CBI
Ministry of Foreign Affairs

Value Chain Analysis Cambodia Rice

Commissioned by The Centre for the Promotion of Imports from developing countries (CBI)

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Table of Contents

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1. Introduction

CBI, the Centre for the Promotion of Imports from Developing Countries, is part of the Netherlands Enterprise Agency, funded by the Netherlands Ministry of Foreign Affairs. The mission of CBI is to connect small and medium-sized enterprises (SMEs) in developing countries to the European market and thereby contribute to sustainable and inclusive economic growth. For more than 40 years, CBI has specialised in supporting value-added exports from selected developing countries in selected high-potential export sectors, allowing these countries to sustainably export the associated products to the European market through capacity building, international promotion and networking activities.

CBI has identified potential in the European rice market, particularly with regard to value-added products, and sees a good match for a support programme with Cambodia that focuses on diversification into value-added products like organic rice and/or further processed products like rice flour, starch, protein, noodles and crackers.

Some underlying reasons for this are given below:

- European demand for sustainably produced rice is growing (including demand for organic rice). At the same time, there are multiple initiatives in Cambodia at farmer level to support the production of organic and sustainable rice. Cambodia has the potential to develop a sustainable rice industry.
- A study has also shown opportunities on the European market for further processed rice products, such as rice noodles and snacks, Gamma oryzanol (and rice bran oil), rice protein and rice starch.
- The costs for the technology necessary to produce processed rice products such as rice noodles and snacks have gone down significantly. This has resulted in an increase in processing in less developed countries. European players are also looking to outsource processing activities. Thailand, India and China are good examples of countries that have developed a large rice processing industry.
- Cambodia currently benefits from GSP preferences for diversified rice products.
- An existing institutional framework is in place in which relevant stakeholders, including national and international development partners, have developed a sector strategy and a branding strategy in order to increase the competitiveness of Cambodia.
- At international level, the Sustainable Rice Platform (SRP) is working on a strategy for producing sustainable rice at a global level. Cambodia is positioned to be a leader in adopting the SRP standard

Several other key trends in the European market offer opportunities for the Cambodian rice sector to find higher value for diversified products, including:

- health awareness, in which the strong drive for gluten and lactose-free products plays an important part;
- diversity in taste – consumers are becoming more and more adventurous, seeking to try out different cuisines even at home;
- convenience – more and more, consumers are looking for easier and faster ways to prepare a home-cooked meal;
- sustainability – SRP rice will have a major appeal and organic and Fairtrade-certified rice play a growing role in the European market, which is also reflected in diversified products.

CBI develops and implements projects using several consecutive phases:

- Value Chain Selection (VCS) phase: based on a preliminary research, the most promising VC in the target country is selected;
- Business Case Idea (BCI) phase: an initial idea for a project is formulated based on CBI criteria for the selected VC;
- Value Chain Analysis (VCA) phase: an in-depth analysis of the VC is conducted;
- Business Case phase: a detailed business case for a project is formulated;
- Implementation and Performance Management phase: the project is implemented and monitored over the course of the project life cycle;
- Audit and Evaluation phase, conducted after project completion.

This Value Chain study therefore feeds into a business case based on which a Committee within CBI's governing structure will approve the investment in a support programme that will last the next five to six years.

2. Overview of the Cambodian Rice Sector

2.1 Production

Cambodia is an up-and-coming player in global rice production at 9-10 million tonnes (t) of paddy production, depending on the source of data. By comparison, its neighbouring competitors produce significantly more: 25 million t in Myanmar, 33 million t in Thailand and 42 million t in Vietnam (FAOSTAT), but they also have a larger land area. Rice is the principal crop of farmers in Cambodia, with rice paddies occupying 75 percent of the cultivated land. An estimated 3 million people are employed in rice production, processing and marketing. This is more than 20 percent of the country's working-age population. The annual paddy production exceeds domestic consumption by around five million tonnes and this surplus is exported as paddy or milled rice through formal and informal marketing channels.

Cambodia has a dry and a wet rice season. The harvested area is significantly larger and consequently production is also significantly higher in the wet season, but yield is actually higher in the dry season. A useful map by USDA depicting the dry and wet season growing areas can be viewed at https://ipad.fas.usda.gov/highlights/2013/11/Cambodia/.

Many different varieties are produced in Cambodia, but broadly speaking they fall under the categories white (long grain) and fragrant, which includes jasmine. This latter group is becoming more and more prominent in export, especially to the European market. The other key producer of fragrant rice in the region is Thailand. Vietnam does not produce fragrant rice, but does export paddy sourced from Cambodian farmers. One distinct difference in Cambodia's rice production portfolio is the absence of glutinous rice. Whilst there are many glutinous rice dishes in Khmer cuisine, it is not produced at an industrial scale and part of what is consumed locally is in fact sourced from Thailand. As will be explained later in this study, this has ramifications for developing rice flour and rice starch industries that are supplied as glutinous or non-glutinous, depending on the intended application. Certain rice snacks also require glutinous rice as an ingredient.

Table 2.1 Production & Yield over Wet and Dry Season

	2016/17		2017/18		2018/19 est.	
	Yield (MT/ha)	Production (th MT)	Yield (MT/ha)	Production (th MT)	Yield (MT/ha)	Production (th MT)
Wet season	2.570	6,630	2.568	6,830	2.586	7,035
Dry season	3.857	1,986	3.855	2,120	3.831	2,184
Total	2.784	8,616	2.788	8,950	2.802	9,219

Source: USDA

2.2 Milling Capacity

There are over 800 rice mills in Cambodia, 200 of which are medium or large-scale mills. About 40 of these are millers/exporters. The top 50 companies in terms of export volume in 2018 are included in the below list. The top 25 have a capacity of over 2,000 t per month, and several have a capacity of between 10,000 and 20,000 t per month.

1 BAITANG (KAMPUCHEA) PLC.
2 CITY RICE IMPORT EXPORT CO., LTD
3 APSARA RICE (CAMBODIA) CO., LTD
4 KHMER FOODS GROUP CO., LTD
5 AMRU RICE (CAMBODIA) CO., LTD
6 PRIMALIS CORPORATION LTD.
7 INTERNATIONAL RICE TRADING (CAMBODIA)
8 GOLDEN DAUN KEO RICE MILL CO., LTD
9 GOLDEN RICE (CAMBODIA) CO., LTD
10 SIGNATURES OF ASIA CO., LTD
11 T.O.T (TRUST OUR TRADE) CO., LTD
12 NIKOLINE INVESTMENT CO., LTD
13 GOLDEN STAR RICCE MILL AND IMPORT EXPORT CO., LTD
14 W.K.R TRADING CO., LTD
15 HERBA (CAMBODIA) CO., LTD
16 WHITE GOLD IMPORT EXPORT CO., LTD
17 INDOCHINA RICE MILL LIMITED
18 LIM KHEANG HOUT IMPORT EXPORT CO., LTD
19 SARY KUNTHEA
20 THMOR KORL RICE IMPORT EXPORT CO., LTD
21 BATTAMBANG RICE INVESTMENT CO., LTD
22 GREAT GREEN & GREMENT ASIA PACIFIC (CAM) CO., LTD
23 KAMPONG THOM RICE MILL LIMITED

24 TECH SOON AGRO INDUSTRY CO., LTD
25 MEKONG ORYZA TRADING CO., LTT
26 CK RICE TRADING CO., LTD
27 EANG HEANG IMPORT EXPORT CO., LTD
28 LOR EAK HENG SEK MEAS RICE CO., LTD
29 FED RICE BATTAMBANG LTD
30 PHENG LEANG SENG IMPORT EXPORT
31 LBN ANGKOR (KAMPUCHEA) CO., LTD
32 T.M.K INVESTMENT CO., LTD
33 GREEN TRADE COMPANY
34 CAM-GRAIN DEVELOPMENT CO., LTD
35 COMMODITY IN FOCUS CO., LTD
36 PHOU POY DEVELOPMENT IMPORT EXPORT CO., LTD
37 CAMBODIAN LI SHINE INTERNATIONAL TRADE CO., LTD
38 OU TONG DEVELOPMENT (CAMBODIA) CO., LTD
39 VONG BUNHENG IMPORT EXPORT CO., LTD
40 SOK KEO IMPORT EXPORT CO., LTD
41 DOMNAK TEUK RICE CO., LTD
42 OVERSEAS FOODS IMPORT EXPORT CO., LTD
43 JIAXUAN INDUSTRY CO., LTD
44 BOOST RICHE (CAMBODIA) CO., LTD
45 ANDURIZ (CAMBODIA) SARL
46 KHY THAY CORPORATION CO., LTD
47 JING MI RICE MILL CO., LTD
48 CAMBODIAN DIAMOND SEAFOOD & AGRICULTURE CO., LTD
49 SOMA TRADING COMPANY LIMITED
50 GUOHONG (CAMBODIA) INDUSTRY CO., LTD

A growing number of mills have HACCP, GMP and/or ISO certification and a few now also have contract production agreements with farmer groups.

Some more key facts about the mills:

- Most mills run at low operating efficiency.
- Commercial mills do not produce their own paddy.
- Few mills have contract farming agreements, but this is changing.
- Lack of liquidity to pre-finance inputs to growers is a constraint to contract farming.

2.3 Standards

Milled rice exports through formal channels increased from 2010 onwards after the Royal Government of Cambodia issued a policy on the "Promotion of Paddy Production and Rice Exports". Since 2010, the rice sector and especially the milling sector have modernised rapidly and now meet the standards required in the international market. The modernisation of mills is in part thanks to an IFC advisory service intervention that worked with 19 leading rice mills and pursued upgrading and modernisation of their facilities.

Equipment upgrades also made it possible for mills to pursue Good Management Practice (GMP), Hazard Analysis and Critical Control Points (HACCP) and ISO 22000 food safety certification. The IFC furthermore worked closely with the Institute of Standards of Cambodia (ISC) and millers to develop standards, prior to which there were very few trading specifications or grading standards for milled rice. This ultimately resulted in the first Cambodian rice standards since the 1950s. Both the rice industry and the government adopted the standards. The development of the standards fostered greater collaboration in the sector, with several improvements and modifications implemented since initial adoption. The standards have led to improved quality in the rice-processing sector, and they are an important contributor to the success in increasing exports from Cambodia to international markets.

2.4 Paddy Rice Exports

Paddy rice is exported informally across land and by means of inland shipping into Vietnam and Thailand. Because this is informal and therefore unrecorded, the exact amount is unknown, but was estimated in a World Bank Working Paper in 2009 to be over 1 million tonnes to Vietnam and half a million tonnes to Thailand. These are very significant quantities. In recent years, according to the Diagnostic Trade Integration Strategy (DTIS) 2014-2018, Thailand has been implementing policy actions to protect its agricultural producers, which has curbed and quite dramatically reduced trade. Export to Vietnam in paddy form is continuing, however, and Cambodia loses significant value as a result, including in terms of value addition from milling. This export also puts a dent in husk and brand volumes, which in turn deters further processing of these products.

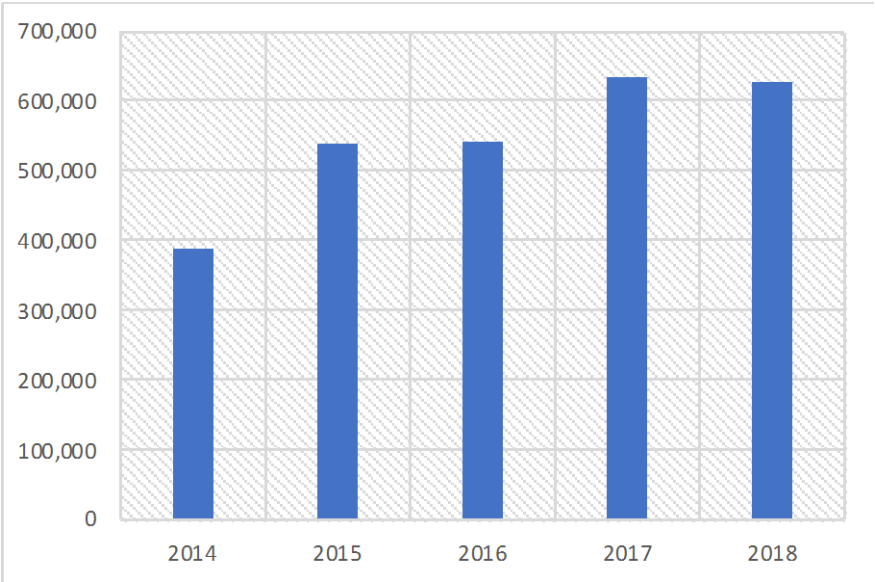
Whilst these paddy exports, which go directly from farmers across the border, are a viable option for Cambodian farmers, it should be pointed out that export of "un-milled" brown rice from Cambodia to, for example, Europe is not competitive when compared to neighbouring countries like Vietnam and Myanmar, which have lower transport and shipping costs.

2.5 Milled Rice Exports

Cambodia has made astounding progress in the last seven to eight years since millers became more efficient and internationally recognised standards were achieved. Much of the export success has been thanks to the preferential access that Cambodia has had to the European market. The export growth started to level off and declined slightly in 2018, most likely due to the safeguard measure imposed by the European Union (see below). Whilst the safeguard measure only came into force in 2019, many shipments in December 2018 were in limbo as they awaited the decision. With China now opening up its quota to Cambodia, further growth can once more be expected from 2019. As shown by the pie charts below, China has already been gaining a greater share of Cambodia's exports. Quality standards are not expected to change, as the Chinese are quite strict about food safety with respect to food product imports.

According to the USDA Global Agriculture Information Network (GAIN) report of 2018, in May 2017, China agreed to raise the purchase quota of Cambodian rice from 200,000 to 300,000 t, starting in 2018. From 2014 to 2017, led by China National Cereals, Oils, and Foodstuffs Corporation (COFCO), China imported a total of almost 400,000 t of fragrant rice, white rice and broken rice. According to COFCO, the percentage of fragrant rice exported to China from Cambodia increased from 47 to 76 percent in the same period. Cambodian rice accounts for only a small percentage of total imports into China, indicating that there is still growth potential for high-quality Cambodian fragrant and other rice exports.

Fig. 2.1 Milled Rice Exports 2014-2018 (t)



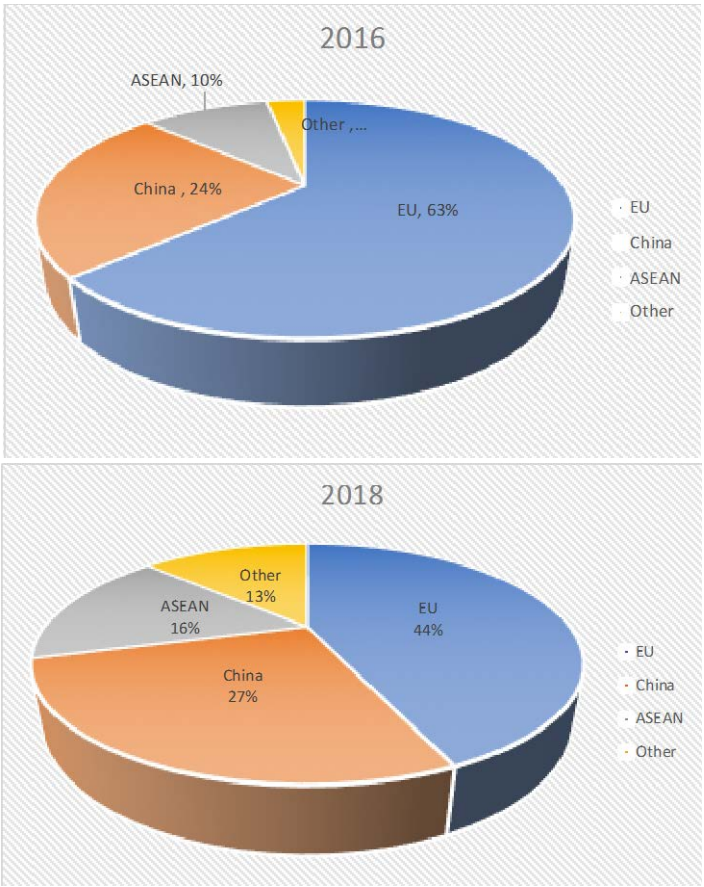
In terms of types of rice exported, fragrant rice has increasingly been the major export, with milled white long grain rice representing about one fifth of total exports and parboiled rice

representing only a small portion. Export of the latter increased in 2017, but declined once more in 2018 because several parboiled plants could not make ends meet.

Leading Destinations	MT
China	170,154
France	86,050
Malaysia	40,861
Gabon	33,060
Netherlands	26,714
Vietnam	25,712
Thailand	23,806
Poland	23,142
Belgium	19,177
UK	18,178

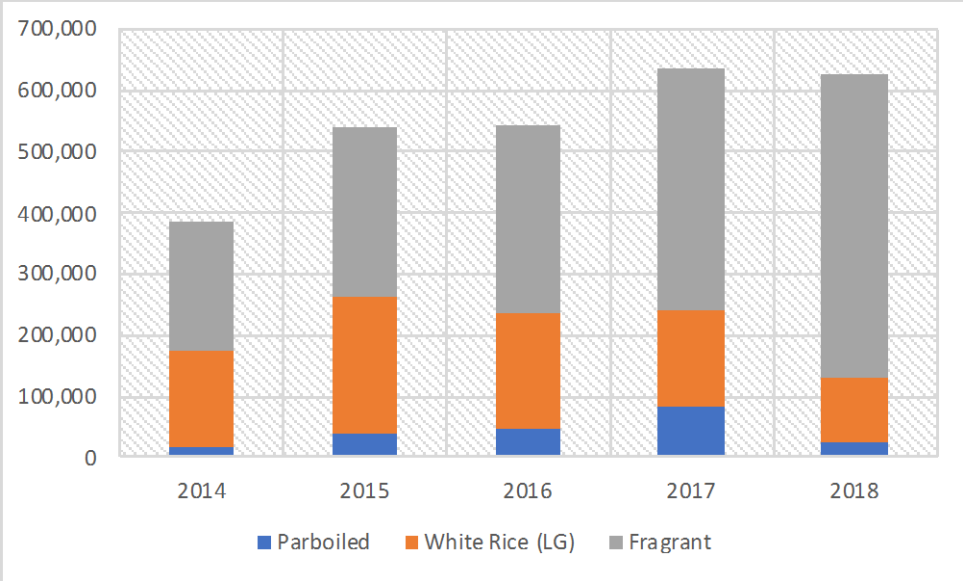
Source: MAFF

Fig. 2.2 Milled Rice Export Destinations 2016 & 2018 (t)



Source: MAFF

Fig. 2.3 Milled Rice Exports – Types of Rice (t)



Source: MAFF

2.6 Organic Rice

Two pioneering companies have recently made great progress with organic rice production and are successfully exporting several thousand tonnes of long grain as well as fragrant organic rice to Europe. One company is also succeeding in producing organic rice paper with the organic brokens. Organic production is achieved through close collaboration with several farmer groups that receive extensive training and attractive pre-agreed prices. Whilst prices are good, yields for organic production do tend to be lower, which means the total gains per hectare are less appealing than one would expect.

