC could also be approached. In the 2021 Food Summit Dialogues, IFC showed interest in exploring a market-based approach to expand the rice fortification initiative. They can help potential millers to invest in the machinery required (58). However, IFC has a minimum threshold of USD 30–40 million for investing in a rice milling company. Thus, they cannot invest in private mills with low revenues and insufficient production capacities.

6.3 Assist millers in installation of blending machinery and procurement of FRK

Indicative timeline: medium (after awarding tenders to interested millers)

WFP and GTC conducted a technical workshop for a few rice millers in May 2022. Such workshops are essential in developing local blending facilities in the country. WFP must continue these efforts and create a technical support team, in collaboration with GTC. They must provide technical support to the millers that have shown interest in rice fortification and help them to set up blending facilities.

Details about the raw materials (FRK) and machinery (blending machinery) used in rice fortification and the production technique must be explained to the millers. Information such as modification of existing machinery (control feeder) to perform the functions of blending machinery must be conveyed to millers through these workshops. Initially, FRK will have to be imported from other countries by these millers. Only after gaining some initial traction would the domestic production of FRK be feasible.

The Government must ensure that there is continuous engagement (and not just one-time meetings or

workshops) with those millers to help them at all stages of production and resolve their queries, if any.

As seen in the case of India, to help the millers bridge the gap in their budgets, funding from the local development banks could be explored. NSCFF must involve banks such as the Agricultural and Rural Development Bank (ARDB) to explore offering cheaper funding options to millers for installing the required machinery. Millers could also be incentivized by a combination of tax benefits (VAT exemption) and subsidies for the purchase of raw materials or machinery.

Commitment from the Government to purchase fortified rice in bulk would help generate initial demand and incentivize the millers to make the required initial investment.

Recommendation 7: Awareness creation campaigns

Campaign to generate awareness about the benefits of consuming fortified rice among the population

Indicative timeline: long term (ongoing process)

Initially, the Government needs to undertake campaigns to raise awareness through the social safety net programmes. This can be done by educating the parents whose children are a part of the programme. Once the Government is able to generate some level of awareness among consumers, it would be essential for the relevant entities to invest in mass-awareness campaigns. The current health campaigns conducted by MoH and RACHA are insufficient to generate the level of awareness needed to address the large Cambodian population. It is essential that the MoH, in collaboration with NSCFF, run campaigns for the public across media – TV, print and social – about fortified rice and its benefits.

The MoH and NSCFF can partner with state-owned broadcasters (such as National Television of Cambodia) and other media channels to run advertisements about the benefits of consuming fortified rice. This would help in generating traction for fortified rice among consumers, especially those that are more health conscious and willing to pay a premium. Given their understanding of MNDs and the importance of vitamin supplements, they are likely to be more inclined to demand fortified rice owing to its nutritional benefits.

Along with television, innovative digital outreach could supplement the awareness efforts. This approach will help reach a certain section of the population (digitally active, younger cohort) at lower cost.

Apart from government funding, aid agencies and corporate social responsibility funds can substantially enhance this effort.

As described above, the success factors in scaling up rice fortification in Cambodia include the following:

- A nudge from the Government by creating initial demand
- Higher awareness about the benefits of consuming fortified rice among all stakeholders
- Establishment of a viable business model for millers
- A sustained campaign to build awareness among consumers.

In the past, the RGC along with the development partners have undertaken several programmes for improving the nutritional profile of Cambodia. But, the coverage of these programmes is small. To ensure that these programmes are beneficial to all, commercialization of the programmes needs to be considered. For this, entrepreneurial millers, who are interested in investing in new products, need to launch the product. They need to focus on deriving long-term profit. To ensure that the millers are aware of the business case for fortification, more workshops need to be conducted. Only then will the millers be aware of the costs and the expected returns.