Organic rice is produced in select locations, as it needs to be isolated from migrating water, which is difficult to prevent in wet seasons. The highlands of Preah Vihar Province are one of the main locations for production. Whilst there is still room for expansion of the areas in which organic rice can be produced, a ceiling may eventually be reached. Nevertheless, the pioneering exporters still have bold expansion plans. AMRU Rice has set a target of 20,000 t of organic rice by 2020.

2.7 Blockchain

An interesting new development is Oxfam's introduction of blockchain, the technology behind Bitcoin. The technology that usually keeps track of cryptocurrency transactions is now being applied to ensure that vulnerable farmers get fair prices. Blocrice is intended to promote contract farming between farmers' cooperatives and exporters, rice cracker makers and other buyers. Contracts predefine the primary purchase price, trade volume, transportation method and other conditions. Payments to farmers are made through bank accounts so they can be recorded. Once a cashless payment has been made, the blockchain is updated.

2.8 Sustainable Rice Platform (SRP)

Many of the world's major commodities have established their own sustainable standard, such as palm oil (RSPO), soy (RTRS) and tea (ETI). Similarly, a growing group of pioneers, including the UNEP, GIZ, IFC and GLOBALGAP, and multiple large rice trading companies, including Mars, Olam and EBRO Foods, are establishing a sustainable standard for rice, the Sustainable Rice Platform, that is environmentally sustainable and socially responsible.

The standard sets a benchmark in the form of 12 performance indicators, covering topics like water and nutrient use efficiency, greenhouse gas emissions, health and safety, child labour, labour-productivity, etc.

The standard has yet to hit the shelves of the market in any part of the world. When it does, it is likely to offer access to market for large volumes, since big players like Mars Foods are setting very ambitious targets for becoming entirely sustainable – by 2020, in Mars' case. This implies that they will be purchasing large volumes of SRP rice and that the early adopters will be in a winning position. Cambodia is one of those early adopters. Several companies are engaging in contract farming to adopt SRP rice in close collaboration with Mars Foods and Olam International.

2.9 Branding

In January 2018, Cambodia unveiled its "Malys Angkor" rice brand, which is a certification mark for high-quality fragrant rice varieties, including Phka Rumduol, Phka Romeat, Phka Romdeng and Somaly. These varieties are premium aromatic photosensitive varieties, grown in the wet season. Certified rice must meet required specifications, dictating a minimum purity of 92 percent, a yellow kernel maximum of 0.1 percent and a chalky kernel maximum of 3 percent. Cambodia expects the brand to promote and boost exports of quality fragrant rice in international markets.

Cambodia has developed several aromatic rice varieties, such as Phka Rumduol, Phka Romeat and Phka Rumdeng, collectively representing "Cambodian Jasmine Rice", which won the "World's Best Rice" award for three consecutive years (2012 – 2014) and again in 2018.

There is no question that Cambodian fragrant rice can compete with Thailand in terms of quality, although Thai Hom Mali is much better known. In general, Cambodian premium rice sells for 22 percent less compared to Thai rice of the same quality (IFC, 2015).[1] The steep price difference is partially due to higher shipping costs when CIF expenses are compared, but is in fact mainly due to the lack of awareness and prominence of jasmine rice, and not a variable of quality. This is an indicator of lower brand value. Despite all the successes Cambodia has achieved in terms of export volume gains over the last eight years, Cambodian rice lacks name brand recognition and must therefore carve out an identity for its rice varieties.

This endeavour of achieving name brand recognition was off to a good start, with the involvement of multiple agencies like the IFC, AFD and the WIPO. A brand promotion plan was designed and initially implemented in 2016/2017, but this has unfortunately lost steam. It is vital that it be picked up again with renewed energy.

[1] The figure is slightly dated, but the steep price difference remains

An additional element of name brand recognition relates to confirming identity and clearly demonstrating that the Cambodian premium is in fact Cambodian, and that a particular shipment is indeed 100 percent of that premium grade. In line with this, a genetic fingerprint has been established for Cambodia's premium grades, which can be confirmed through DNA testing. Thailand, with the same objective, has even made this test compulsory for every export sales contract. As the price for DNA testing comes down, Cambodia should consider increased use of the genetic fingerprint.

2.10 Safeguard Measures

Italy has claimed that rice imported from Cambodia and Myanmar on a duty-free basis under the preferential Everything But Arms GSP scheme for Least Developed Countries exporting goods to the European Union has caused injury to the domestic Italian rice industry and has called for safeguard measures. After an investigation by the EU, a decision has now been made in Italy's favour. Despite efforts from Cambodia to convince the EU that fragrant rice, which is increasingly the main product being exported to the European Union, is distinctly different to Italian rice and is therefore not in direct competition, the investigation concluded that a safeguard was warranted. The safeguard imposed as of 18 January 2019 entails the introduction of a tariff on imports from Cambodia and Myanmar with progressive reduction over three years from €175/tonne in year 1 and €150/tonne in year 2 to €125/tonne in year 3.

This applies to specific EU HS Code categories falling within:

1006 30 27
1006 30 48
1006 30 67 and
1006 30 98.

Brown and broken rice therefore fall outside these categories.

As the safeguard duty imposed is a specific tariff – i.e. a specific value per tonne, regardless of the rice being imported, the impact will be higher on lower value rice. Fragrant and organic rice will therefore be less affected than plain long grain rice. At an FOB value of $400-450/tonne, translating to a CIF value of approximately €410-460/tonne, a duty of €175/tonne is severely inhibiting. Export of brown rice for further milling in Europe is unlikely to happen on a wide scale, as Cambodian prices are not competitive enough compared to those of its neighbours.

Fragrant, jasmine and organic (LG or fragrant/jasmine) are likely to continue despite the safeguard and long grain is likely to find a new market in China in response to Chinese quotas

opening up. Parboiled rice is similarly affected, as its CIF price is not much higher than that of long grain.

Other markets are also being approached by exporters, including the US, Canada, UAE and Australia.

2.11 EBA Enquiry & LDC Graduation

The Cambodian rice sector needs to brace itself for more hurdles going forward. Whilst the safeguard measure ends in three years' time, there are two looming possibilities that could block the return to zero duties that Cambodia enjoyed for exports to the EU prior to imposition of the safeguard. Firstly, the European Union has launched an enquiry related to violations of human rights that investigates whether the EBA as a whole (for all products, not just for rice) can continue. The enquiry will last for two years and Cambodia rice exporters will need to prepare for the possibility that the EBA privilege will be lost at the end of this enquiry-cum-negotiation period. The second imminent hurdle is the process of graduation from LDC to Developing Country status. Cambodia has achieved rapid economic growth over the last decade. Gross Domestic Product (GDP) per capita increased from 367 USD in 2003 to 1,138 USD in 2014 (Caussin, 2014).

Other aspects defined by the United Nations Committee for Development Policy (CDP), a subsidiary body of the UN Economic and Social Council (ECOSOC), such as poverty reduction, improvements in health care provision, nutrition and literacy, are also taken into consideration. Cambodia has made strides forward in this regard as well. The CDP evaluates and revises the status every three years based on threshold levels of per capita gross national income (GNI), human assets and economic vulnerability to external shocks. The latter two are measured by two indices of structural impediments, namely the human assets index (HAI) and the economic vulnerability index (EVI). In order to graduate out of LDC status, a country needs to surpass thresholds in at least two of the three indices. In the next triennial assessment in 2021, Cambodia stands a good chance of graduating out of its LDC lower income status. If this were to occur, Cambodia would face different tariffs, as applied to Developing Countries. This would not occur overnight, though. A grace period allowing for a smooth transition would likely apply, determined by the importing markets concerned, such as the US, Japanese and EU GSP schemes.

In short, there are further barriers down the road that Cambodian exporters have to take into account, and these not only affect rice, but all diversified products too. As is analysed in more detail later in the report, some of the diversified products would face very significant duties. For

example, rice paper export to the EU would no longer be viable when faced with a tariff equivalent to 4.50 percent + €60.50/100 kg outside a quota or 40 percent inside a quota.

2.12 Competitive position against Vietnam under the EU-Vietnam FTA

Besides possible tariff regime obstacles in the coming years in the form of a possible EBA withdrawal and/or a possible graduation out of LDC status, the Cambodian rice sector also needs to take account of its competitive tariff position compared to Vietnam. After signing an FTA with the EU, which will come into force very soon once the EU parliament gives the agreement its final stamp of approval, somewhere in the next few months, Vietnam will benefit from quotas being opened up and reduced tariffs. Some products will immediately become duty free, while this will gradually be reduced to zero over the course of three to seven years for others, depending on the product.

In the event that Cambodia loses its EBA or LDC status, it would end up facing significantly higher duties than its competition both from within the EU (as intra-EU trade is duty free) and from Vietnam. There is a possibility that Myanmar could keep its EBA status, in which case Myanmar would also be in a comparatively more advantageous position.

The table below gives an overview of the status of tariffs as per the Vietnam-EU FTA for rice and diversified rice products.

Brown rice:

Aggregate quota of 20,000 t covering the following CN codes:

1006.10.21	1006.10.92	1006.20.11	1006.20.92
1006.10.23	1006.10.94	1006.20.13	1006.20.94
1006.10.25	1006.10.96	1006.20.15	1006.20.96
1006.10.27	1006.10.98	1006.20.17	1006.20.98

Milled rice:

Aggregate quota of 30,000 t covering the following CN codes:

1006.30.21	1006.30.42	1006.30.61	1006.30.67
1006.30.23	1006.30.44	1006.30.63	1006.30.92
1006.30.25	1006.30.46	1006.30.65	1006.30.94
1006.30.27	1006.30.48	1006.30.98	1006.30.96

Milled rice:

Aggregate quota of 30,000 t covering the following CN codes:

1006.10.21	1006.20.11	1006.30.21	1006.30.61
1006.10.23	1006.20.13	1006.30.23	1006.30.63
1006.10.25	1006.20.15	1006.30.25	1006.30.65
1006.10.27	1006.20.17	1006.30.27	1006.30.67
1006.10.92	1006.20.92	1006.30.42	1006.30.92
1006.10.94	1006.20.94	1006.30.44	1006.30.94
1006.10.96	1006.20.96	1006.30.46	1006.30.96
1006.10.98	1006.20.98	1006.30.48	1006.30.98

Whilst 60,000 t of milled rice is a relatively small amount compared to Cambodia's total export to the EU of 270,000 t, it is always possible that the quotas under the FTA will expand in years to come.

Table 2.2 EU duty schedule for by-products under the Vietnam FTA

Product	Code	Duty	Category
Flour	11029050	138 eur/1000kg	A
Syrup	17023090	20 EUR/100 kg	B7
Starch	11081910	216 eur/1000kg	B7
Protein	21061020	12.80%	B3
	21061080	0% + EA	B3
Noodles	1902191020	7,7 + 24,6 EUR/100 kg	A
Paper	1905902010	4,5 + 60,5 EUR/100 kg	B3
Snacks	1904 10 30	5,1% + 46 EUR/100 kg	B5
	1904.2095	5,1% + 46 EUR/100 kg	B5

Source: Annex to EU-Vietnam FTA document

A: immediately duty free
B3: reduced in steps over three years, duty free thereafter
B5: reduced in steps over five years, duty free thereafter
B7: reduced in steps over seven years, duty free thereafter

2.13 Appetite for diversification towards higher-value rice products

The Cambodian rice sector is still at the early stages of diversification. This diversification began on the initiative of individual, entrepreneurial companies. Several have successfully ventured into higher-value rice segments like parboiled and organic and, with regard to processed products, into rice paper, noodles and crackers. Fragrant rice, particularly jasmine rice, has been mainstreamed to a significant extent. The companies that produce and export organic rice

have also integrated this into paper and noodle production. The main rice cracker producer is also adding value to the crackers by using the higher-value Jasmine head rice as a raw material.

Rice flour is only produced on a small scale and the sector is still unfamiliar with starch, syrup and protein. Rice bran oil has attracted interest from entrepreneurs and foreign investors from Japan, Thailand and Malaysia, but they have so far held back because of concerns about adequate continuous supply of fresh bran to justify the high cost of investment.

Meanwhile, a project to produce silica from rice husk ash using Russian technology is in the starting blocks and looks like it will be in operation fairly soon.

Until now, there has not been sufficient pressure or incentive to venture into diversification at a larger scale, beyond mere experiments. With the imposition of the EU safeguards, the pressure has increased significantly. In response to this pressure, the appetite for diversification has also become significantly stronger.

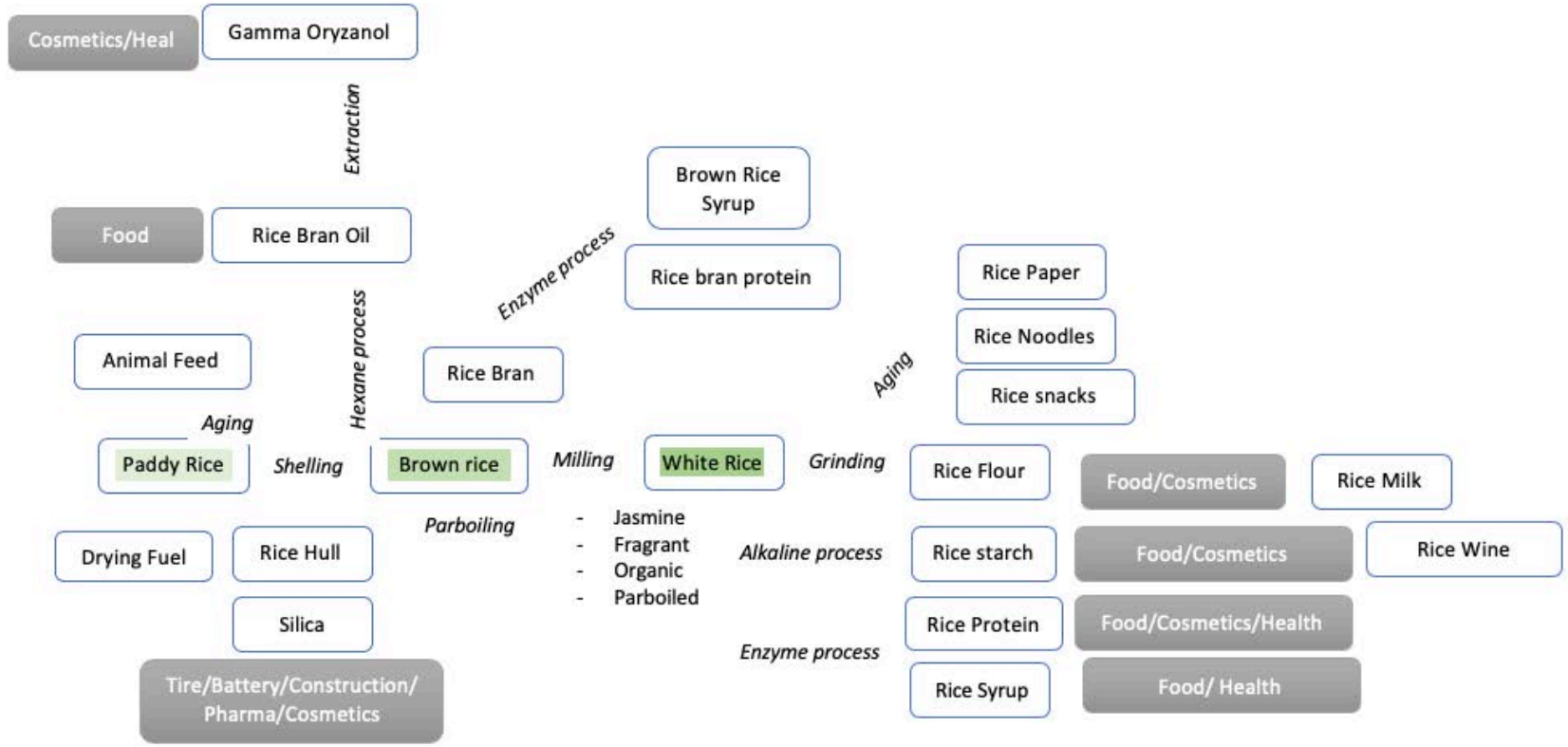
Incentives also need to be ramped up. A wait-and-see attitude and the government's "leave it to the private sector" approach will not provide the support that the sector needs to make this transformation to higher value a reality. Part of the hesitation in the enabling environment owes to a lack of expertise related to diversification. This expertise needs to be ramped up to move alignment of incentives in the right direction. Such incentives partially already exist, but are used for broader purposes and have not been shaped into a strategy.

Support from all interested parties will be required, as diversification is challenging and risky and above all will only benefit from a very short incubation period, at least for the EU market, as full duties for many products like starch, protein and noodles are substantial.

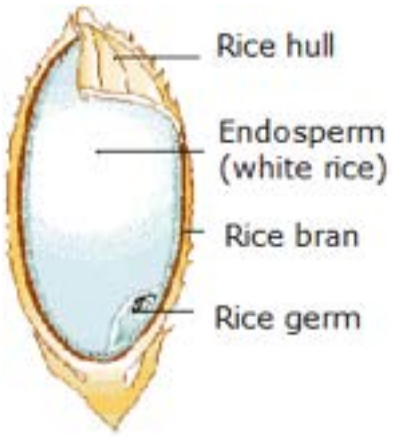
Current appetite amongst a group of the most innovative companies is focused on rice bran oil, flour, starch and noodles.

3. Product Specifications

Fig. 3.1 A diagram of the various rice diversification possibilities



Rice is one of the most consumed staple commodities worldwide. It is predominately produced and consumed in Asian countries, accounting for 90 percent of global production and 87 percent of consumption (Ricepedia.org). Outside of Asia, rice consumption is growing. Rice is a unique product. Aside from its use as a staple food, different elements of the rice grain can be processed into value-added rice products.



Source: Healthy Living

Figure 3.1 gives an overview of the broader spectrum of options for rice processing. Firstly, in paddy form, the rice is dried before it can be milled. Milling involves two stages: (1) hulling – in which the hull, also known as the husk, is removed – after which (2) the bran is removed. After the second stage, the milled rice is either "head rice", i.e. the complete endosperm, or broken. Brokens are usually categorised as large brokens and small brokens. The large brokens are used mainly for blending with the head rice to offer a broken rice percentage of e.g. 5 percent or 10 percent broken. The small brokens are either sold as "broken rice" or can be further processed. Prior to the milling stage, the "brown rice" with bran still intact is a product in its own right, preferred by some consumers as a healthier product or purchased as raw material by millers abroad.

Diversification also concerns differentiation in the form of higher-value milled rice, such as **aromatic** rice, **jasmine** rice and **organic** rice, as opposed to basic rice.

Parboiled rice production involves an additional process of boiling and drying brown rice prior to milling, with the aim of passing on more "good nutrients" from the bran and husk into the endosperm rice grain.

Husk, bran, head rice and brokens all serve as raw materials in different forms for further processed diversified rice products. The hull has traditionally been used as a **combustion fuel for drying** wet paddy or parboiled rice. In recent years, however, the production of **amorphous silica** from rice husk ash has become commercially viable, pioneered by Russian scientists and businesses. The product is high in demand for a series of industries, including the tyre industry, construction and pharmaceuticals, and Russian companies are expanding production beyond Russia into Asian rice-producing countries.