Conclusion:

Possible Road Map to Commercialization

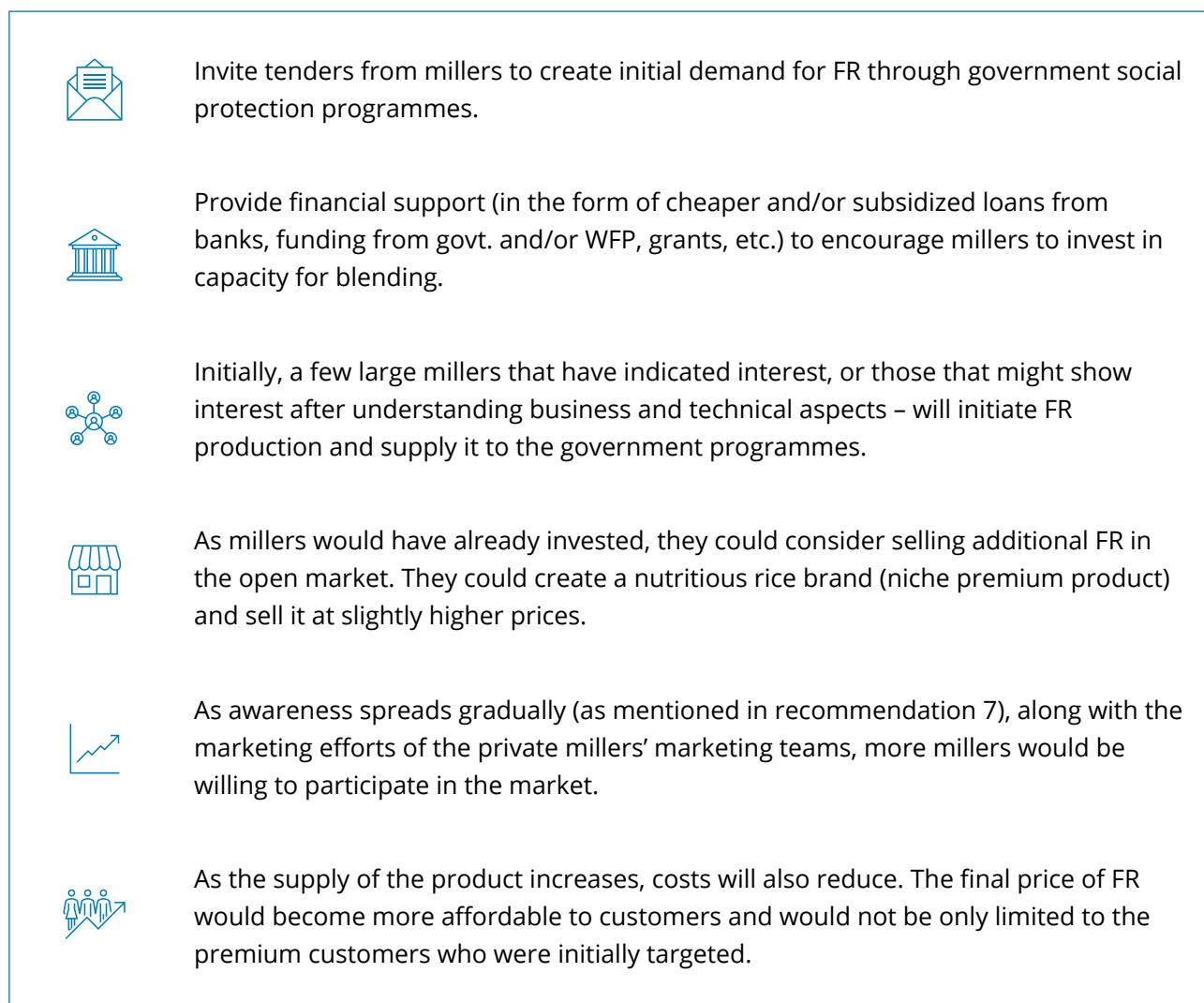
As discussed in the previous section, the scale-up of rice fortification would require immense efforts from the Government along with WFP, other development partners and donor agencies. The success will depend on continuing advocacy and awareness building, business model development, restructuring of the mandatory fortification legislation and implementing a regulatory framework, and demand creation.

Given the hesitancy of the private sector to invest in rice fortification without support from the Government, commercialization of fortified rice will take time, and needs several other things to fall into place first.

However, based on the recommendations above (in chapter 7), figure 10 shows a possible road map to commercialization of fortified rice.