Rice bran, traditionally simply used as **animal feed** (cattle and fish), can be processed into **rice bran oil**. This cooking oil is made appealing by its high smoking point (healthy), mild flavour and a unique fatty acid profile that helps lower bad cholesterol and improve good cholesterol. In the extraction process, hexane is universally employed as a solvent to extract oil from rice bran.

Gamma oryzanol can be extracted from rice bran oil. Gamma oryzanol is a mixture of ferulic acid esters of sterols and triterpene alcohols. It consists of four molecules, bound together to a ferulic acid molecule. Various studies have also shown that ferulic acid is a potent antioxidant. Ferulic acid is also used on its own as an antioxidant in anti-ageing cosmetics. The product is highly sought after as an ingredient for both the cosmetic and health industries.

Rice flour can be produced by grinding milled rice, typically broken rice (to be precise, brown rice flour also exists, which is ground brown rice). This is an efficient use of lower-value components of the rice production process. Thanks to its gluten-free appeal, rice flour is increasingly applied in the food industry, in bakery and confectionery, for example, but also in products like baby food, due to its hypoallergenic properties and being easy to digest.

Rice starch is extracted from milled brokens through an alkaline process. An automatic by-product of this is **rice protein**, as protein and water remain after the starch extraction. Rice starch is an increasingly popular product in the food industry, because of features like its whitening properties, its ability to create a creamy texture in fat substitutes, its smoothening with melt-in-mouth properties and its long shelf life, whilst also being gluten free. Rice protein is particularly in demand for sport supplements like energy bars, protein powder or drinks and as a cosmetic ingredient.

Rice bran protein is a different kind of protein. This follows a more complex enzymatic method of extracting protein from the de-fatted rice bran.

Rice syrup is extracted from rice starch through an enzyme process. It is a versatile sweetener and is considered healthy; it is widely used in food and beverages such as soft drinks, fruit

drinks, breads, cakes, canned fruits, jams, breakfast cereals and bars, as well as dairy products. Recently, it has been used more and more for gluten-free products. Brown rice syrup is a healthier version that is supplied directly to consumers as an equivalent to golden or maple syrup for use on pancakes or waffles.

Rice noodles and **rice paper** are produced either from brokens or from a combination of head rice and brokens. Generally, the rice needs to be harder and have higher amylose content. This is of great importance for noodles especially. Aged rice (6-12 months) is required to give the noodles more structure. Aging of rice is also essential for the production of **rice snacks**, particularly Japanese snow crackers or Senbei, which are produced from jasmine head rice.

From the perspective of the European market, the following HS codes apply:

Rice • HS (Harmonised System) code 1006.20: Husked or brown rice; • HS codes 1006.2011-2017: Parboiled husked or brown rice; • HS codes 1006.2092-2098: Husked or brown rice, not parboiled; • HS code 1006.30: Semi or wholly-milled rice; • HS codes 1006.3021-3027: Parboiled semi-milled rice; • HS codes 1006.3042-3048: Semi-milled rice, not parboiled; • HS codes 1006.3061-3067: Parboiled wholly-milled rice; • HS codes 1006.3092-3098: Wholly-milled rice, not parboiled.
Rice Flour HS Code 11029050: Rice Flour
Rice Starch HS Code 108.1910: Rice Starch
Rice Protein HS Code 2106102090: Protein concentrate and textured protein substances containing less than 5 percent sucrose/isoglucose, glucose or starch, **not** based on soy (**not** whey protein – defined as having less than 1.5 percent milk fat)

Note: 2106102090 can include other vegetable proteins such as pea protein, hemp protein or quinoa protein

Note 2: trade statistics are not available at this level, but at one level higher, which does include soy-based protein, but not dairy-based (whey) protein

Rice snacks on the European market include:
Puffed or popped rice

- different types of rice crackers;
- rice cakes;
- rice chips.

Trade data on rice snacks covers the following product groups:

- HS code 1904.1030: Prepared foods obtained by swelling or roasting of rice cereals;
- HS code 1904.2095: Prepared foods obtained from unroasted rice cereals or from mixtures of unroasted rice cereals and roasted or puffed rice cereals.

[2] Puffed rice cereal crackers, also known as rice cakes, are the most commonly known form in Europe – as a preferred low-calorie health food.

Senbei crackers are usually savoury but sometimes sweet. Senbei are often eaten with green tea as a casual snack and offered to visiting house guests as a courtesy refreshment. They are not yet well known in Europe despite being healthier than many other snacks.

[2] Picture sources: Wikipedia, Makro.nl

Rice Snacks are often retailed in mixes, e.g. combined with nuts. These are known in Japan as **"Arare"** and are made from glutinous rice and flavoured with soy sauce. In Europe, they are often served at cocktail bars or parties as catering mix.

Rice Noodles

HS Code 1902191020: Uncooked pasta, not stuffed or otherwise prepared, not containing common wheat flour or meal or eggs, containing rice

Note: this code also includes other non-wheat pastas, like maize corn-based pasta

Rice Paper

HS Code 1905902090: Communion wafers, empty cachets for pharmaceutical use, sealing wafers, rice paper and similar products

Rice Syrup

HS Code 17023090: Glucose in solid form and glucose syrup, not containing added flavouring or colouring matter and not containing fructose or containing in the dry state < 20 percent by weight of fructose (excl. isoglucose and glucose "dextrose" in the form of white crystalline powder, whether or not agglomerated)

Rice Bran Oil

HS Code 15159059: Crude fixed vegetable fats and oils, in immediate packings of a content of > 1 kg, or crude, liquid (excl. those for technical or industrial uses; soya-bean, peanut, olive, palm, sunflower, safflower, cotton-seed, coconut, palm kernel, babassu, rubsen, mustard seed, linseed, maize germ, castor, tung, sesame, jojoba or oiticica oil; myrtle wax, japan wax and tobacco seed oil)

4. Weighing Diversification Options from the Cambodian Perspective

4.1 Diversified product assessment criteria

By means of desk research and prior CBI market research and by interviewing buyers, interviewing experts and studying the situation on the ground in Cambodia, the range of diversification options were evaluated from a prioritisation perspective. These prioritisation angles were also put forward to the sector in two sessions with stakeholders, one with innovative companies seeking to diversify and one with institutions in the enabling environment.

Several key criteria were used to weigh each diversification option with regard to the goal of arriving at a set of product-market combinations for further value chain investigation. It should be stressed here that this is within the context of the European market. Several diversified products make sense for other markets, but less so for Europe. The key criteria looked at included:

- level of establishment in Cambodia;
- scope for CBI to offer value;
- options/opportunities to add value;
- European market size;
- European market growth;
- European consumer trends;
- importance of regional and domestic market;
- key market requirements/import duties/comparative tariff position;
- cost of required technology;
- processing complexity;
- competition from within the EU;
- competition from elsewhere;
- joint venture options;
- logical fit with other production of diversified product(s).

4.2 Outcome of weighing priorities

Running through this set of filters gives a good foundation for assessing the products against each other in the Cambodian context and, in tandem with CBI's context, helps us to arrive at a shorter list by eliminating some products and only offering those with more scope than others. The colour coding in the tables below attempts to highlight priorities. Yellow suggests a fit, orange suggests that the product is more attractive and green is an already proven success. Grey suggests possible exclusion for various reasons.

GREY – Four diversified products are rejected:

1. Rice Bran Oil

Whilst this is a high-value product and offers excellent potential in the domestic market and in attractive high-end markets in the region, like S. Korea and Australia, rice bran oil presents a poor match in Europe. In its basic form as cooking oil, there is very little to no demand for the product in Europe. Whilst there is no market for rice bran oil in Europe, gamma oryzanol, which can be extracted from rice bran oil, does have a good market in the cosmetics and pharmaceuticals segments in Europe. However, since no rice bran oil production exists at this time, it is not realistic to expect that gamma oryzanol extraction can be achieved within the lifespan of a CBI project.

This by no means suggests that Cambodia should not consider the product as a diversified product with high potential. In fact, it is especially interesting considering that jasmine rice bran is considered ideal for making premium bran oil – this would entail great use of a priority export grain that cannot be used for starch production. Even so, there is simply no match to be found with the European market at this stage.

It should also be mentioned that it would be a challenge to set up rice bran oil production in Cambodia because of the continuous quantity of fresh (within 72 hours of milling, after which oxidation begins to occur affecting quality of the oil) bran required to justify the cost of oil extraction machinery. This is also the main reason why foreign investors have so far held back. Consolidation of mill ownership or a location that would satisfy the prerequisites for rice bran oil production may change this scenario, but rice bran oil is not yet feasible for the immediate future.

2. Amorphous Silica.

As mentioned previously, amorphous silica, produced from rice husk ash, uses a Russian technology that is now being set up in Cambodia by means of a joint venture with a local partner. Since the Russian technology supplier will also be handling the marketing of the product, which is high in demand and requires limited marketing efforts, CBI has no role to play in supporting the marketing of this product.

3. Rice Milk

Rice milk is one of the products on offer as a replacement for dairy milk for consumers with lactose intolerance, along with soy milk and almond milk. However, rice milk is doing poorly compared to soy and especially almond milk, primarily because rice milk has significantly more calories, which the diet-conscious consumers of such vegetable milk products try to avoid.

Moreover, the vegetable milk substitute market is heavily dominated by large, mostly Australian and US players and by a large Belgian player in Europe, which would make it a challenging domain for Cambodian producers to enter.

4. Rice Syrup

Rice syrup is extracted from rice starch through an enzymatic process. It is a versatile sweetener and is considered healthy; it is widely used in food and beverages such as soft drinks, fruit drinks, breads, cakes, canned fruits, jams, breakfast cereals and bars, as well as dairy products. Recently, it has been used more and more for gluten-free products. In its basic form, it is very much a commodity and does not offer significant added value compared to exporting rice. However, "brown rice syrup is a product-variant that is consumed like maple syrup on, for example, pancakes or waffles. The differentiation from maple and golden syrup can be further strengthened by offering "organic brown rice syrup". This higher-value consumer product is likewise not commonly consumed in Europe, unlike in N. America. Pakistan and India have a strong position in rice syrup, which means they would pose strong competition. They have lower shipping costs, which is important for a commodity product. In the event that Cambodia loses its LDC status, the European duty of 20 percent will also be a further hindrance.

GREEN – This category is already operating well and has seen solid growth on the European market, offering the standards sought by the market.

5. High-Value Rice

Organic, fragrant and jasmine rice have performed well in Europe in recent years. The market for organic continues to grow and jasmine and fragrant remain popular. Exports to Europe will most likely face a setback caused by the EU-imposed safeguard measure, as buyers will seek other sources to circumvent the additional duty. They are unlikely, however, to stop buying higher-value rice from Cambodia, as the duty from the safeguard measure is proportionately less for higher-value rice (since the safeguard duty is based on quantity).

In the case of parboiled rice, the value addition is insufficient, making the safeguard measure-imposed duty proportionately too high. Buyers are already shifting their sourcing of parboiled to Myanmar where a shorter grain is available. (The safeguard measure applies only to long grain parboiled with a length of grain that is more than three times the width of the grain. For grains that are between two and three times the width, the safeguard measure does not apply.) Cambodian exporters will need to seek shorter grains to continue selling parboiled. According to the expert consulted, such shorter grains are currently exported as paddy to Vietnam and could be redirected with an incentive of value addition through parboiling and by keeping the rice and its by-products inside Cambodia.

Demand for higher-value rice products, especially organic rice, remains strong in Europe. There is also further scope for achieving more brand recognition, to help negotiate prices for Jasmine rice closer to those commanded by Thailand. If SRP rice makes it to a market, this will need to be fragrant rice, as SRP offers greater volume, but not higher prices. There is also scope for further product development, e.g. through blending with products like quinoa or lentils and shifting from bulk-packed exports to smaller packaging, similar to what Thailand has achieved.

ORANGE – these products have secondary priority, offering more potential with higher value and/or larger market opportunities compared to e.g. flour or starch

6. Rice Protein

Rice protein enjoys a significantly sized market (EU markets imported 99,000 t of vegetable proteins in 2016) for a high-value product. Despite moderate growth in demand for conventional protein, growth in demand for organic rice protein is very strong and is forecast to increase rapidly in the coming years (according to Transparency Market Research). Cambodia faces tough competition from Europe and the US, however. Meanwhile, there is some scope for collaboration towards further finishing of products, for example in the health industry – crude products are produced in Cambodia and are then supplied to a partner in Europe, which completes the finishing touches with regard to taste and stability as well as packaging of, for example, a protein powder sport supplement.

The current main supplier in Asia is China, and an industry insider has suggested that concerns relating to food safety scandals are serious enough to make buyers switch supply sources. This would work in Cambodia's favour. Other market outlets also benefit from substantial demand in the USA and Asia. As a by-product of starch, protein is an attractive product to exploit, although achievability in terms of adequate raw materials does need to be considered, especially in the event of a singular focus on organic. In terms of expertise, it takes more than simply ending up with protein as a by-product of starch. Thai investors have shown some interest in providing such expertise in partnership with local starch production. In this sense, reaching an international standard within a reasonably short period of time should be possible. Currently, Cambodia enjoys a tariff advantage under the EBA, but if Cambodia were to lose the EBA or LDC advantage, it would be subject to a 12.8 percent duty, which is less prohibitive than the duties for other diversified products.

7. Rice Noodles

Noodles also have a larger market in Europe, especially when "rice pasta" is added to this category. Europe imports more than 1 million t of non-wheat pasta. Growth is driven by the

gluten-free trend, especially in Southern countries like Italy, where pasta is very frequently consumed. It is estimated that 8 percent of Italian consumers eat gluten-free pasta.

The market size, combined with the trend in which producers are seeking to switch production to countries with lower wages as the cost of machinery declines, makes rice noodles a priority choice for Cambodia in terms of diversification. At the same time, however, loss of EBA or LDC status, after which a 7.7 percent + €24.60 per 100 kg duty would apply, presents a heavy threat. This is the outside quota tariff rate. An 11 percent duty applies within a quota limit. Under the EU-Vietnam FTA, Vietnam already enjoys duty-free status for rice noodles.

Demand for organic in the rice noodle market in Europe is less present than in rice, starch and protein, although rice pasta is very frequently marketed as super healthy, "brown", "gluten-free" and "organic".

YELLOW – these products have tertiary priority, being diversified products that show potential, but have some limitations in terms of, for example, market size or strength of competition.

8. Rice Flour

The European import market is moderately large (115,000 t in 2017), though only a small percentage comes from outside the EU. However, the market is growing substantially and is quite promising, with a significant market size in Asia too. In the event of loss of LDC status or EBA, the EU duty for rice flour would be manageable at €135 per tonne, though Cambodian producers would be at a disadvantage versus EU and Vietnamese producers. Value addition could be achieved through organic flour production, pre-gelatinisation, brown flour production or exact customisation regarding application of flour in food industries. This does require special grinding methods that influence starch content, etc. Cambodia would face some limitations with its lack of glutinous rice – restricting the possibility to produce glutinous rice flour, which is important in Asian markets as well as in European markets as an application alternative.

9. Rice Starch

Rice starch has a small market (20,000 t import), although it shows progressive growth, driven by the interest in gluten-free food products and low-fat foods (for which rice starch offers a very suitable replacement). It should also be noted that most of that supply comes primarily from within Europe, which has a strong and well-protected industry. In the event that Cambodia would lose its LDC status or EBA privilege, competition against European suppliers would be tough, as they can sell their products duty-free whilst non-LDC external suppliers face

a hefty duty of €216/tonne. Thai competition is also a force to reckon with. Like with rice flour, Thailand has the added advantage of having glutinous as well as non-glutinous rice. Unlike Cambodia, it can therefore produce both types of starch. Cambodia does benefit from the increasing demand for organic rice starch. According to Transparency Market Research, this trend is predicted to continue in the coming years. Organic starch would therefore be a unique advantage for Cambodia and would be achievable in terms of raw material requirements, as starch production retains over 85 percent of rice from organic brokens. A further added advantage of prioritising rice starch production is that rice protein is a by-product by default.

10. Rice Paper

Rice paper is becoming increasingly popular with European consumers who are driven by their search for more diversity, want to try more adventurous cuisines and want to eat healthier. The opportunities for supplying organic rice paper are favourable. Competition from within Europe and from Vietnam is significant, however, and if Cambodia were to lose its LDC status or EBA privilege, the resulting EU duty would be stifling, to the tune of 4.5 percent + €60.50/100 kg. It should be noted that this is an outside quota tariff rate. An inside quota tariff rate of 40 percent also applies, which is slightly less extreme, but still stifling.

11. Rice Snacks

Europe has a sizeable market for rice snacks, with 120,000 t imported in 2017. However, only 2 percent of that is imported from outside the EU. That means that competition from within Europe is tough. Furthermore, if Cambodia were to lose its LDC status or EBA privilege, the European industry would be further protected with a hefty duty of 5.1 percent + €46 per 100 kg. European suppliers are also very on the ball when it comes to consumer and private label preferences. As private labels become more and more important, this will become a critical advantage for European suppliers. As with rice starch and flour, Cambodia faces the challenge of being unable to produce snacks that are normally made from glutinous rice, due to a lack of production thereof.

	5.Higher Value Rice (Jasmine/Fragrant/ Organic/Parboiled)	8. Rice Flour	9. Rice Starch	6. Rice Protein	4. Rice Syrup	3. Rice Milk
Final Score	Jasmine, Fragrant, Organic, SRP continued priority. Parboiled requires a shorter grain to compete under EU safeguard measure duties	Growing rapidly but face tough competition from Europe and Thailand. Strong regional market. Good demand for organic.	Demand expanding but face tough competition from Europe and Thailand, limited regional market. Strong demand for organic. Protein as a by-product. Only competitive in EU as organic.	Substantial market but face tough competition from Europe and US. Significant market in Asia and US. Strong demand for organic. By-product of starch. Only competitive in EU as organic.	Market for value added product limited. Regional market limited. Well established competition from Pakistan, India. By-product of starch.	Declining interest in product vs. almond and soy milk, strong competition from large US, Australian and Belgian companies
Value addition options	Build reputation for high quality aromatic. Shift from bulk to retail pack and easy to cook options. Focus on organic. Branding	Organic, pre-gelatinized, customization for food industry segments	Organic, purity	Organic, purity	(Organic) brown rice syrup – consumer product	
Logical fit with other products	Limited use of fragrant brokens, but Jasmine type very suited for oil	Milk	Protein (not with fragrant)	Starch	Starch	Flour
CBI Fit	Y	Y	Y	Y	Y	Y

	5.Higher Value Rice (Jasmine/Fragrant/ Organic/Parboiled)	8. Rice Flour	9. Rice Starch	6. Rice Protein	4. Rice Syrup	3. Rice Milk
Level of Establishment in Cambodia	Well	Not yet, interest expressed	Not yet, interest expressed	Not yet, interest expressed	Not yet, interest expressed	Not yet
EU Market size	LG – 530,000 MT (extra-EU) – amongst which basmati and jasmine are very popular Parboiled 170,000MT extra-EU	Moderate 7,000MT extra-EU 108,000 MT intra-EU	Moderate 1,450 MT extra-EU 18,100 MT intra-EU	Significant (51,000MT) extra EU)	As a basic commodity – Significant As an added value product – "(organic) brown rice syrup" – Small	Unknown
EU Market growth	Organic growing by 10% per year Parboiled sourcing from DCs increasing rapidly	Rapid – driven by gluten free trend	Progressive – esp. organic (+high forecast in years to come)	Moderate, Organic-rapid (+ high forecast in years to come)	Stable	Not performing well vs Soy and Almond milk
Importance for Local /Regional Markets	China quota opening significantly	China, HKG, Malaysia – more important than EU, Local market also present	Insignificant	Significant – Japan, Philippines, Singapore, India	Moderate – Philippines, S. Korea., Malaysia	Limited

	5.Higher Value Rice (Jasmine/Fragrant/ Organic/Parboiled)	8. Rice Flour	9. Rice Starch	6. Rice Protein	4. Rice Syrup	3. Rice Milk
EU Tariff & Comparative Tariff Position	Brown: 0% Broken: 0% Long grain: €175/ton VNM_FTA: 30,000MT quota duty free	EBA: 0% vs: 6.5% ad valorem VNM_FTA: 0%	EBA: 0% vs: €216/ton VNM_FTA: 7yrs grade down to zero	EBA: 0% vs: 12.8% ad valorem (for protein with <5% sucrose) VNM_FTA: 3rs grade down to zero	EBA: 0% vs: 20 EUR/100 kg VNM_FTA: 7yrs grade down to zero	
Key EU Market Requirements	Free of - Pesticide residues - Aflatoxin - Arsenic - Non-GMO - HACCP	Free of - Pesticide residues - Aflatoxin - Arsenic - Non-GMO Voluntary food safety/ quality standards e.g. BRC/ISO 22000	Free of - Pesticide residues - Aflatoxin - Arsenic - Non-GMO Voluntary food safety/ quality standards e.g. BRC /ISO 22000	Free of - Pesticide residues - Aflatoxin - Arsenic - Non-GMO - Labelling of food supplements legislation Voluntary food safety/ quality standards e.g. BRC / ISO 22000	n/r	n/r
Complexity	Low	Moderate	Moderate	As by-product of starch – Moderate As rice bran protein - Complex	Moderate	Low

	5.Higher Value Rice (Jasmine/Fragrant/ Organic/Parboiled)	**8. Rice Flour**	**9. Rice Starch**	**6. Rice Protein**	**4. Rice Syrup**	**3. Rice Milk**
Required Technology	Already acquired	Fine Milling and Sorting, Wet Milling Cost: ++	Alkaline treatment Cost: +	By-product of starch Cost: + Rice Bran Protein Cost ++	By-product of starch Cost: +	Cost: +
Competition from EU	Milling competition intensified by EU Safeguard measures	Strong (equipment intensive) Beneo, Meurens, Belourthe, Moorhead & McGavin, Lassi, Celnat, Coolax Holding	Strong AGRANA, Beneo, Belourthe, Royal Ingredients, Meurens	Strong Beneo, Caremoli, Absorice, Royal Ingredients, Celnat	Moderate – in organic segment Biona Organic, Horizon, Lima, Celnat Meurens, Cargill Inc., ABF Ingredients	Alpro B.V. , Panos Brands Llc.

	5.Higher Value Rice (Jasmine/Fragrant/ Organic/Parboiled)	8. Rice Flour	9. Rice Starch	6. Rice Protein	4. Rice Syrup	3. Rice Milk
Competition from elsewhere	Thailand Jasmine, Parboiled Lower energy cost, superior branding, larger scale, well-coordinated, better logistics Vietnam Fragrant. Not good image for residues. Lower energy cost, efficient & cheaper logistics Myanmar Parboiled, shorter grain. Lower energy cost	Thailand Pornkamon Rice Thai Flour Industry Bangkok Inter Food Burapa Prosper China Huangguo Cho Heng Lieng Tong Vietnam Tai Ky Food Flour Corp Chanh Khang Agrifood Indonesia Rose Brand	Thailand Bangkok Starch Industrial Burapa Propser China Jiangxi Golden Agriculture Biotech Co Ltd, Shaanxi, Golden Grain Group Anhui Lianhe	China Golden Grain Group Thailand Medi Foods US Ingredion (Acquired Thai – Sunflower Industries), Ribus inc., Axiom Foods, AIDP, RiceBran Technologies	Pakistan, India Nature Bio-Foods, Bharat Glucose, Shafi Gluco Chem Matco Foods Habib-ADM	US, AUS – big players The Trader Joe's Company, Vitasoy Australia Products Pty Ltd, Pacific Foods of Oregon, Inc., The Hain Celestial Group, Inc. (Dream), Pureharvest Pty Ltd., Nature's Choice Pty Ltd, Good Karma Foods Inc.

	5.Higher Value Rice (Jasmine/Fragrant/ Organic/Parboiled)	8. Rice Flour	9. Rice Starch	6. Rice Protein	4. Rice Syrup	3. Rice Milk
Basic RM export – stepping stone for JV	Brown rice	(Org)Brokens	(Org)Brokens + open to SRP	(Org) Brokens/ Brown	(Org) Brokens/ Brown	Flour
Interest in JV	Y	N - machine intensive	N - machine intensive	Y – Thai FDI (provided starch plant is in place) Also some scope for further processing collaboration in Europe		

	7. Rice Noodles	10.Rice Paper	11.Rice Snacks	1.Rice Bran Oil	2.Silica
Final Score	Very significant market size, especially in rice pasta, competition from Europe and Thailand /Vietnam/ Singapore. Shifting production to Asia possible	Small market size, progressive growth, opportunities for organic, competition in Europe and Thailand/Vietnam Shifting production to Asia possible	Significant competition from Europe – only 1% imported. But significant market. Options for organic and fair trade	No market for Rice cooking oil in Europe, Time for CMB to develop Gamma-Oryzanol likely longer than lifespan of project	No CBI fit – product will be marketed by investment partner, no role for CBI
Value addition options	Rice pasta, Fair Trade	Organic	Organic, Fair Trade	Gamma Oryzanol extraction	n/a
Logical Fit with other products	Paper, Flour	Flour, Noodles		Rice bran protein	
CBI Fit	Yes	Yes	Yes. Quite a significant product adjustment required to meet market preference. But CBI role to achieve this	Production of Gamma Oryzanol likely not to be achievable within the lifespan of a CBI project	No. The foreign partner will handle marketing of the product, therefore no role for CBI to play.
Level of Establishment in Cambodia	1 Company - successfully exporting,	2 Companies, including organic – successfully exporting to EU ISO22000 certified	1 Company – successfully exporting, not yet to EU. ISO 22000 certified	Several FDI attempts already, held back by the RM quantity challenge	1 company starting

	7. Rice Noodles	10.Rice Paper	11.Rice Snacks	1.Rice Bran Oil	2.Silica
EU Market size	$190M Sales Revenue 130,000MT import intra-EU, 2% extra-EU(non-wheat pasta)	Moderate 8,000 MT extra EU 10,000 MT intra EU	>120,000MT (98% from inside Europe)	No market in Europe for Rice Bran "Cooking Oil" only for Gamma Oryzanol	H
EU Market growth	Moderate growth	Progressive growth	Moderate growth	n/a	n/a
Consumer trends	Gluten free Healthy eating Adventurous	Gluten free Healthy eating Adventurous Sustainability	Gluten free Healthy eating Sustainability		
Importance Local /Regional Market	Local	Local	Local, Australia	Import substitution opportunity locally (imported from Thailand) Good markets in Korea, Australia	n/a
EU Tariff EU Tariff & Comparative Tariff Position	EBA: 0% vs: 7.7% + € 24.60 per 100 kg 11% non-preferential tariff quota EU-VNM FTA: Duty free immediately	EBA: 0% vs: 4.50% + 60.50 EUR / 100 kg 40% non-preferential tariff quota EU-VNM FTA: 3 year phase out	EBA: 0% vs: 5.10% + € 46 per 100 kg EU-VNM FTA: 5 year phase out	n/a	n/a

	7. Rice Noodles	10.Rice Paper	11.Rice Snacks	1.Rice Bran Oil	2.Silica
Key EU Market Requirements	- Pesticide residues - Aflatoxin - Arsenic - Non-GMO - Private food safety/ quality standards e.g BRC / ISO 22000 - SEDEX - Traceability up to mill	- Pesticide residues - Aflatoxin - Arsenic - Non-GMO Private food safety/ quality standards e.g BRC / ISO 22000	- Pesticide residues - Aflatoxin - Arsenic - Non-GMO Private food safety/ quality standards e.g BRC / ISO 22000	n/a	n/a
Complexity	Moderate	Moderate	Moderate	Bran Oil: Moderate Gamma-Oryzanol: High	n/a
Required Technology	Already known in CMB	Already known in CMB	Already known in CMB	$+++ Challenge with RM need for continuous supply of bran (<72 hrs after milling) to justify investment. Large capital required to buy up stock required)	n/a

	7. Rice Noodles	10.Rice Paper	11.Rice Snacks	1.Rice Bran Oil	2.Silica
Competition from EU / Prospective Partner	Fair Trade Original, WestMills	Koh Thai Kreyenhop & Kluche Arche Naturprodukte	Sanorice JLM Global Foods Lima Food Continental Bakeries	n/a	n/a
Competition from elsewhere	Acecook Vietnam Tuan Phong Nissin Foods Koka Noodles Tat Hui Foods Pte Ltd Chanh Khang Agrifood Cho Heng Vermicelli	Thailand Thai President Foods Vietnam Tuan Phong Vinh Thuan Production Sonaco	Thailand Namchow (Thailand) Ltd.	n/a	n/a
Basic RM export – stepping stone for JV	Head and brokens	Head and brokens	Head and brokens	n/a	n/a
Interest in JV	Y – more labour dependent than e.g. starch	Likely - – more labour dependent than e.g. starch	Likely - – more labour dependent than e.g. starch	FDI interest	Foreign partnership

5. Product-Market Combinations with growth potential

For the products (in the green, orange and yellow categories) selected for further analysis, product-market combinations with growth potential were identified and studied in more detail within that context. Particular attention was given to identifying issues along these value chains and suggesting possible solutions.

Diversified Rice Product	**Selected European Market Segments and Channels**
Higher-Value Rice	**Food Industry** (repacking and rice-based pre-cooked meals) Food Retail and Food Service
Rice Flour	**Food Industry** (gluten-free confectionery and other food products like breakfast cereals and bread crumb coatings) *Not in baby food* (whilst this is a very lucrative business, it poses a high risk for Cambodian exporters because it is extremely stringent regarding food safety – "one mistake and you are out") *Not in the cosmetics industry* – use of rice flour for talcum powder is quite limited.
(Organic) Rice Starch	**Food Industry** (fat-replacement thickener, whitener, frozen foods enhancer) *Not in baby food* (whilst this is a very lucrative business, it poses a high risk for Cambodian exporters because it is extremely stringent regarding food safety – "one mistake and you are out") *Not in the cosmetics and pharmaceutical industry* – application of rice starch in these industries is quite limited.
(Organic) Rice Protein	**Health Industry** (sport supplement drinks, bars, powders) **Food Industry** (ingredient in processed meats and in meat substitutes) *Not in the cosmetics industry* – hydrolysed rice protein has applications in skin and hair care, but the health and food

	industries are more significant segments in terms of sales volume
Rice Noodles	**Food Retail** (ethnic segment for rice noodles, mainstream for rice pasta) and **Food Service** (have a better understanding of how to prepare Asian rice noodle dishes)
Rice Paper	**Food Retail** (ethnic and mainstream) and **Food Service**
Rice Snacks	**Food Retail** (ethnic and mainstream)

6. European Market Characteristics, Trends and Requirements of the Selected Value Chains

The following diversified/higher-value rice product chains were selected for further analysis:

- higher-value rice (including organic, fragrant) – food industry & retail;
- rice flour – food industry;
- rice starch – food industry;
- rice protein – health and food industry;
- rice paper – food industry & retail;
- rice noodles – food industry & retail;
- rice snacks – food industry & retail.

In order to give the right context in which to analyse the value chains to which these products belong, it is important to first study the European market for these products in some more detail, in terms of opportunities & threats, market demand, market trends and market requirements. This chapter covers these topics for each value chain, grouped together where possible.

6.1 Higher-Value Rice

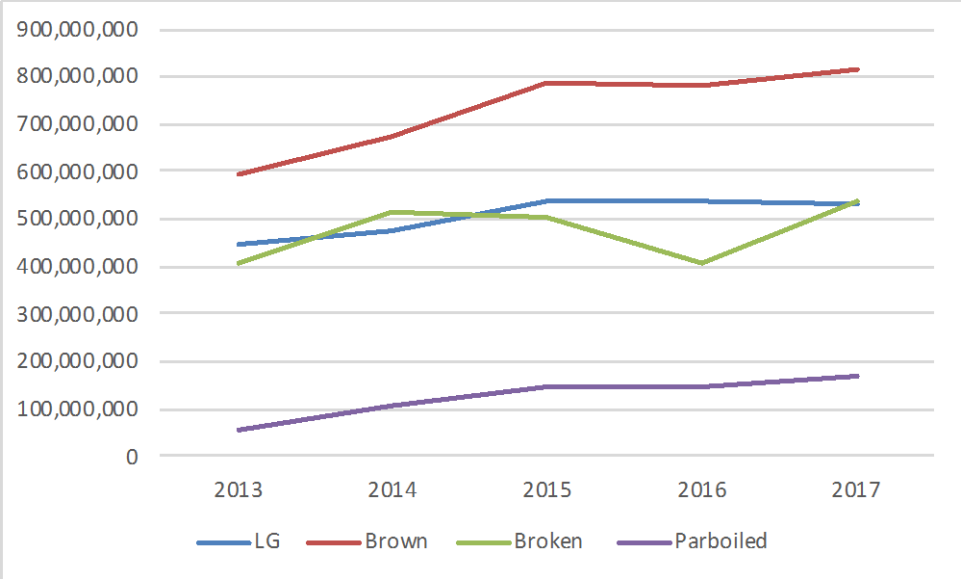
6.1.1 Opportunities & Threats

Opportunities	• growing importance of sustainability in the rice industry; • European market for organic growing at more than 10 percent annually; • growing demand for speciality rice, including aromatic rice such as jasmine and basmati rice; • growing demand for healthy convenient food products.
Threats	• strong negotiating power of European retailers; • European rice packing companies moving to the place of origin, assuring integrated supply chains; • increased competition for fragrant rice from Asian suppliers such as Vietnam; • increasingly strict legal requirements for rice, especially in terms of Maximum Residue Levels (MRLs); • Italy and Spain are already taking legal action to further extend the current three-year safeguard measure imposed; • the European Commission is conducting a human rights

	enquiry that could lead to withdrawal of EBA access for all products; • Cambodia may soon graduate from LDC status.

6.1.2 Market Demand

Fig. 6.1 Imports from outside the EU – Long grain milled, brown, broken & parboiled (in kilogrammes)



Source: Eurostat

Rice is neither a staple food nor a major crop in Europe, though it is more prominent and is grown in Mediterranean countries like Italy, Greece, Portugal and Spain in Southern Europe. Per capita consumption ranges from 3.5-5.5 kg in non-rice growing countries in the north to 6-18 kg in southern countries. Compared to around 150 kg in Cambodia, European rice consumption is very low. Production of paddy is approximately 3.1 million t, about 70 percent of what is needed for self-sufficiency, equivalent to approximately 1.8 million t milled rice (Ricepedia.org). Of this, 75 percent consists of Japonica rice. For this type, Europe is self-sufficient. Indica rice, which is a longer grain, makes up the remaining 25 percent of European production. For this variety, Europe is a large importer.

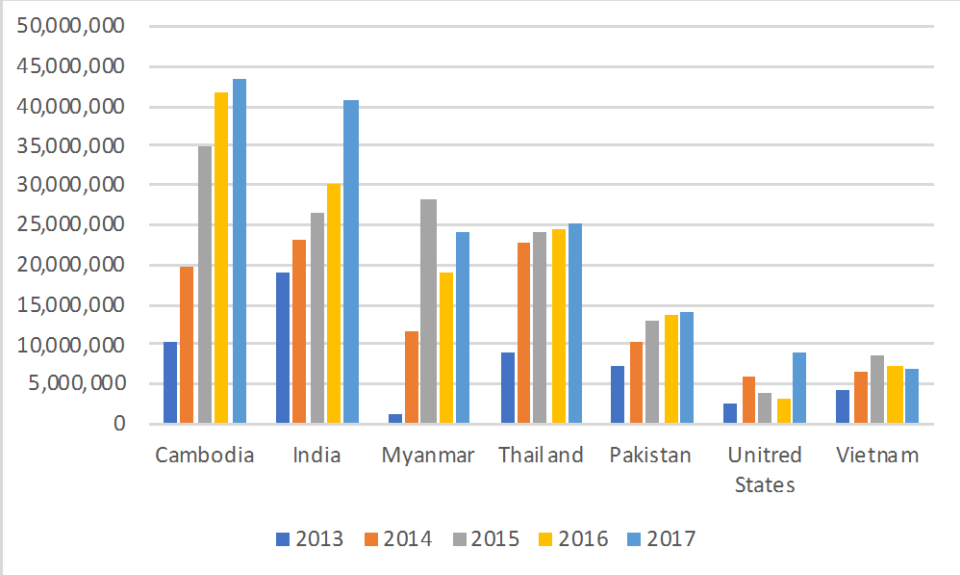
Rice trade within Europe is quite complex and difficult to analyse, with produced, exported and re-exported being all mixed up. From the Cambodian perspective, it is simpler and makes more sense to look only at EU imports from outside the trade bloc. Figure 6.1 therefore looks at imports from outside the EU-28. Most of what is imported is in fact brown rice that is fed into the European milling industry. Between 2013 and 2017, this quantity grew from 600,000 t to 800,000 t. Brokens that are fed into the European rice flour, starch and other rice derivatives

industries also represent a significant amount, surpassing half a million tonnes. India, Myanmar and Guyana are major suppliers of brown rice. Cambodia, Thailand and Vietnam also supply brown rice to Europe, but significantly smaller amounts. Turkey, China and the United States are leading suppliers of broken rice.

Parboiled rice

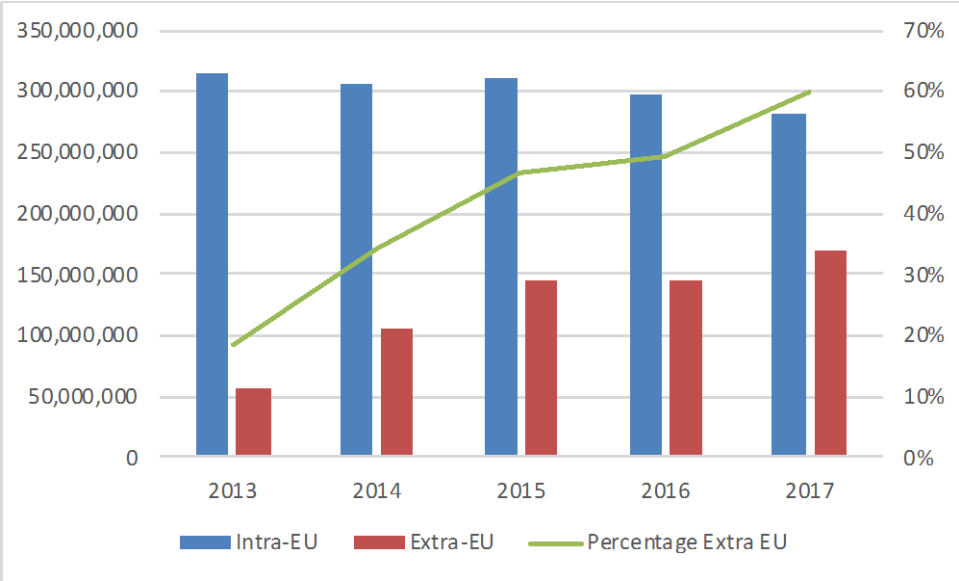
Prior to the decline of parboiled exports from Cambodia in 2018, Cambodia was the leading external supplier of parboiled to the EU. Supply of parboiled from outside the EU is a growing trend, expanding from 20 percent of intra-EU imports in 2013 to 60 percent in just five years.