The scale-up of the rice fortification programme requires effective coordination among all stakeholders coupled with long-term commitment. Eventually, a combination of government support and rising acceptance by the public will create a sustainable ecosystem. This will help significantly in reducing MNDs in Cambodia.

Figure 10: Possible road map to commercialization of fortified rice





Annex:

GOVERNMENT INITIATIVES TO REDUCE ANAEMIA

The following steps were taken by the RGC to reduce the prevalence of anaemia in children and women of reproductive age:

- Iron folic acid (IFA) tablets for pregnant women and women of reproductive age
- Iron and/or folic acid fortification legislation
- Dietary diversity for complementary feeding
- Deworming for children
- Deworming for pregnant women
- Breastfeeding and complementary feeding (59)

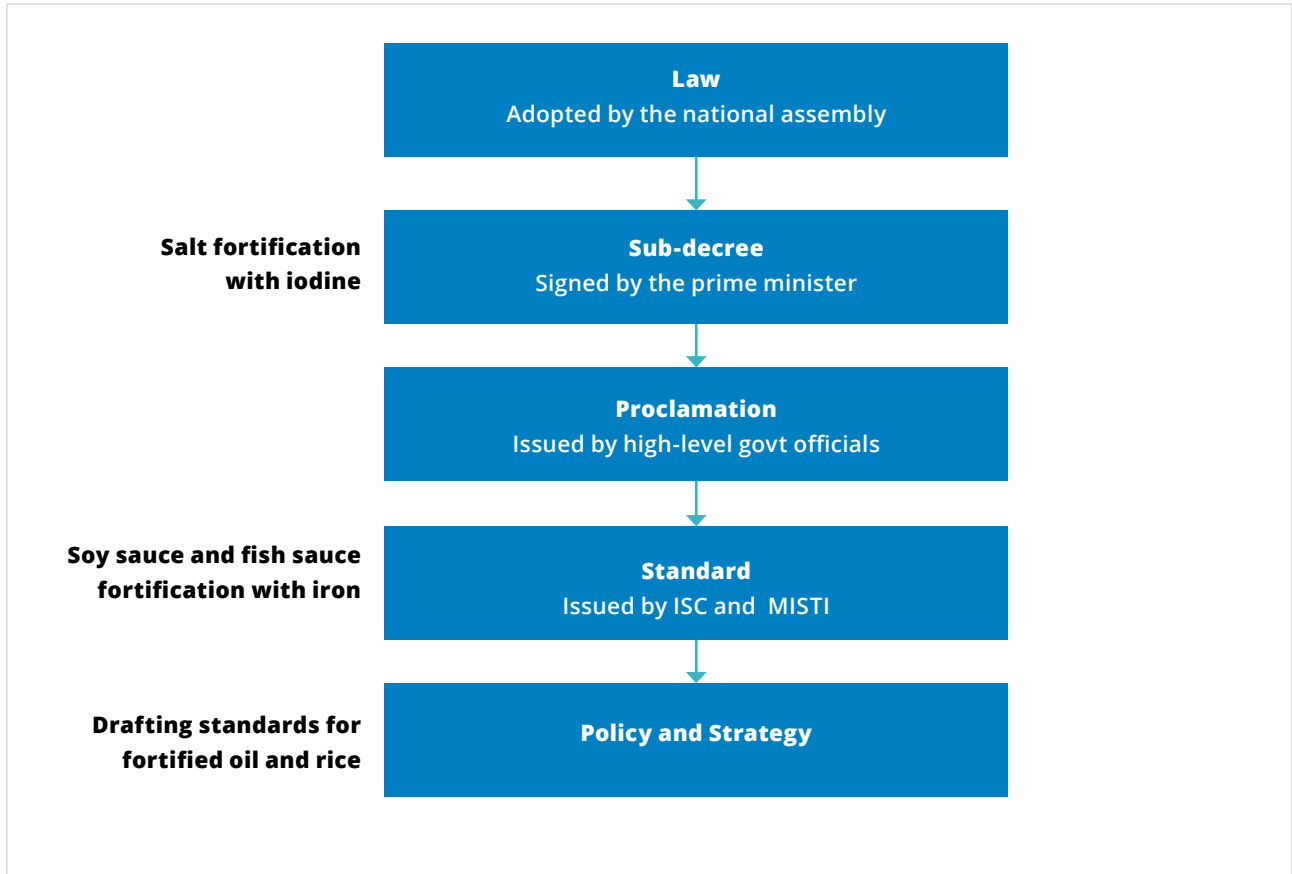
In addition to these initiatives, the RGC also prepared a national framework for food fortification in the Strategic Framework for Food Security (2008–2012) (60) and the National Nutrition Strategy (2009–2015) (61).