Fig. 6.2 Parboiled (Long Grain) Imports from Leading Suppliers outside the EU (in kilogrammes)



Source: Eurostat

Fig. 6.3 Parboiled supply increasingly from outside the EU (in kilogrammes) (in percentages)



Source: Eurostat

Fragrant and speciality rice

Industry experts indicate that the European market for speciality rice products is growing, for example for certified rice and aromatic rice. This interest in speciality rice types has particularly benefitted basmati and other aromatic rice varieties, such as fragrant or jasmine rice from Cambodia, Vietnam and Thailand and glutinous rice. The popularity of fragrant rice is also evident from Cambodia's continuous successes in fragrant in the European market in recent years. There are small emerging niches for wild, black and red rice as well, especially on the organic and vegetarian food market.

Organic rice

The European market offers good opportunities for organic rice. Around 3 percent of the European rice market consists of organic rice. Demand for organic rice is growing by over 10 percent annually according to rice importers. Supply cannot keep up. This trend follows the overall growth in demand for organic food in Europe. The organic food market in Europe continues to grow. In 2017, it increased by almost 11 percent and reached €37.3 billion. (FiBL)

The main markets in Europe for organic food are:

- Germany (€10 billion in 2017);
- France (€7.9 billion);
- Italy (€3.1 billion);
- Switzerland (€2.4 billion).

Per capita expenditure on organic food is highest in Switzerland, amounting to €288/person.

European production of organic rice is limited. Industry sources indicate that organic production in Europe is expensive compared to organic production outside of Europe. There is a scarcity in the supply of organic rice, due to a stricter control of crop rotations. This leads to increased opportunities for suppliers of organic rice. China is the main producer of organic rice, at 322,000 hectares in 2016. This country accounted for 68 percent of organic rice production in Asia (organic-world.net and FiBL).

6.1.3 Market Trends

Health awareness

European consumers are becoming more aware of the importance of a healthy lifestyle. They take greater responsibility for their personal health. At the same time, the understanding of what it means to be healthy is changing as well. Instead of the absence of illness, consumers perceive health increasingly in terms of preventing illness and feeling good. Healthier diets play a big role in this new definition. This trend has led to growing demand for healthy rice products: brown rice, basmati rice (which both have a lower Glycemic Index level than white rice), parboiled rice and, more recently, mixtures of rice and other grains or pulses such as quinoa and lentils.

Diversity in taste

The expansion of ethnic cuisines in Europe is leading to a growing interest in lesser-known and exotic food products. This is the result of various international developments, such as migration and globalisation. Consumers are also increasingly interested in the origin of their food. A growing interest in Asian, Italian and Spanish cuisines stimulates rice consumption:

- In general, rice consumption in Europe is growing, especially in Northwestern Europe, where rice consumption is traditionally lower than in Southern Europe.

- There is also growth in Southern Europe, particularly in new rice varieties, aside from the traditional consumption of short-grain rice (Japonica).

- Demand for glutinous rice is growing, mainly due to increased consumption of sushi. Glutinous rice in Europe mainly originates from the United States.

With the increase in rice consumption, there is room to introduce greater variation within the range of products. In the past decades, many speciality rice types have found a market in Europe. This is an ongoing trend. Every rice-producing country has its own specific specialities, with differences in use/taste.

1. glutinous black rice from Thailand;
2. black rice from China, as well as Italy;
3. wild rice from North America;
4. red rice varieties from France, Thailand and Bhutan.

Convenience

On the European market, convenience in cooking is the third megatrend in food. Increasingly, consumers are looking for easier and faster ways to prepare a home-cooked meal. Convenience products include frozen and chilled ready meals. There are several options for convenience using rice products:

- pre-cooked or pre-steamed rice, which has a shorter cooking time;
- rice included in ready meals;
- rice in individual packaging;
- mixes of rice and other grains and pulses.

Pre-cooked rice was introduced to the rice market in the 1950s. For example, the Dutch rice packing company Lassie introduced Lassie Toverrijst (Miracle Rice) in 1953. Nowadays, mixes of rice and other grains and pulses have been introduced as a convenient way to prepare a healthy meal, such as a mix of rice and quinoa or lentils. Although consumers want food that is convenient, this should not compromise consumer demands for healthy and tasty food.

Sustainability

Sustainability plays a growing role in the rice sector, as it does for many products on the European market. Various initiatives exist that promote production of sustainable rice worldwide. These include the Sustainable Rice Project Group and the Sustainable Rice Platform. The standard established under the Sustainable Rice Platform has not yet hit the shelves, but going by the appetite for sustainability, the European market is likely to be one of the first to introduce it. That said, players in the industry are less willing to invest because rice is not a very exciting product on which a marketing hype can be built. Avocado, for example, would be more interesting. Rice consumption in Northern Europe is less than 5 kg per capita. That means the return on marketing investment is not quite adequate for any of the players to make the first move, and major hypermarket chains like Tesco and Carrefour are not willing to raise the retail price to absorb marketing costs.

Meanwhile, organic and Fairtrade certified rice play a growing role in the European market.

6.1.4 Market Requirements

Tariffs

As a consequence of the safeguard duty imposed by the European Union, Cambodia has lost its privilege of duty-free access for all rice products. For a selected series of products, imports from Cambodia will be subject to progressive reduction over three years, from €175/tonne in year 1 and €150/tonne in year 2 to €125/tonne in year 3. This applies to specific EU HS Code categories falling within:

1006 30 27
1006 30 48
1006 30 67 and
1006 30 98.

For all other products within the rice group 1006, the duty remains at zero tariffs under the EBA. It should be noted that the codes listed above do not include brokens or brown rice. Moreover, if grains are slightly shorter, as may be possible for parboiled (because the parboiling adjusts the shape of the grain, expanding the width somewhat), they will fall outside the safeguard measure and the duty will automatically go back to 0 percent under the EBA.

HS Code	Product Label	EU Import Duty Applied
100620	Brown Rice	0 percent under EBA, outside safeguard measure
1006 30 48	Semi-milled long grain rice, length-width ratio >= 3 (excl. parboiled)	€175/tonne
1006 30 27	Semi-milled long grain rice, length-width ratio >= 3, parboiled	€175/tonne
1006 30 25	Semi-milled long grain rice, length-width ratio > 2 but < 3, parboiled	0 percent under EBA, outside safeguard measure
1006 30 67	Wholly-milled long grain rice, length-width ratio >= 3, parboiled, whether or not polished or glazed	€175/tonne

1006 30 98	Wholly-milled long grain rice, length-width ratio >= 3, whether or not polished or glazed (excl. parboiled)	€175/tonne
100640	Broken rice	0 percent under EBA, outside safeguard measure

Source: European Customs Tariff database (TARIC)

EU Food Law

To export rice to the European food segment, suppliers need to comply with the European Union General Food Law.

Maximum Residue Levels (MRLs): maximum levels of pesticides, a major concern for buyers. The MRLs for rice are listed in the pesticides database. The European Union recently lowered the MRL for the pesticide Tricyclazole, which is used in rice production. In June/July 2017, it was decided that rice produced and imported by Europe could only contain 0.1mg/kg. Basmati rice will probably have a six-month period before the new limits come into effect. This may make it more difficult to export to Europe, especially for Cambodia (FAO Rice Market Monitor 2017). If Cambodian rice producers cannot conform to the lower MRL for Tricyclazole in Europe, exports to Europe could decrease in coming years. The Cambodian government has banned the import of Tricyclazole to ensure that rice producers stop using the fungicide. The European Union delayed the ban from June to September 2017 after Cambodian farmers complained that it was coming into effect too soon.

The Rapid Alert System for Food and Feed (RASFF) is a tool with which European countries can share information on detected risks to public health in the food chain. The RASFF database gives several border rejections and alerts for rice. The RASFF database lists far more notifications for rice from Cambodia. Rice exporters and producers need to pay special attention to common border rejections listed here. The most common border rejections and alerts for rice from Cambodia include:

- contamination with aflatoxins and ochratoxins;
- unauthorised substances in rice;
- unauthorised genetically modified rice;
- infestation with insects;
- inorganic arsenic in organic rice.

No genetically modified organisms (GMOs)

The use of genetically modified organisms (GMOs) and their derivatives is restricted in Europe. No genetically modified rice grain varieties are authorised in Europe. Unauthorised use of GMOs in rice is a cause for border rejection.

Maximum arsenic levels in rice

The European Food Safety Authority (EFSA) published a study that showed high levels of inorganic arsenic in rice. As a result, the European Commission has set maximum levels of arsenic in certain foods, including rice, in Regulation (EC) No 2015/1006. This legislation sets the following limits for rice:

Rice product	Arsenic limit
Non-parboiled milled rice (polished or white rice)	0.20 mg/kg
Parboiled and husked rice	0.25 mg/kg

Quality requirements

The minimum quality requirements for rice are covered in the Codex Alimentarius standard for rice: Codex Standard 198-1995. This standard covers husked, milled and parboiled rice for direct human consumption. ***The image of Cambodia is quite positive; producers in the country use limited pesticides, according to a rice importer. There is also no contamination with heavy metals, such as cadmium and lead.***

Food safety certification

Food safety is a top priority in all European food sectors. In addition to the mandatory HACCP standard, European food industries increasingly demand compliance with more comprehensive food safety standards.

Sustainable rice and certifications

Sustainability in the rice sector is increasingly important, although this is still a niche market. According to industry sources, sustainable rice is not readily available. They point towards several sustainability issues in the rice sector:

- low farmer incomes;
- greenhouse gas emissions, especially methane;

- irrigation and efficient water use.

Industry sources expect that sustainability will become a main requirement for rice in the future. This means that suppliers will need to pay more attention to sustainability in the future. Several initiatives promote sustainable supply of rice:

The rice project aims to develop a pragmatic and globally acceptable Sustainable Rice Practices Standard.

The Sustainable Rice Platform aims to develop and test sustainability guidelines, standards and tools.

Certification standards for rice include:

- organic certification: the market for organic rice is growing, but regulation is strict. Companies need to comply with European legislation on production and labelling of organic products;
- Fairtrade certification: Fairtrade certification is a niche market for rice. It can help products to stand out on the market. The main certification standard for rice is FLO Fairtrade (included in the Fairtrade Standard for Cereals). Meeting social requirements is not only a means of meeting the requirements of a niche market, but also an important factor contributing to the exporting country's sustainable image. The Cambodian rice sector should be aware that successful products with a social dimension like the Pad Thai of Fairtrade Original, which is directly sourced from farming communities and gives a full story of the people behind the product, is an important PR tool for the country as a sourcing destination and can be as valuable as, for example, Geographical Indications in highlighting the uniqueness of specific regions in the country.

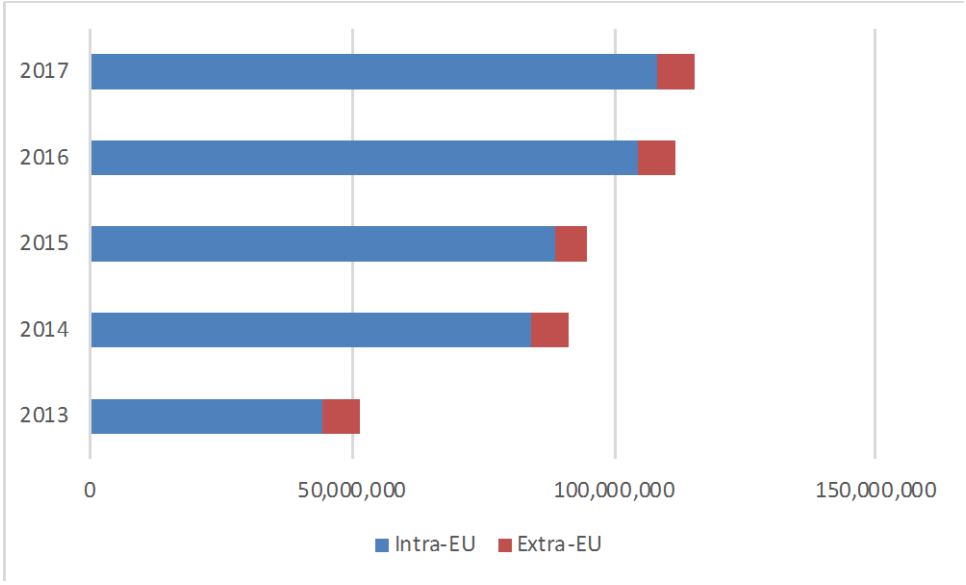
6.2 Rice Flour

6.2.1 Opportunities & Threats

Opportunities	• growing importance of a healthy lifestyle, leading to increased demand for gluten-free, natural, fat-free food products; • growing demand for organic flour; • application-based customisation for the food industry; • Cambodia's tariff preference under the GSP; • adding value to broken rice.
Threats	• consolidated market that is dominated by high-tech and specialised companies in Europe; • well-established companies in Thailand competing on the international stage.

6.2.2 Market Demand

Fig. 6.4 Rice Flour Imports from within and outside the EU-28 (in kilogrammes)



Source: Eurostat

Table 6.1 Leading Rice Flour Importers and Suppliers in the EU-28

Leading importers	Leading Suppliers (intra EU)	Leading Supplier (extra EU)
Germany	Netherlands	Thailand
France	Belgium	India
Poland	Italy	

Source: Eurostat

As figure 6.4 shows, European demand for rice flour has seen a strong surge in demand in recent years, up 124 percent in the last five years, reflecting the trends described below. Germany is a key destination taking up significantly more than other EU Member States. This could also be due to the fact that Beneo, a leader in rice flour and rice starch, is a German-owned company (part of the Südzucker Group) that has its rice-processing branch – Beneo – in Belgium. Two other key destination markets in Europe are France and Poland. All three destination markets have shown very strong growth in recent years. France has been slower to adopt the gluten-free trend, but growth is now expected to pick up strongly and France has been described as the "sleeping giant". As Fig. 6.1 shows, most rice flour is supplied from within Europe. The Netherlands, Belgium and Italy are the leading suppliers. The former country does the most re-exporting. Supply from outside Europe primarily comes from Thailand and India.

In short, demand for rice flour is in a strong upward surge in Europe, but this demand is largely being met from within Europe, which presents Cambodia with a significant challenge.

6.2.3 Market Trends

Health awareness

European consumers are becoming more aware of the importance of a healthy lifestyle. They take greater responsibility for their personal health. Rising health concerns amongst people and the increasing need for a gluten-free diet are facilitating the growth of the rice flour market. Excess gluten concentrations in food can pose a serious health threat for people with a gluten intolerance. The gluten-free property of rice is likely to increase the application of white rice flour as a gluten-free ingredient in a wide range of flour-based products, which is in turn accelerating demand for rice flour. In fact, the growth effect is stronger; the "Gluten-Free" marketing lobby is connecting with all those people who aspire to eat healthier food because of their gluten intolerance.

As a growing consumer base is embracing improved, healthier, easy-to-cook and ready-to-eat food options to suit their busier lifestyle, baked foods and snack products have been gaining traction since the recent past, in turn offering growth opportunities for rice flour.

Consumption of gluten-free food products has grown tremendously. Euromonitor forecasts that the global market will grow from an estimated $3.5 billion in 2016 to $4.7 billion in 2020. Europe was the second-largest market for gluten-free food in 2016, accounting for 25 percent of the global market (Mordor Intelligence, 2017). Within Europe, the United Kingdom is expected to grow the most rapidly.

Applications

Rice flour is a form of flour made from finely milled rice. It is distinct from rice starch, which is usually produced by steeping rice in lye. Rice flour is a particularly good substitute for wheat flour, which causes irritation in the digestive systems of those who are gluten intolerant. Rice flour is also used as a thickening agent in recipes that are refrigerated or frozen, since it inhibits liquid separation.

Many products are now, at an industrial scale, being made using rice flour as the starting material. Rice flour is now required for production of baby foods, extruded breakfast cereals and snack foods, as well as pet foods. Its appeal for baby food is particularly due to the ease with which rice flour can be digested, as compared to other types of flour, like wheat flour.

Furthermore, it is used to bake bread, pan bread, waffles, pizza, muffins, biscuits and cookies wherever wheat cannot be used. It is also used as dusting flour to separate dough pieces, for pan release and to impart crispness.

Pre-gelatinised rice flours have a water holding capacity of approximately five times their weight, making them an ideal "clean label" humectant. Its humectant properties aid in properties like cookie breakage prevention, good freeze-thaw cycling, improved scoopability of ice cream, etc.

On the basis of application, the market is segmented into bakery and confectionery, breakfast solutions, baby food and other segments. Consumption of rice flour is expected to be highest in bakery and confectionery, followed by baby food. The use of rice flour in breakfast solutions is also gaining traction. Nowadays, it is hard to pass through the breakfast cereal aisle in supermarkets without being bombarded with gluten-free marketing messages.

[3]

[3] Image sources: Nestle-cereals.com, Alara.co.uk

Applications of rice flour in cereal solutions primarily involve brown rice flour, so demand for brown flour rice is expected to surge.

By source, the global rice flour market is segmented into white rice flour and brown rice flour. According to Transparency Market Research, the white rice flour segment is expected to hold a major revenue share, whereas the brown rice flour segment is foreseen to witness higher adoption over the coming years. Based on type, the market is segmented into long grain, medium and short grain and pre-gelatinized. The medium and short grain segment is likely to be the largest through to 2025.

Versatility

Rice flour offers a wide range of versatility and as such can be custom-made for specific clients. Companies like Beneo and Belourthe have become highly specialised in such customised solutions. The versatility stems from the following:

- Rice varieties differ widely in their inherent qualities, such as glutinous vs non-glutinous.
- The flour can be prepared by either dry or wet grinding, which again results in different characteristics.
- There are different types of mills (grinders), which impart different properties to the product, including different particle sizes and starch damage.
- By using either raw rice (regular rice) or parboiled or otherwise pre-gelatinised rice, it is possible to produce flours with different properties.
- While flour is normally made from milled rice, un-milled brown rice can also be used. This imparts a different flavour as well as texture to the product made from the flour.
- Using either fresh or aged rice would also result in different product property profiles.

6.2.4 Market Requirements

Tariffs

HS Code	Product Label	EU Import Duty Applied
11029050	Rice Flour	EBA: 0 percent vs: VNM_FTA: 0 percent
		€138/1000 kg outside EBA

Source: European Customs Tariff database (TARIC)

Rice flour falls outside the EU safeguard measure, which means the EU applied duty remains zero. If Cambodia were to lose its EBA privilege or LDC status, the duty would increase to €138/tonne. Vietnamese producers already face a 0 percent duty under the EU-Vietnam FTA.