The National Strategy for Food Security and Nutrition (NSFSN), during 2014–2018, focused on expanding the fortification of food items in the country (62).

Annex:

HIERARCHY OF LEGAL FRAMEWORK FOR FOOD FORTIFICATION IN CAMBODIA

Figure 11: Hierarchy of legal framework for food fortification in Cambodia



Source: *Micronutrient Challenges and Solutions (WFP)*

Annex:

HOME GROWN SCHOOL FEEDING PROGRAMME

Acceptability trial (2010): WFP and IRD carried out an acceptability trial for fortified rice:

- The trial took place across four schools in Kompong Speu province with 2,000 students.
- The premix used in the research included two different types of extruded rice kernels:
 - UltraRice procured through PATH-Brazil (produced using cold extrusion)
 - NutriRice provided by DSM-China (produced using hot extrusion)
- The results of the trial showed that the two types of fortified rice were well accepted by the teachers, parents and schoolchildren (34).

FORISCA (2012–13):

- FORISCA trial was undertaken by RGC, WFP, PATH, IRD and DSM. The study took place over 36 weeks and involved 9,500 children in 20 schools.
- The following entities produced FRK with different micronutrient compositions:
 - NutriRice was produced by hot extrusion by DSM and Buhler (China)
 - UltraRice Original used cold extrusion techniques by Maple Grove Gluten Free Foods, Ltd (United States)
 - UltraRice New used warm extrusion techniques by the Food Technology department of Kansas State University (United States)
- The students received the above three varieties and a placebo (normal rice).

- The results showed that fortified rice improved the levels of vitamin A, zinc and folic acid in schoolchildren. However, there was no impact on iron levels.
- The outcome of the research was used to advocate and sensitize the Government and other stakeholders to engage in rice fortification programmes. The recommendation of this study was approved and supported by the RGC (35).
- At the end of the trials, hot extrusion was the accepted method for extrusion as rice kernels with added vitamins and minerals look similar to normal rice kernels (35).

Inclusion of fortified rice in HGSFP (2016):

- In 2016, a home-grown school feeding programme was started to supply fortified rice to 17,000 students (36).
- Fortified rice was procured from USDA.
- In 2017–2018, 57,000 students received food, including fortified rice, through this programme (37).

Pilot study by GTC:

- In 2019, WFP and the GTC blended FRK, imported from the United States, with locally produced white rice and distributed it.
- The fortified rice was sent to 908 target primary schools in five provinces: Kampong Chhnang, Pursat, Siem Reap, Kampong Thom and Oddar Meanchey (40).

Annex:

WORKPLACE NUTRITION PROJECT IN CAMBODIA (2018–2019)

- ILSI Japan and RACHA undertook a pilot study of women factory workers of childbearing age. The study was conducted for 12 weeks between November 2018 and February 2019.
- ILSI procured FRK from the Philippines and blended it with normal rice at its own facility with the help of its technical team.
- The workers were divided into two groups. One group was given rice fortified with micronutrients, while the other was given standard rice.
- The results showed that fortified rice improved the levels of folic acid.
- In July 2019, a workshop was held to provide information on the results of the pilot study to Cambodian government agencies, WFP and local companies (38).
- They are currently planning to enter the second phase of the programme and submit the research for publication (39).

Annex:

FOOD SUMMIT DIALOGUES

The food system dialogues bring together a diversity of stakeholders to debate, collaborate and take action towards a better future.

In 2021, Food Summit Dialogues took place to promote investment opportunities for the private sector in food fortification and to plan for further dialogue among a wider audience of stakeholders. The dialogues were conducted from January 2021 to August 2021 in Phnom Penh, Cambodia. Some of the attendees included WFP Representative and Country Director, Minister for Agriculture, Forestry and Fisheries, Vice-Chairman of CARD, Deputy Representative, UNICEF Cambodia and Chairman of the Technical Working Group for Food Security and Nutrition. The participants also included millers, NGOs, local authorities, regional economic community, United Nations, international financial institutions and consumer groups (63).

Preliminary discussions for moving forward with food fortification in Cambodia:

- The dialogue was convened by His Excellency Sok Silo, Secretary General of CARD.
- The main findings of this discussion were:
 - The rice supply chains in Cambodia include multiple stakeholders, making it difficult to introduce fortification and to regulate the activities or to make fortification compulsory.
 - Commercial fortification of rice is possible by marketing the product as a contributor to good health (50).

In-depth exploration for food fortification – operational environment:

- The dialogue was convened by His Excellency Sok Silo, Secretary General of CARD and Claire Conan, Representative and Country Director, WFP.
- The discussion in this session was around rice fortification and the challenges of commercial viability of fortified rice. The product will be commercially viable only if the Government and development partners include fortified products in social assistance programmes, especially if quality standards are maintained.

The discussions concluded that:

- The food fortification policy and regulation environment needs to be strengthened.
- Integrating rice and food fortification into social safety net programmes will better help to reach vulnerable people (42).

Commercialization of Food Fortification Roundtable:

- The dialogue was convened by His Excellency Sok Silo, Secretary General of CARD and Duong Sarak, International Finance Corporation.
- There were discussions with IFC regarding the commercialization of food fortification.
- IFC is keen on supporting the private sector for staple food fortification and product development, providing finance, technical and business support and trade facilitation. IFC has increased its focus on the rice sector where their efforts over the years have been most successful in Cambodia (58).

Based on the outcome of these dialogues, CARD, with the support of WFP and other agencies, developed Cambodia's Roadmap for Food Systems for Sustainable Development 2030. The plan was presented at the Food System Summit on 23 September 2021 and will guide future national efforts (64).

Annex:

SUN BUSINESS NETWORK

In July 2021, WFP Cambodia launched SUN Business Network Cambodia (SBN), to accelerate progress in nutrition across the country. WFP facilitated the development of the SBN five-year strategy. The plan involves developing a strong SBN brand by:

- Increasing nutrition awareness and demand
- Increasing the supply of nutritious foods and fortified products
- Strengthening the enabling environment for improved nutrition
- Promoting health and nutrition in communities and the workplace (43)

Annex:

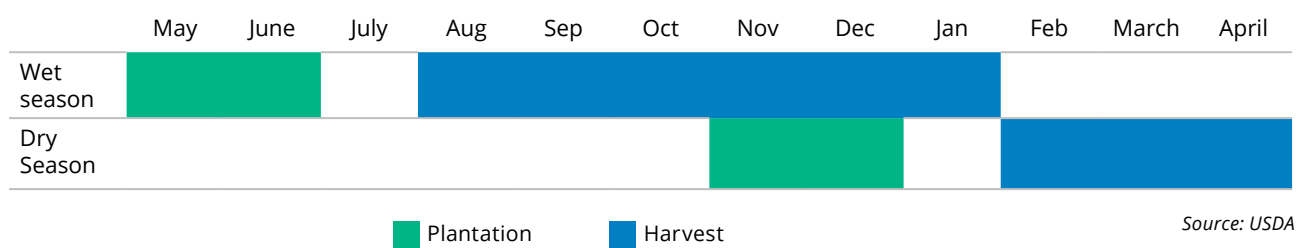
KEY SEASONS FOR RICE PRODUCTION AND HARVEST

In Cambodia, rice production is highly dependent on the monsoons. The yield of paddy in the country is the second lowest in Asia because of low access to irrigation and quality inputs.

Rice is planted in two seasons, wet (primary crop season) and dry.

The main raw material for producing fortified rice (i.e. premixes and rice flour in the form of fortified rice kernels) needs to be supplied before the harvest commences as it has to be blended with regular rice.