Other legal market requirements and voluntary private standards are very similar to those for starch in connection with the food industry. Therefore, please refer to the market requirements section for starch below for European market requirements for flour.

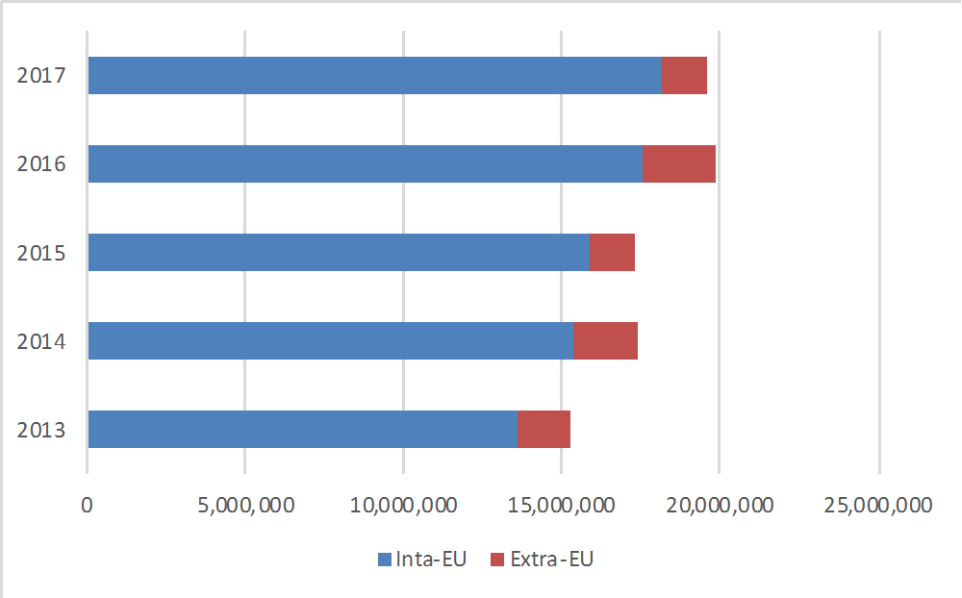
6.3 Starch & Protein

6.3.1 Opportunities & Threats

Opportunities	• growing importance of a healthy lifestyle, leading to increased demand for gluten-free, natural and fat-free food products and sport supplements; • growing European market for plant-based proteins; • growing demand for organic starch and protein; supply cannot keep up; • Cambodia's tariff preference under the GSP; • adding value to broken rice.
Threats	• consolidated market that is dominated by high-tech and specialised companies in Europe and North America; • If EBA/LDC status is lost, high import tariffs to protect the starch industry in Europe.

6.3.2 Market Demand

Fig. 6.5 Rice Starch Imports from within and outside the EU-28 (in kilogrammes)



Source: Eurostat

Table 6.2 Leading Rice Starch Importers and Suppliers in the EU-28

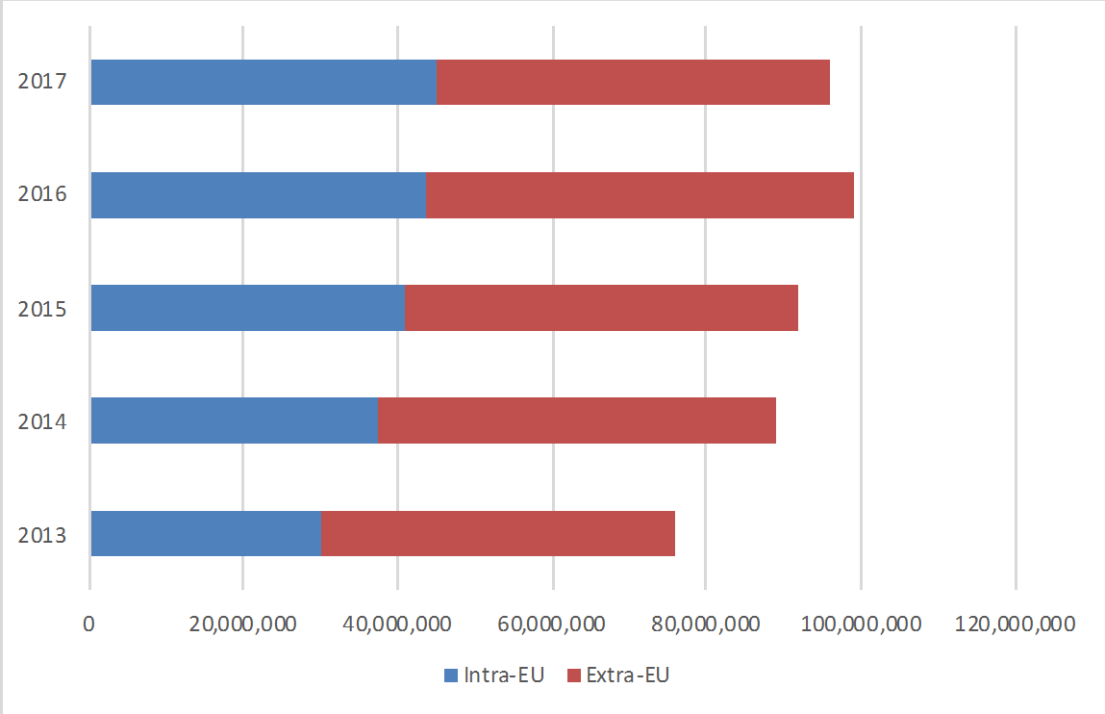
Leading importers	Leading Suppliers (intra EU)	Leading Supplier (extra EU)
Denmark	Belgium	Thaiand
Italy		
Germany		

Source: Eurostat

Whilst rice starch is generally more costly than other types of starch, its granules are the smallest amongst all commercially available food starches, with granule sizes in the range of about 2 to 8 micron. This makes rice starch ideal for creating soft and creamy textures that can be used as fat substitutes in yoghurts and deserts, for example. It also has a unique amylopectin structure, giving it exceptional shelf-life stability. Its structural characteristics also render it highly digestible, making it a popular ingredient in infant food products. The product is therefore highly sought after in the European food industry. Nevertheless, the quantities of rice starch imported into Europe are not very large (even taking into account that rice starch is lighter than flour). This market is showing growth, however. In 2017, imports were up 28 percent from imports in 2013. Belgium is a key supplier within Europe and its supply is expanding rapidly. The amount of extra-EU imports compared to intra-EU imports is larger for

rice starch than for rice flour. However, supply from the main supplier – Thailand – has been declining in recent years.

Fig. 6.6 Vegetable Protein Imports from within and outside the EU-28 (in kilogrammes)



Source: Eurostat

Table 6.3 Leading Vegetable Protein Importers and Suppliers in the EU-28

Leading importers	Leading Suppliers (intra EU)	Leading Supplier (extra EU)
France	Netherlands	United States
Germany	Belgium	Serbia (mainly soya protein)
UK	UK	
Be;gium	Denmark	

Source: Eurostat

There is strong demand for vegetable-based proteins in Europe – reaching almost 100,000 t in 2016 – and this demand has been expanding in recent years. In contrast to other rice by-products, a larger share is imported from outside the EU; the United States and Serbia are key players.

6.3.3 Market Trends

Health awareness

European consumers are becoming more aware of the importance of a healthy lifestyle. They take greater responsibility for their personal health. This trend has led to growing demand for natural, low-fat products with clean labels, gluten-free products and sport supplements. This is creating opportunities for rice starch, as a fat replacement, as well as rice protein. Consumers see plant proteins as healthier alternatives to animal proteins and as having a reduced impact on global warming.

The healthy living trend also reinforces the popular view that natural health products are safer than synthetic alternatives. Formulators can make tailor-made gels with a wide range of properties by using different rice starches. These would all still be called rice starch on a final product, which fits the clean label trend[4] in Europe.

A key segment is the market for sport supplements, which is expected to grow by 9.1 percent annually from 2014 to 2020 on a global level. This growing demand is another result of the changing perception of health. Consumers are increasingly aware that maintaining physical health and fitness are important.

Traditionally, these supplements were mainly consumed by athletes and bodybuilders. Now, more and more other consumers take supplements for health and fitness as lifestyle users. Also, such supplements are used not only during or shortly after training, but also to recover from sports. Protein powders are expected to hold the largest market share in sport supplements in 2020.

[4] Clean label trend – food manufacturers are striving to be more transparent, showing more natural and fewer synthetic ingredients

Convenience

On the European market, convenience in cooking is an important trend. Time-pressed consumers do not have time to prepare a home-cooked meal. Convenience products include frozen and chilled ready meals. Although consumers want food that is convenient, this should not compromise consumer demands for healthy, natural and authentic foods.

This trend offers opportunities for rice starch and protein. Rice protein is used in energy bars and meal replacements. Frozen products present opportunities for rice starch, due to its ability to keep the same texture when it is frozen and thawed. Because its granules have a similar size to fat globules, rice starch can mimic a full-bodied fatty mouthfeel. It provides creamy textures and can serve as a natural fat replacer.

Sustainability

The European market offers good opportunities for organic rice protein and starch. Demand is growing, but supply cannot keep up. This trend is the result of the growing importance of a healthy lifestyle, combined with a society that is more focused on sustainability. A growing concern for animal welfare has also led to an increase in demand for plant proteins as a meat substitute. Moreover, the environmental impact of vegetable protein is much lower when compared to that of animal protein.

6.3.4 Market Requirements

Tariffs

HS Code	Product Label	EU Import Duty Applied
1108191000	Rice Starch	EBA: 0 percent vs: €216/1000kg
2106102090	Protein concentrate and textured protein substances containing less than 5 percent of sucrose/isoglucose, glucose or starch, **not** based on soy (**not** whey protein – defined as having less than 1.5 percent milk fat)	EBA: 0 percent vs: 12.8 percent

Source: European Customs Tariff database (TARIC)

European Food Law

To export rice protein and starch to Europe, suppliers need to comply with European legislation for food, cosmetic or health ingredients, depending on the use of the components in Europe. For use in food, rice parts need to comply with the European General Food Law.

The Rapid Alert System for Food and Feed (RASFF) is a tool with which European countries can share information on detected risks to public health in the food chain. The RASFF database gives several border rejections and alerts for rice. Producers should pay special attention to prevent the most common causes, such as:

- contamination with aflatoxins and ochratoxins;
- unauthorised substances in rice;
- unauthorised genetically modified rice;
- infestation with insects.

Food safety and quality management

Especially for the health market segments, demonstrating food safety and quality management is key. If exporters can show that they have good food safety and quality management systems, they can create a competitive advantage.

Food safety: food safety is a top priority in all European food sectors. In addition to the mandatory HACCP standard, European food industries increasingly demand compliance with more comprehensive food safety standards. The most common standards include:

- International Standard Organization (ISO) 22000 – international standard for food safety management. This standard specifically targets food manufacturers and includes HACCP. The Food Safety System Certification 22000 allows for certification according to ISO 22000;
- British Retail Consortium Global Standard for Food Safety – provides technical standards for food safety, consumer products, packaging, storing and distribution. It is a widely accepted standard in Europe and key to entering the market with rice protein, according to industry experts;
- International Food Standard – safety standard for food processors and packers; industry experts indicate that this is an important standard for rice protein.

Sustainability and certifications

European buyers are increasingly paying attention to the social and environmental impact of their business. This is in response to consumers becoming increasingly aware of the social and environmental impact of their purchases. The market for organic rice protein is growing, but regulation is strict. Companies need to comply with European legislation on production and labelling of organic products. Industry sources indicate that, for both products, there is a growing demand for organic certification.

Quality requirements

Starch quality and protein quality are affected by differences in the variety or cultivar, growing conditions and processing practices. For both products, it is important that exporters develop products with a consistent quality. European companies specialise in developing a range of starches with different applications in final products. General rice starch quality depends on:

- purity of the starch (low moisture, protein and ash content);
- molecular composition;
- textural properties;
- gel consistency.

In general, the quality of rice protein powder mainly depends on:

- chemical composition;
- moisture content;
- protein levels of the product.

Many buyers have additional quality requirements. Exporters need to discuss with their buyers what these quality needs are and to what extent they can meet these requirements. These can go beyond legislation and standards, especially if producers target the health market segment. Requirements are established in buyer specifications. For example, requirements can relate to:

- active ingredient content;
- moisture content;
- contaminants;
- residues.

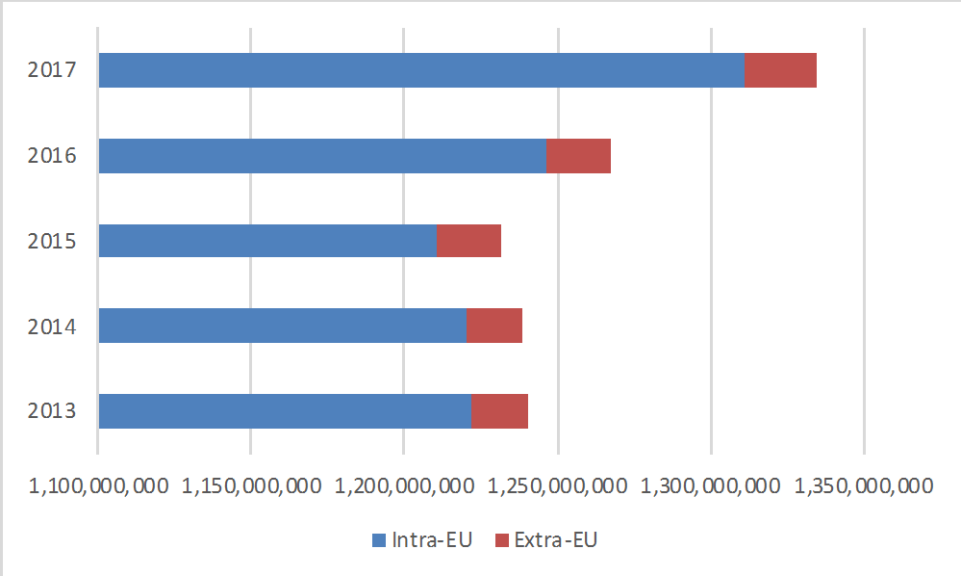
6.4 Noodles, Paper and Snacks

6.4.1 Opportunities & Threats

Opportunities	• growing awareness of the importance of a healthy lifestyle; • growing demand for gluten-free food products; • growing demand for sustainable rice noodles and snacks; • increasing interest amongst consumers in exotic food products; • growing potential to produce rice noodles in countries of origin, as machinery is becoming less expensive; • Cambodia's tariff preference under the GSP.
Threats	• consolidated market dominated by few suppliers in Europe and Asia; • strong competition from European suppliers that dominate premium and niche market segments; • the competitive advantage of European brands in terms of brand power and market knowledge, catering to growing private label requirements, including product development, marketing, consumer preferences and legal issues; • large-scale rice noodles and snack producers in Asia that dominate low segments; strong competition from current suppliers; • if EBA/LDC status is lost, high import tariffs to protect the starch industry in Europe.

6.4.2 Market Demand

Fig. 6.7 Non-wheat Pasta Imports from within and outside the EU-28 (in kilogrammes)



Source: Eurostat

Table 6.4 Leading Non-wheat Pasta Importers and Suppliers in the EU-28

Leading importers	Leading Suppliers (intra EU)	Leading Supplier (extra EU)
France	Italy	Turkey
Germany	Spain	Thailand
UK		

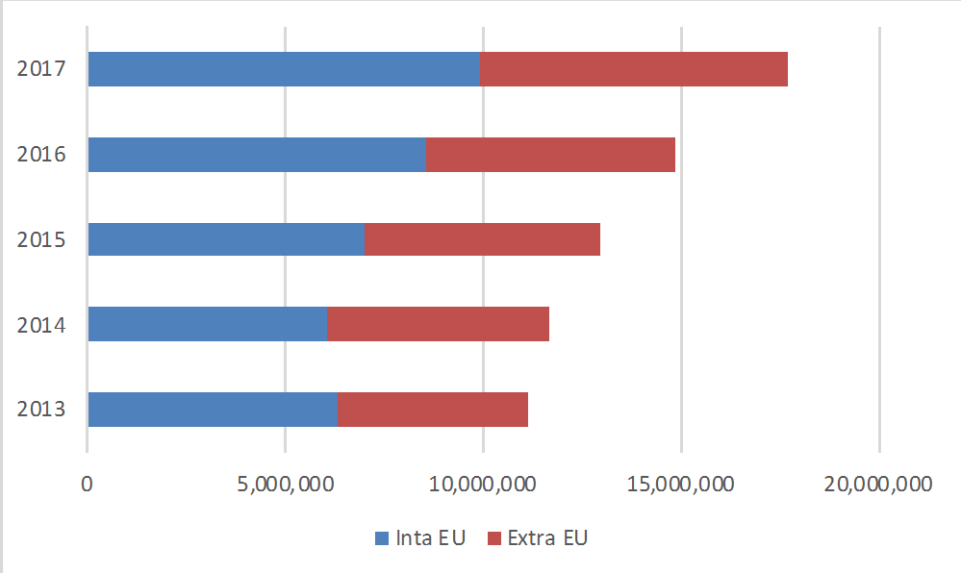
Source: Eurostat

Whilst the above graph is not entirely representative of rice noodles and rice pasta, as the category also includes other types of non-wheat pasta, including maize and quinoa, it shows the magnitude of the market and the recent, very substantial increase in imports. Italy remains a key supplier, but Turkey and Thailand are emerging as important suppliers from outside the EU. In the case of Thailand, it can be expected that this is primarily rice based. (Turkey is not a major rice producer – its non-wheat pasta supplies are likely to be maize corn-based.)

Germany, France and the UK are the largest markets for rice noodles in Europe. This reflects the growing demand for ethnic and Asian cuisines, combined with a growing population of consumers from Asian and Middle Eastern descent. In recent years, these trends have led to a growing number of noodles retail shops and Asian restaurants in Europe, including Germany and France.

Italy and Spain are also important markets for rice noodles. Although Italy is traditionally a large consumer of wheat pasta, Mintel estimates that 23 percent of Italians are reducing their pasta consumption for health reasons. Consumption of gluten-free pastas, such as rice noodles, is growing. Currently, 8 percent of Italians eat gluten-free pasta at least once a week. In Spain, consumption of chilled pasta and instant noodles is seeing the largest growth.