Table 8: Plantation and harvest seasons of rice in Cambodia



Note: Wet season has two harvest seasons for different types of rice: August–September (for short and medium duration varieties) and October–January (for long duration varieties)

Annex:

RICE IMPORTING COUNTRIES

Table 9: Top rice importing countries from Cambodia (2020)

Country	Region	Exported quantity (MT)	% of imports out of total
China	Asia	214,381	39%
France	Europe	76,498	12%
Gabon	Africa	31,120	7%
Malaysia	Asia	33,702	6%
Netherlands	Europe	26,528	4%
Australia	Asia	22,537	4%
Other	Misc.	150,690	27%
Total		654,287	100%

Annex:

VARIETIES OF RICE PRODUCED

Rice varieties in Cambodia are classified under two categories: aromatic and non-aromatic.

- The top five provinces that produce non-aromatic rice are Prey Veng, Battambang, Banteay Meanchey, Takeo and Kampong Thom.
- The top five provinces that produce aromatic rice are Battambang, Banteay Meanchey, Siem Reap, Prey Veng and Preah Vihear (44).

Table 10 elaborates on the varieties of rice.

Table 10: Rice varieties in Cambodia

Premium aromatic	Types	Details	Season
Aromatic rice	Phka Malis (Jasmine): Phka Rumduol Phka Romeat Phka Rumdeng Somali, Neang Malis	Extra-long grain, aromatic, soft texture, tender-fluffy when cooked	Wet season
Premium non- aromatic	Sen Kra Ob Sen Pidao	Long grain with a fragrance and characteristics similar to jasmine, soft texture, tender when cooked, full of flavour	Dry season
Non-aromatic rice	Ginger Rice: Phka Knhey Phka Chan Sen Sar CAR 4, CAR 6, Riang Chey	Medium-length grain, kernel with a translucent endosperm, white colour, distinct scent, soft after cooking, a versatile tasty variety	Wet season
Sticky Rice	Pearl Rice Neang Khon Ponla Pdao Neang Minh IR 66 Chulsa	Medium-length and long grain varieties, kernel with white endosperm, firm texture after cooking	All seasons

Annex:







KEY RICE BRANDS OPERATING IN CAMBODIA

To find the key rice brands in Cambodia, the websites of online retail channels and the websites of multiple millers were mined to find important details such as their milling capacity, their production levels, and their domestic and export orientation. Accordingly, the millers were classified based on their production capacities.

Additional desk research across websites and articles was done to confirm the names of the top rice brands and millers in Cambodia.

Table 11 provides a list of the top rice brands in Cambodia.

Table 11: Key rice brands operating in Cambodia

Key brand	Rice mill/Company
<p><u>Royal Mongkut</u></p> 	Apsara Rice
<p><u>Chhun Thom</u></p> 	Chhun Thom Rice Mill
<p><u>Baitang</u></p> 	Baitang (Kampuchea) Plc.
<p><u>Long Grain</u></p> 	Long Grain Cambodia
<p><u>Sek Meas</u></p> 	SekMeas Rice Mills
<p><u>Hak Se</u></p> 	Hak Se Rice Mill

Annex:

ROLE OF DIFFERENT ENTITIES IN THE RICE SUPPLY CHAIN

Table 12: Supply chain participants and their role

SN	Key players	Step involved in
1	Input suppliers	Supply inputs such as seeds, fertilizers and pesticides to farmers
2	Farmers	Produce paddy and sell it to wholesalers through the following channels: <ul style="list-style-type: none"> • via small millers • to collectors who then sell it to the small millers
3	Collectors	Buy rice from farmers and remove the husk (primary processing) before selling it in the rural wholesale market.
4	Traders	Purchase rice from collectors and sell it to large rice millers.
5	Commune rice millers	Commune rice mills (milling capacity of less than 1 MT/hour) obtain paddy rice from farmers and then sell milled rice in the domestic market. The rice is sold to households in the nearby villages.
6	Small rice millers	Small rice mills (milling capacity of less than 5 MT/hour) obtain paddy rice from farmers/collectors and then sell milled rice in the domestic market through wet and mini markets.
7	Medium rice millers	Medium rice millers (milling capacity of 5–10 MT/hour) process the milled rice and sell it to large millers and wholesalers.
8	Large rice millers	Large rice millers (milling capacity greater than 20 MT/hour) process milled rice and sell it in the domestic market through wholesalers. Most of these mills export rice either through trading companies or directly.
9	Retail outlets	At the retail level, rice is sold either in open bags in traditional wet/mini markets, or in packaged form in modern supermarkets <ul style="list-style-type: none"> • Traditional channel – Wet markets, grocery stores, rice kiosks, etc. • Modern retail channel – Western-style shopping malls, convenience stores and supermarkets (AEON and Makro). This channel, which primarily caters to wealthy Cambodians, the urban middle class and expatriates, is gaining prominence.
10	Wholesalers	They purchase the rice from medium and large rice millers and sell it in supermarkets and wet and mini markets.
11	Exporters	Cambodia has over 80 licensed exporters, about 25 percent of whom operate at a large scale. These firms export milled rice to the EU, Asia and Africa. Trading companies, who also export rice, tend to contact a trusted network of primary and secondary millers for supply.
12	Importers from other nations	Importers are traders who import rice from Cambodia and sell it in their respective countries. Importers include the governments of other countries.
13	Domestic consumer	Consumers can buy rice from multiple channels such as traditional wet markets, mini markets, e-commerce websites, e-stores and retail stores of major local brands and supermarkets.

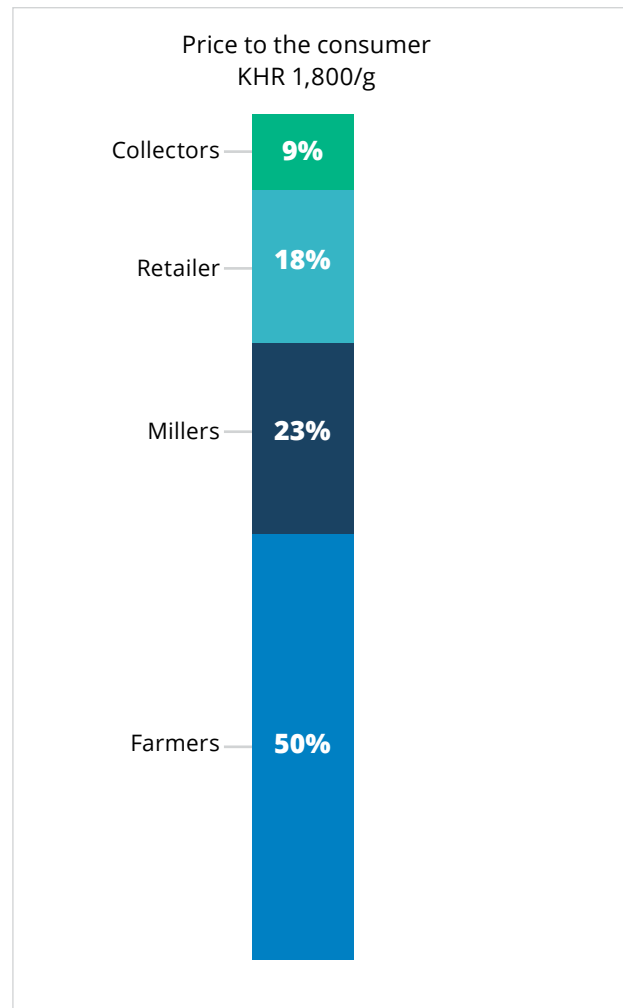
Annex:

VALUE ADDITION IN THE RICE VALUE CHAIN

On average, the value added was between KHR 428,900 and KHR 1,631,500 per ton of milled rice. Rice farming shared 50 percent of the total value addition in the rice value chains. According to the analysis done by the Cambodian Rice Sector Economic Observatory, in the case of value addition, farmers receive the maximum benefits. Of the total value addition generated, 23 percent went to millers, 18 percent to retailers and 9 percent to collectors (65).

The milling capacity utilization (above 30 percent of the total capacity) affects the miller's profitability and the value chain competitiveness.

Figure 12: Value addition in the rice value chain in Cambodia



Source: Cambodian Rice Sector Economic Observatory

Note: The conversion for average value added is based on USD/KHR exchange rate on 31 December 2017.