Fig. 6.8 Rice Paper Imports from within and outside the EU-28 (in kilogrammes)



Source: Eurostat

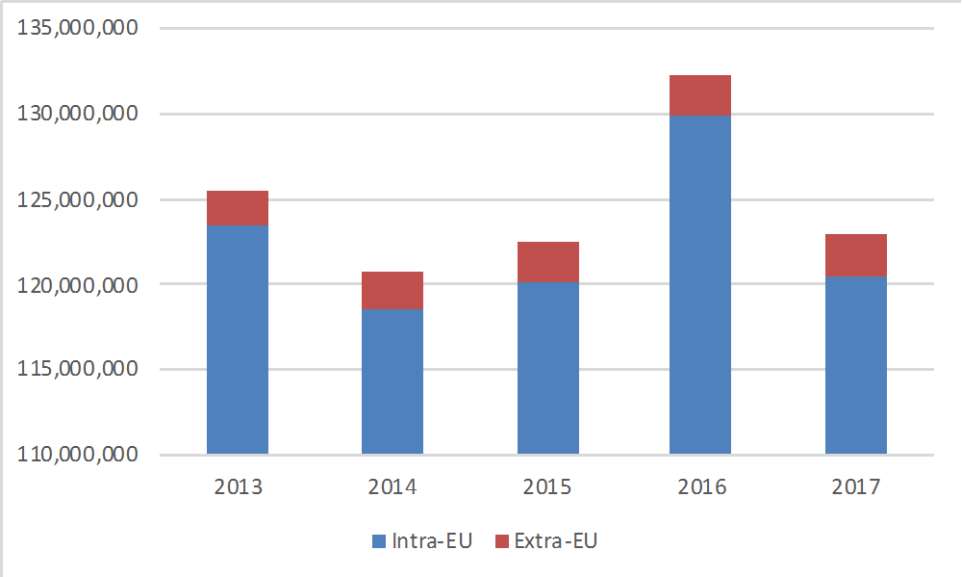
Table 6.5 Leading Rice Paper Importers and Suppliers in the EU-28

Leading importers	Leading Suppliers (intra EU)	Leading Supplier (extra EU)
Belgium	Germany	Vietnam
Germany	Netherlands	
Romania	Spain	& small qty from Cambodia

Source: Eurostat

As a result of the health trend – fresh rice paper spring rolls being similar to eating a salad – and European consumers' interest in different tastes, rice paper is becoming increasingly popular. The above graph reflects these trends, showing the growth that has taken place in recent years. Vietnam's position as the leading external supplier is rapidly getting stronger. This trend can be expected to continue, as the duty applied to Vietnamese rice paper will be phased out over the next three years as per the EU-Vietnam FTA. Within the EU, Germany is the leading supplier.

Fig. 6.6 Puffed Rice Snacks from within and outside the EU-28 (in kilogrammes)



Source: Eurostat

Table 6.7 Leading Puffed Rice Snacks Importers and Suppliers in the EU-28

Leading importers	Leading Suppliers (intra EU)	Leading Supplier (extra EU)
Belgium	Gernany	Switzerland
France	Spain	Australia
UK	UK	USA
		UAE

Source: Eurostat

Snacks find a significant market in Europe, reaching imports of over 130,000 t in 2016. Considering how light these snacks are, this is a considerable volume. This data also fails to capture the full picture, as domestic production and sales are not included in international trade statistics. For example, the amount produced by the Dutch company Sanorice and consumed in the Netherlands is not included. Moreover, puffed rice snacks do not represent all rice snacks, so the market for rice snacks is in fact larger. The graph above highlights the fact that the share of supply from outside Europe is very small, as well as Asia's small portion in that share.

6.4.3 Market Trends

Health awareness

As mentioned before, European consumers are becoming more aware of the importance of a healthy lifestyle and a healthy diet. This leads to opportunities for various rice noodles and

snacks, such as popped rice grains or rice cakes as a healthy snack. Rice, especially whole-grain brown rice, is seen as a healthy food product. Rice cakes and popped rice grains are commonly low in fat and provide fibres if they were made using brown rice. Rice noodles also benefit from this trend. Consumers commonly see these products as healthier substitutes for instant and plain noodles and wheat pasta.

The health trend leads to a growing demand for gluten-free food. Only a small percentage of the global population has been diagnosed with celiac disease and needs to buy gluten-free food products. Some other conditions, such as irritable bowel syndrome, may also require a gluten-free diet. Many other consumers buy these products because they believe these products are healthier.

Consumption of gluten-free food products has grown tremendously. Euromonitor forecasts that the global market will grow from an estimated $3.5 billion in 2016 to $4.7 billion in 2020. Europe was the second-largest market for gluten-free food in 2016, accounting for 25 percent of the global market (Mordor Intelligence, 2017). Within Europe, the United Kingdom is expected to grow most rapidly.

This growing market offers a great opportunity for food products based on rice, such as rice noodles and rice snacks. At the same time, the market for gluten-free products is very competitive. Leading brands focus on innovation in products to increase their market share.

Diversity in taste

The expansion of ethnic cuisines in Europe is leading to a growing interest in lesser-known and exotic food products. Consumers are also increasingly interested in the origin of their food. This offers opportunities for rice noodles and snacks, in the form of rice snacks with seasonings that are specific to the place of origin, or rice noodles that are traditionally produced in a particular region, for example. European and international brands use this interest in how they market rice snacks and noodles. For example, the Dutch company Koh Thai markets its product range, including rice noodles, based on the notion that consumers will be able to produce an authentic Thai meal at home. The company also includes recipes on its website.

Overall, rice noodles (as consumed in Asia) are still quite unknown in Europe, so boosting awareness could lead to a revolution for this product, making consumption of rice noodles comparable to current pasta consumption.

Convenience

On the European market, convenience in cooking is an important trend. Time-pressed consumers do not have time to prepare a home-cooked meal. Convenience products include frozen and chilled ready meals, such as instant noodles or noodle soup. Although consumers want food that is convenient, this should not compromise consumer demands for healthy, natural and authentic foods. This trend also influences the way consumers eat. Consumers eat snacks throughout the day and have many options to buy them. According to Grand View Research, the growing demand in Europe for healthier convenience food products led to an increase in easy-to-prepare instant rice noodles, for example with low salt.

Sustainability

Sustainable rice noodles and snacks take up a small part of the total market. The supply of these products from Asia is limited. This market is dominated by European and North American manufacturers. Examples include organic brown rice noodles from Clearspring (United Kingdom) and organic and fair trade rice noodles from King Soba (United States).

6.4.4 Market Requirements

Tariffs

HS Code	Product Label	EU Import Duty Applied
1905902010	Rice Paper	EBA: 0 percent vs: 4.5 percent + €60.50/100 kg Non-preferential tariff quotas apply – in this case, under 33 or 40 percent
1902191020	Rice Noodles	EBA: 0 percent vs: 7.7 percent + €24.60/100 kg
1904 10 30	Prepared foods obtained by swelling or roasting of rice cereals	EBA: 0 percent vs: 5.1 percent + €46/100 kg
1904.2095	Prepared foods obtained from unroasted rice cereals or from mixtures of unroasted rice	EBA: 0 percent vs: 5.1 percent + €46/100 kg

	cereals and roasted or puffed rice cereals	

Source: European Customs Tariff database (TARIC)

As has been mentioned previously, EU duties without the benefit of EBA will be hefty for all three of these products. Rice paper will suffer the most, and EU duties will likely stop the possibility of pursuing rice paper further in Europe altogether.

EU Food Law

To export rice noodles, rice paper and snacks to Europe, suppliers need to comply with the European General Food Law. The Rapid Alert System for Food and Feed (RASFF) is a tool with which European countries can share information on detected risks to public health in the food chain. Producers should pay special attention to prevent the most common causes. The most common border rejections for rice noodles are:

- high metal content, such as aluminium;
- absence of health certificate;
- unauthorised genetically modified rice noodles,

Listed border rejections for rice snacks and crackers include:

- contamination with aflatoxins;
- absence of health certificate;
- unauthorised genetically modified rice crackers.

Maximum arsenic levels in rice and derivatives

The European Food Safety Authority (EFSA) published a study that showed high levels of inorganic arsenic in rice and rice products. The highest levels were found in rice cakes. For example, a study found high levels of arsenic in rice breakfast cereals. As a result, the European Commission has set maximum levels of arsenic in certain foods, including rice and its derivatives, in Regulation (EC) No 2015/1006.

This legislation sets the following limits for rice:

Rice product	Arsenic limit
Rice waffles, rice wafers, rice crackers and rice cakes	0.30 mg/kg
Rice destined for the production of food for infants and young children	0.10 mg/kg

No genetically modified organisms (GMOs)

The use of genetically modified organisms (GMOs) and their derivatives is restricted in Europe. No genetically modified rice grain varieties are authorised in Europe.

Sustainable food and certifications

European buyers are increasingly paying attention to the social and environmental impact of their business. Consumers are increasingly aware of the social and environmental impact of their purchases. Processed foods can also be certified to show their sustainability. The most common certification standards include:

- organic certification: the market for organic food is growing, but regulation is strict. Companies need to comply with European legislation on production and labelling of organic products;
- Fairtrade certification: Fairtrade certification is a niche market for rice noodles and snacks. It can help products stand out on the market. The main certification standard on the market is FLO Fairtrade.

Quality and food safety requirements

Industry sources indicate that, to develop the rice noodle industry in Cambodia, producers need to be experienced in quality and food safety audits, negotiations with customers and consumer preferences on the European market. They could overcome these challenges by cooperating with European companies. Quality requirements are determined by buyers, who respond to consumer wishes. Producers selling rice snacks and noodles need to be able to match demand from these buyers. If they sell directly to consumers, they need to be able to meet consumer demand. Quality requirements include:

- taste and flavour;
- appearance;
- shape;
- grade;
- cooking characteristics, if applicable.

Food safety is a top priority in all European food sectors, especially for companies who want to sell rice snacks and noodles directly to consumers. In addition to the mandatory HACCP standard, European food industries increasingly demand compliance with more comprehensive food safety standards. The most common standards include:

- International Standard Organization (ISO) 22000 – international standard for food safety management. This standard specifically targets food manufacturers and includes HACCP.

The Food Safety System Certification 22000 allows for certification according to ISO 22000;

- British Retail Consortium Global Standard for Food Safety – provides technical standards for food safety, consumer products, packaging, storage and distribution. It is a widely accepted standard in Europe;
- International Food Standard – safety standard for food processors and packers.

Packaging and handling requirements

Rice noodles and snacks should be kept dry, dark, cool and well ventilated during storage, loading and shipping. Moreover, rice noodles and snacks need to be packed in such a way as to prevent breaking during transport. Rice noodles are commonly packed in plastic bags in cardboard boxes.

Food contact materials

Exporters who want to market rice snacks and noodles directly to consumers need to comply with requirements on food contact materials. In Europe, there are specific health control provisions for consumer packaging materials that come in contact with food. These materials cannot:

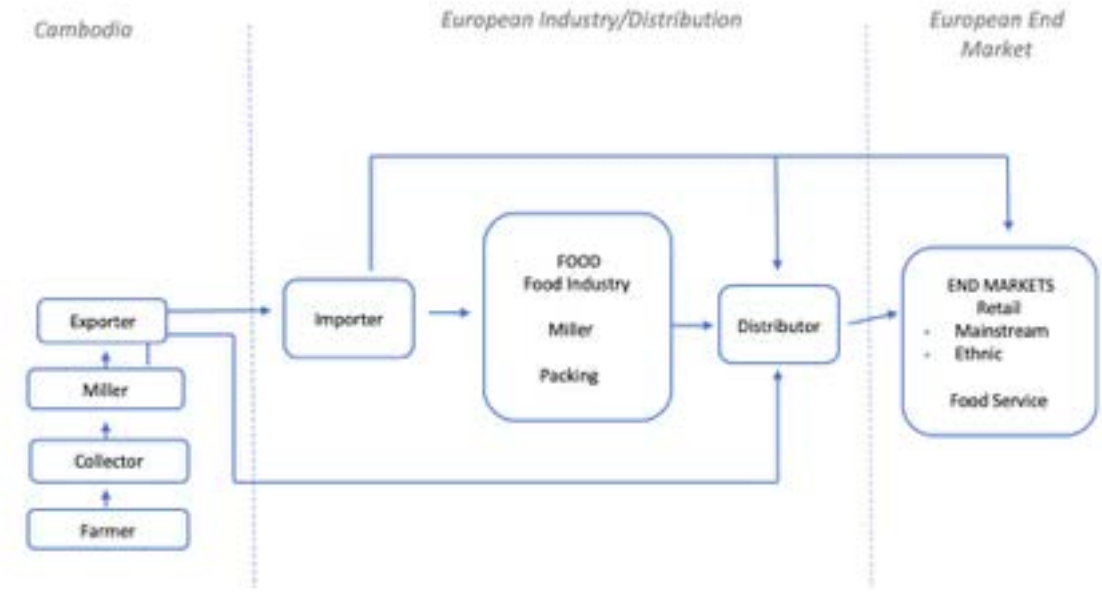
- endanger human health;
- change the composition of the food in an unacceptable way;
- deteriorate a product's taste and odour.

Commonly restricted substances include:

- vinyl chloride monomer;
- N-nitrosamines;
- N-nitrosatables;
- BADGE;
- NOGE;
- BFDGE;
- heavy metals.

7. Structure of the Selected Value Chains

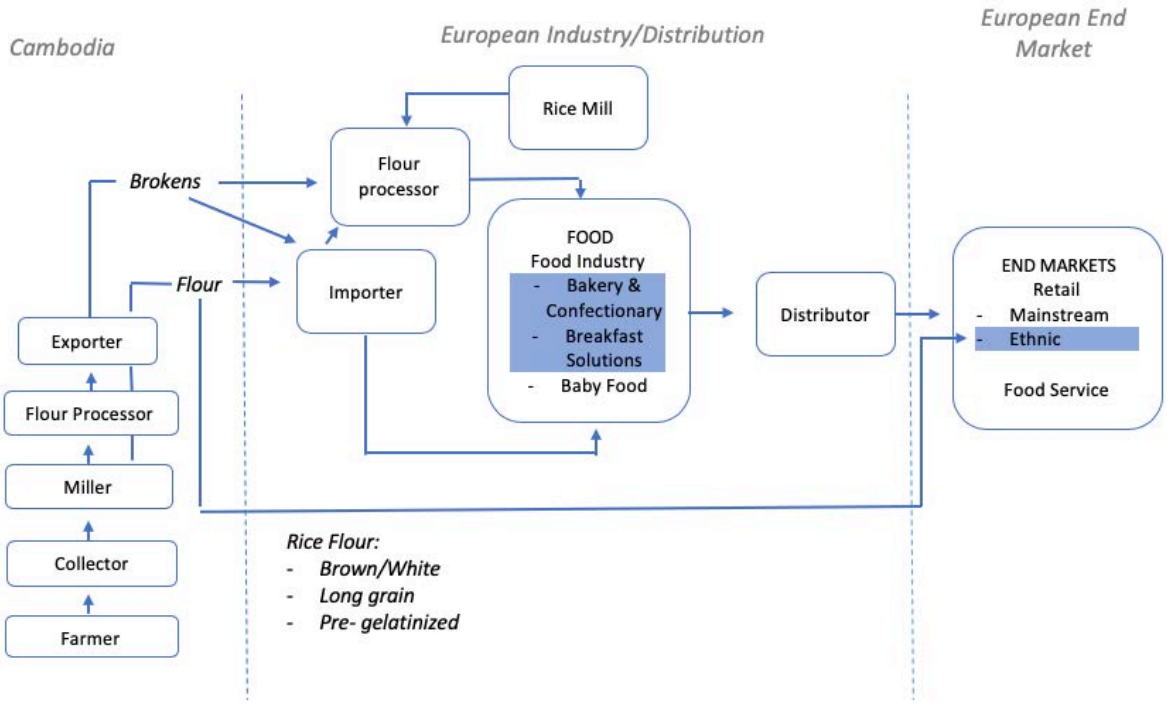
7.1 High-Value Rice



The above diagram depicts the structure of the value chain for rice. Millers are frequently exporters as well, but not always; some companies focus exclusively on trading. In many cases, millers buy directly from farmers; this practice is becoming increasingly widespread as contract farming becomes more commonplace, though collectors are still very much part of the chain, especially for supply to the larger traders. Cambodia generally exports rice in bulk, after which it is further cleaned, repacked and branded in Europe by companies that often have their own mill and brand and packaging that meets their end-customer needs. Van Silevoldt is an example of a company that does this very well for private-label goods. This company frequently caters to the consumers' preference for convenient easy-to-cook products, like Lassi products or ready-to-eat meals that include rice. Ready-made microwave meals containing rice are also part of the food industry, such as Brillante's bright cups.

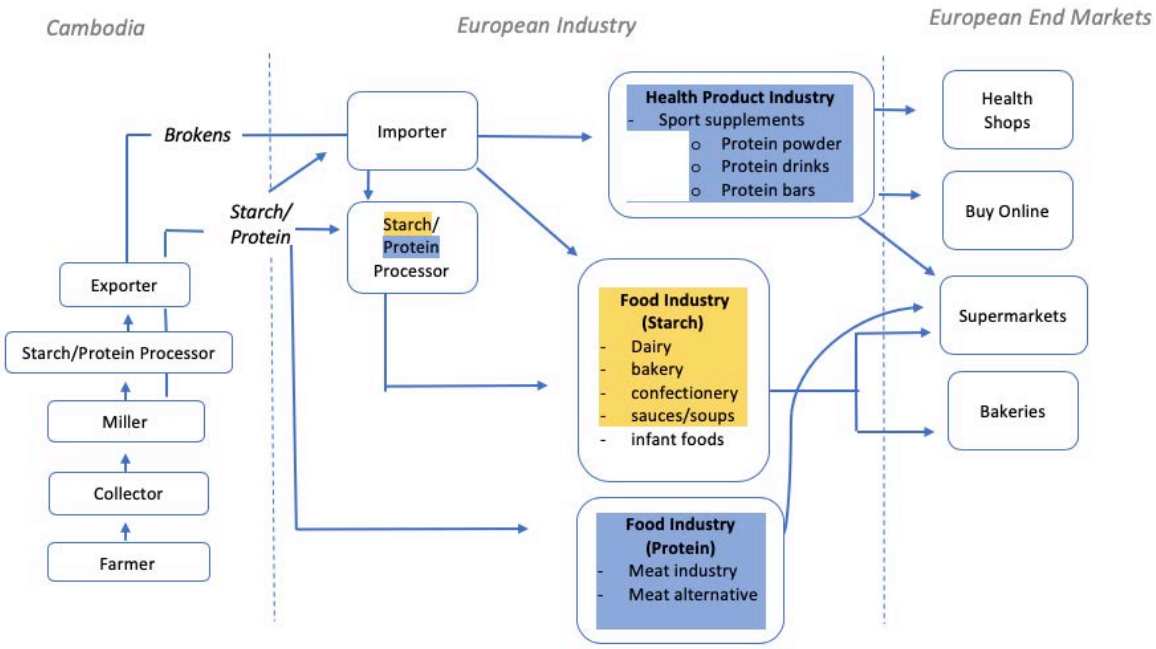
If Cambodian millers or exporters want to sell rice directly to retailers, they will face competition from established brands. They will also need to be able to meet consumer expectations in terms of packaging and branding.

7.2 Rice Flour



Based on the existing rice flour channel, brokens are supplied to an importer or a flour processor in Europe that then offers solutions to the food industry. Companies like Beneo (German-owned, but its rice branch is in Belgium) and Belourthe (Belgian) specialise in offering customised solutions to the food industries, particularly bakery & confectionery, breakfast solutions and baby food. Taking care of flour processing before exporting to Europe would mean seeking to supply either through an importer or directly to the food industry and competing directly with the likes of Beneo. It is not common for European consumers to buy rice flour and consume it directly as is done in Asia, so rice flour would not be sellable through mainstream supermarkets. However, there is a possibility that retail-packed branded products could sell directly through the ethnic channel in Asian shops.