Annex:

Export Regulations/Policies

Export:

In Cambodia, rice exports account for about 60 percent of total agricultural gross domestic product. The country became one of the top 10 exporters in 2021 (66).

Recent developments:

From 18 January 2022, the Indica rice exports measures set by the EU in January 2019 ceased to exist. According to those regulations, Cambodia had to pay import duty of USD 198 per MT in the first year, USD 170 per MT in the second, and USD 142 per MT in the third. The regulations affected 70 percent of Cambodian milled rice exports. As the duties are now lifted, it is expected that more millers will be able to sell their products in the European market. This will help increase the share of the EU in Cambodia's rice exports (67).

In late 2020, RGC signed a free trade agreement with China, allowing 340 agricultural products, including rice, to enter the Chinese market. The agreement was implemented in early 2022. In an export agreement signed in November 2021, Cambodia will export 400,000 tons of milled rice to China. These agreements will help RGC hit the target of 1 million MT of exports (68).

On 5 April 2020, RGC banned the export of white rice and paddy to protect domestic consumption. The ban was lifted on 20 May 2020. The ban allowed the export of aromatic rice. Hence, the export of aromatic rice increased in 2020 (69).

Barriers:

Official data shows that average export of paddy rice from Cambodia to Vietnam is 5.8 percent. However, the amount of paddy rice exports is higher because of unofficial border exports. In 2018, RGC recognized that "up to 44 percent" of the rice exports occur informally. This is due to limited processing facilities and the high cost of processing. This rice is then exported from Vietnam at a lower price than the rice exported from Cambodia. This market opportunity can be utilized to export higher volumes of rice at lower prices (70).

Annex:

TECHNOLOGIES FOR RICE FORTIFICATION

Rice can be fortified using multiple technologies, such as dusting, coating, cold extrusion, warm extrusion and hot extrusion. This report focuses on rice fortification through extrusion.

Extrusion is a fortification technique in which FRK is added to the polished rice in ratios ranging from 1:50-1:200. Two types of extrusion process can be applied for rice fortification: cold extrusion and hot extrusion.

Cold Extrusion: The process, also called “shape forming”, uses no additional heat except that generated during the mechanical processing of the rice dough. The product temperature during the entire processing operation remains below the melting temperature of the rice starch (30–40°C); hence gelatinization of the starch does not take place.

Hot Extrusion: In this process, additional heat energy is applied normally through steam heated barrel jackets and the melting temperature of starch is exceeded (80-110°C). The dough containing micronutrient premix in the required concentration and other optional additives are pressed through the extruder tube where steam and water are added. The pasta shaped extrudate is cut into rice size pieces at the exit and the wet FRK is subsequently dried. The process results in fully or partially pre-cooked simulated rice kernels that have similar appearance to normal polished rice (71).

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Annex: Acronyms

CDHS	Cambodia Demographic and Health Survey
CIAS	Cambodian Inter-Census Agriculture Survey
CRF	Cambodia Rice Federation
DSM	Royal DSM N.V,
FAO	Food and Agriculture Organization of the United Nations
FCFD	Federation of Cambodian Farmer Organizations for Development
FORISCA	Fortified Rice for School Children in Cambodia
FRK	Fortified rice kernels
GTC	Green Trade Company
HGSFP	Home Grown School Feeding Programme
IFC	International Finance Corporation
ILSI	International Life Sciences Institute
IRD	Institut de Recherche pour le Développement
ISC	Institute of Standards of Cambodia
LSFF	Large Scale Food Fortification
MISTI	Ministry of Industry, Science, Technology and Innovation
MMT	Million metric tons
MN	Micronutrients
MND	Micronutrients deficiency
MT	Metric tons
NSCFF	National Sub-Committee for Food Fortification
PATH	Programme for Appropriate Technology in Health
RACHA	Reproductive and Child Health Alliance
RGC	Royal Government of Cambodia
RUSF	Ready-to-Use Supplementary food

SAM	Severe acute malnutrition
UNICEF	United Nations Children's Fund
US	United States
USDA	United States Department of Agriculture
WFP	World Food Programme
WHO	World Health Organization
WRA	Women of reproductive age