7.3 Rice Starch and Protein



Importers are the main market entry channel through which rice starch products reach Europe. These products are commonly imported by companies that specialise in texturing systems. They blend various thickeners to produce specific thickening solutions for their clients in the food industry. Key European importers for starches include FMC International, CP Kelco, Tate & Lyle and Cargill.

Other processors, like Beneo, buy brokens (either directly or through an importer), manage the entire milling process themselves and customise products to meet the needs of their clients in the food industry.

As rice starch production is very machine intensive, as opposed to labour intensive, there is insufficient interest in investing in production outside Europe, so joint production is not really an option.

Rice protein is commonly produced in rice-producing countries in Asia, such as China and Thailand. Protein powders are further processed and refined to improve taste and stability.

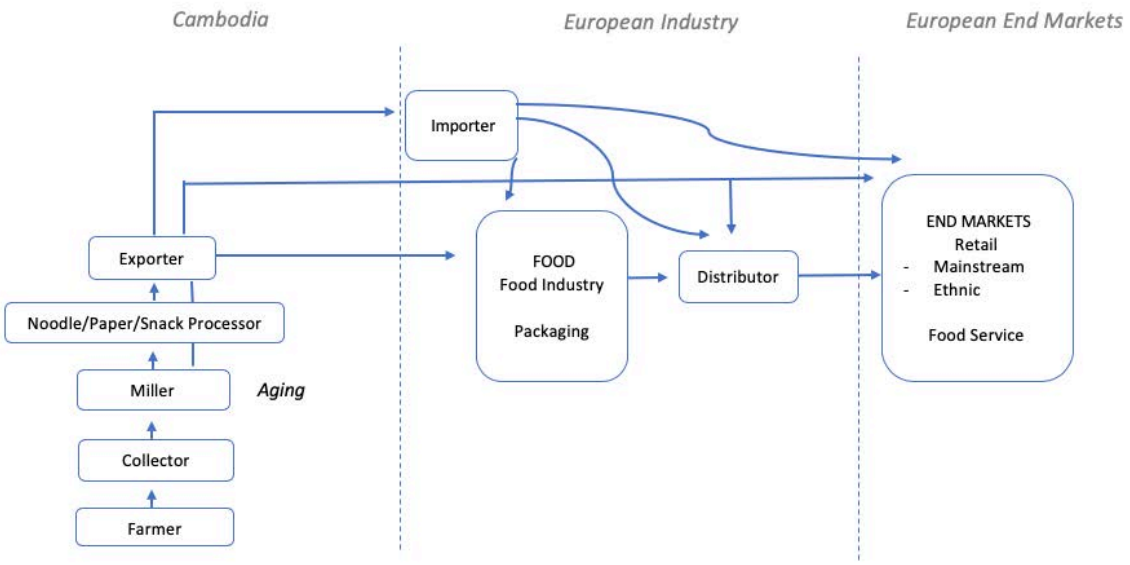
Further processing commonly takes place in Europe or North America. Protein can be processed into concentrates or isolates with enzyme treatment of the protein powder.

Many of the health products, like rice protein powder sport supplements, are sold extensively through the online channel as well as in health shops and supermarkets.

Supplying rice protein to the meat industry or artificial meat industry, like Celnat in France, is more likely to be done through specialised importers, but direct supply is also possible.

Many of the larger companies in value-added rice ingredients produce a wider offering of rice flour, starch and protein, such as Beneo in Belgium.

7.4 Rice Snacks, Noodles and Paper

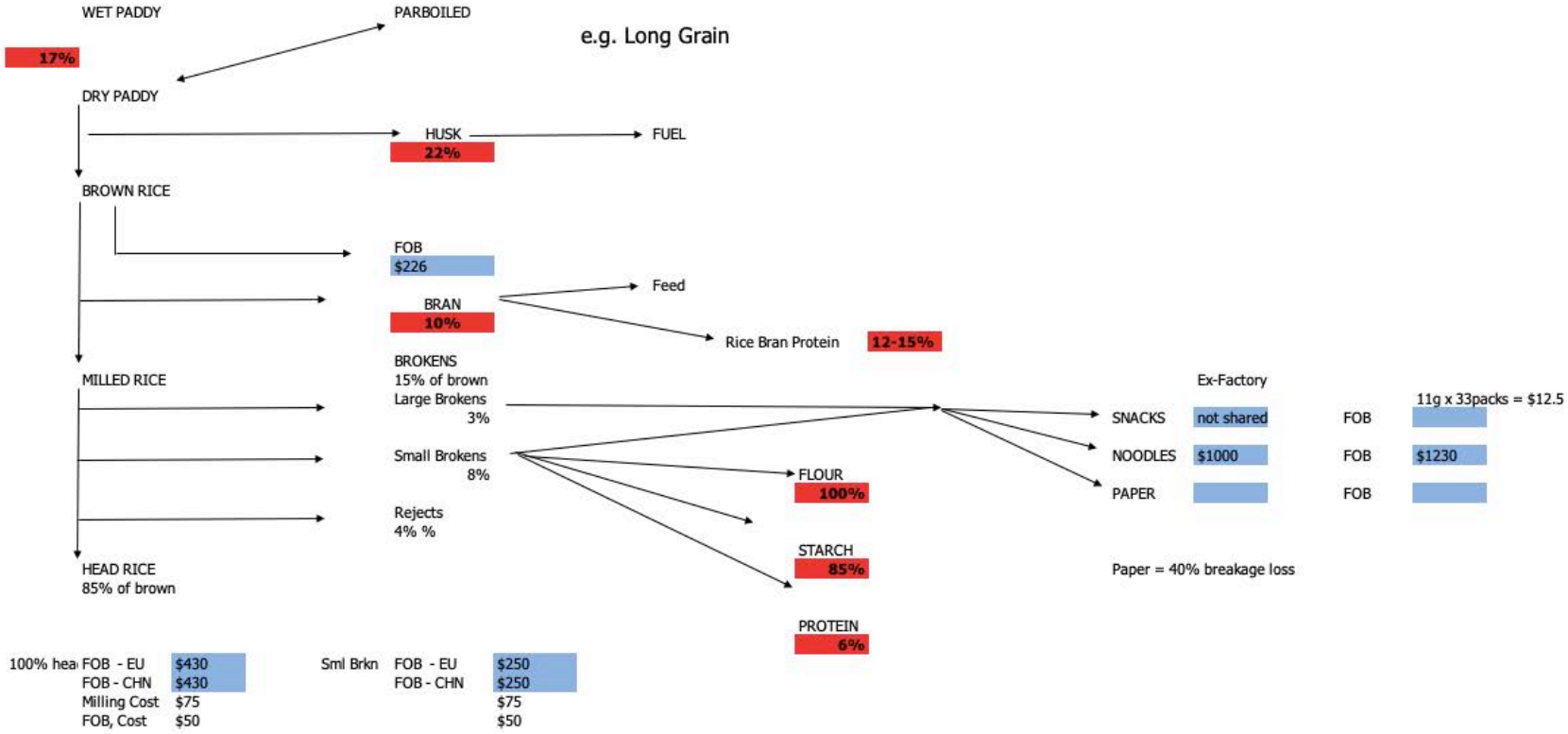


As with rice, millers frequently act as exporters, and they can take care of processing as well, as is the case with IndoChina Noodles, which carries out both rice milling and exporting and noodles processing and exporting. It is of course also possible to specialise instead and only take care of processing, as is done by Lily Foods.

Noodles, paper and snacks supplied to Europe can be repacked and branded by the food industry in Europe, but are most likely to go directly to ethnic end markets catering to Asian and Middle Eastern consumers living in Europe. The ethnic market is not small, especially in the UK. WestMills, for example, only supplies to ethnic markets.

Unlike rice starch, noodles, paper and snacks are more labour intensive and the cost of machinery is decreasing. There may therefore be more scope for seeking joint-venture operations in Cambodia.

7.5 Supply Chain Raw Material Requirements & Costing



Source: Experts and Exporters

Table 7.1 Broken proportions and FOB values by grain type

% of milled	Long Grain		Organic Long gr.		Jasmine		Organic Jasmine		Parboiled	
	%	FOB	%	FOB	%	FOB	%	FOB		
Head	85	$430	45	$600	76	$940	70	$1,225	90	$440
Large brokens	3		35	$	6		7		1	
Small brokens	8	$250	5	$375	14	$460	19	$700	5	$250
Rejects	4		15		4		4		4	

Source: Experts and Exporters

Some key facts:

- In theory, one would mill rice and then use up the remaining husk, bran and brokens by further processing these into by-products.

- The percentages of brokens one would end up with can be calculated by considering how much of the weight of the original paddy is lost during each step of the processing:

    - percent weight loss from drying the paddy;

    - percent weight loss from removing the husk;

    - percent weight loss from removing the bran during milling.

- Milled rice consists of head, large brokens, small brokens and rejects. The proportions of head, large brokens, small brokens and reject waste vary per type of rice. Organic rice typically has more brokens and so does jasmine/fragrant rice.

- Some markets buy brokens, others buy percent broken, e.g. 5 percent or 10 percent. Usually, the large brokens have a higher market value, and are combined with the head rice for this purpose.

- Small brokens, especially organic, have less market value – particularly for processors of products like flour and starch abroad.

- Whilst a larger proportion of Cambodian rice exports is jasmine and fragrant, and these types of rice are therefore the largest source of brokens, such rice is not suitable for making flour, starch and noodles due to its low amylose content.

- Jasmine rice is very suited for Senbei crackers, however, and its bran is best suited for premium rice bran oil. Jasmine brokens are used for making congee rice porridge, which is consumed in the local market. Congee is sold for more than the broken jasmine, so some value is added here.

- Parboiling increases the milling yield, with a lower percentage of brokens. The remaining broken rice cannot be used for further processing and can only sold as broken parboiled.

- Starch is glutinous (amylopectin) or non-glutinous (amylose), from glutinous and non-glutinous rice respectively. Cambodia does not produce any glutinous rice, reducing the market possibilities for rice flour and rice starch.

- Retention in conversion from brokens to rice flour is high – almost 100 percent.

- Retention in conversion from brokens to starch, depending on the method with temperature control, etc., is between 80 and 90 percent.

- Retention of protein from brokens after starch has been extracted is a mere 6 percent. Large amounts of raw material are therefore required to produce adequate volumes of protein (keeping in mind that the rice cannot be fragrant and ideally needs to be only small brokens). Furthermore, if the aim would be to focus on production of organic protein, this would present a significant challenge, especially since large organic brokens collect a good price on the market, so these may end up being exported before they can be processed into starch/protein.

- Organic protein is still achievable, but through a different process – not as a by-product of starch, but in the form of rice bran protein. Rice bran contains 12-15 percent protein. This translates to 0.012 percent (modest estimation) of dry paddy, considering that the bran is usually 10 percent of the dry paddy weight. Therefore, making 12 kg of protein requires 1 tonne of dried paddy, or 8.3 t for 100 kg. Rice bran protein can be made from the bran of any rice type.

- FOB prices are the same for export to Europe and China.

Table 7.2 The Farmer's perspective

	Fragrant			Jasmine			Long Grain			Organic Long Grain			Organic Jasmine		
	$ per Ha	Ton/ha	$ per ton	$ per Ha	Ton/ha	$ per ton	$ per Ha	Ton/ha	$ per ton	$ per Ha	Ton/ha	$ per ton	$ per Ha	Ton/ha	$ per ton
Seed	$112			$61			$76								
Pre-Planting and planting	$79			$69			$87								
Water Use management	$50			$10			$39								
Fertilizers	$125			$110			$171								
Pesticide	$50			$28			$33								
Harvesting	$87			$105			$115								
Total	503	4.5	111.8	383	2.8	136.8	511	5.4	94.6	320	3	106.667	310	2.2	140.909
At mill price ($)			275			350			165			198			420
minus transport ($)			265			340			155			188			410
Gain/ha ($/ha)			689.5			569			326			244			592

Assumption – no collector, direct purchase from farmers by millers

Source: Experts and Exporters

From the farmer's perspective, there are evident differences between crops. Fragrant is the most profitable if a high yield is achieved. Whilst organic collects better prices per tonne against similar production costs, the gain per hectare is limited by a lower yield. Organic farming could greatly benefit from methods to improve yield, which would create a strong incentive for farmers to adopt organic production.

It is safe to assume that more fragrant and jasmine will be produced in response to the EU safeguard measure. At the same time, as a consequence of the safeguard, farmers will be under the most pressure from parties further up the chain to bring down their prices, in order to accommodate the additional safeguard duty. Long grain prices at the farmer level would be affected less strongly, as export of this product can be redirected to China, rather than being halted completely.

7.6 Actors, Governance and Sustainability in the Value Chains

7.6.1 Companies (CBI Business Export Coaching Programme Prospects)

For this VCA, we have interacted with some 18 companies, 13 of which have shown a good appetite for developing diversified rice products for export. These are all well-established exporting companies that have significant exports of primarily jasmine to Europe, as well as two companies that are contracting out production of organic for export and a few that have achieved export of parboiled. Although they have not been subjected to an audit, the companies appear to fit the criteria for a CBI programme in terms of size, maximum share of foreign ownership and motivation to participate.

	Company	Existing Products	Products they hope to become able to sell	Certifications
1	Lilly Foods www.lylyfood.com	Snacks	European market (already exporting to other developed country markets)	ISO 22000
2	AMRU www.amrurice.com.kh	HVR, Paper, Noodles	Rice Bran Oil, Rice Flour	ISO 22000, SRP, Fair for Life, Fairtrade, GMP, HACCP
3	Signatures of Asia http://signaturesasia.com	Organic Parboiled (JV with Alesi – PSI)	Rice Bran Oil, Starch, Mix with other product, e.g. quinoa	Organic (2,000 t to Europe)
4	Indochina Rice Mill http://rice.com.kh	Noodles, HVR	Noodles, Rice Pasta – European market, food service segment	
5	City Rice http://cityrice.com	HVR	Strong interest in diversification	HACCP
6	Khmer Foods http://khmerfoods.com	HVR	Rice Bran Oil	HACCP, GMP, ISO 9001
7	Lor Eak Heng Sek Meas Rice Co Ltd http://www.lehsekmeasrice.com	HVR	Noodles, Starch	HACCP

8	Batambang Rice Investment (BRICO) www.battambangrice.com	HVR	No contact, but leading dynamic company	GMP, HACCP, BRC
9	White Gold http://www.khmerwhitegold.com	HVR	Interested, but undecided	HACCP, GMP
10	Trust our Trade www.trustourtrade.com	HVR	Rice Syrup	
11	Nikoline Investment http://nikoline.com.kh	HVR	Wants to learn about diversification options	
12	Kampong Thom Rice Mill http://kampongthomrice.net	HVR	Interested, but undecided	
13	Andumoriz (Cambodia) http://andumoriz.com	HVR	Silica	

Four companies that fit the profile sought by CBI for business export coaching programmes frankly informed us that they were not interested in diversification. These were:

1. Vong Bun Heng Import Export;
2. Golden Rice Company;
3. Baitang (Kampuchea);
4. International Rice Trading (Cambodia).

One company that fits the profile sought by CBI failed to respond:

- Bayon Cereal.

7.6.2 Enabling Environment

Cambodia exports a large number of unprocessed crops, such as paddy rice, cassava and cashew nuts, to Thailand and Vietnam, which process the raw materials into value-added goods and re-export them to International markets. The new government mandate is to improve the business climate through enhanced regulatory frameworks, promotion of innovation and technology, increased access to finance, strengthened and expanded related support services

and integration of SMEs into global value chains. In 2015, the Royal Government of Cambodia launched the Industrial Development Policy, outlining the government's plans to diversify Cambodian industry beyond the garment and footwear sector and identifying value-added agricultural products as a potentially important export. This policy encourages FDIs and domestic investment and strengthens the capacity of both foreign and domestic SMEs in order to boost their production of goods, both for export and for import substitution.

Cambodia Rice Federation (CRF)

The CRF represents not only exporters, but also millers and farmers with close to 300 members (farmers represented through farmer groups). It was set up to improve the productivity of farming and milling techniques, lower the costs of our export processes and uphold an industry-wide code of conduct.

The CRF has taken on the task of building name recognition for Cambodian rice and took off to a good start with support from the IFC and other partners like AFD, also within the framework of the Strategic Rice Plan for 2017-2021. The CRF appears to be facing several internal issues and many of its members are frustrated because their mandatory contribution of 1 percent of exports is not showing the expected results. Financing has now become a major issue, as many members have apparently stopped paying their contribution. The organisation is currently not in the best position to drive and coordinate diversification, nor to promote the Cambodian Rice Brand.

Institute of Standards of Cambodia (ISC)

The ISC was set up to manage and promote national standards for products, services and management systems and to assess compliance with product safety standards and product management systems to ensure public health and safety.

Cambodia has a great track record when it comes to achieving internationally recognised standards in a very short period of time, which are then efficiently adopted by a large number of millers and applied to very substantial export volumes. The ISC has played an important role in this and should again be closely involved in developing and supporting the adoption of standards for diversified rice products. Standards have already been developed for rice noodles and rice starch. The ISC should take the lead in developing standards for other diversified products with export growth potential as soon as possible.

General Directorate of Agriculture, Ministry of Agriculture Fisheries and Forestry (MAFF)

Has the mandate to:

- ensure food security;
- manage and monitor the quality and security of agricultural products;
- promote increased agricultural productivity through the diversification of agriculture;
- contribute to poverty reduction through increased farm incomes and value added on agricultural products;
- ensure access to markets.

Department of Agro-Industry (MAFF)

The Ministry of Agriculture, Fisheries and Forestry also has a Department of Agro-Industry, which focuses on diversified rice industries. It has the mandate to:

1) formulate policy, plans, programmes, projects and measures for developing agro-industrial crops;
2) participate in solving problems related to the development of food and agro-enterprises and to formulate the agro-industrial policy for directing investment into production, processing and business;
3) participate in sharing the vision for enhancing policy in order to promote agro-enterprises and agri-food processing;
4) participate in promoting investment in and exporting of agricultural products and agri-food products;
5) disseminate the technology information with regard to agricultural economics to the association of farmers and to the industrial and commercial partnerships in cooperation with the public institutions concerned and the farmers' organisations.

Other Relevant Ministries

- the Supreme National Economic Council (SNEC) – the highest-level body mandated to provide the Prime Minister of Cambodia with technical analyses and recommendations regarding policies and strategies for rapid and sustainable socio-economic development;
- the Ministry of Industries and Handicrafts;
- the Ministry of Economic Affairs.

Academic Institutions

The Institute of Technology (IoT) and the Royal University of Agriculture (RUA) should both have a key role in addressing the awareness gap in Cambodia at public as well as private level with respect to diversification of rice. However, they are significantly behind their counterparts in

Thailand. These counterparts are leaders in this field of knowledge and are followed closely by the private sector in active collaboration. An amount of fast-tracking support would be required to engage them fully in a coordinated effort to promote diversification.

The **Cambodian Organic Agriculture Association (COrAA)** is a private sector organisation that works to promote organic agriculture in Cambodia. COrAA brings together individuals and organisations that are active in organic farming, processing, marketing or trading or in supporting organic agriculture. A strong motive for establishing COrAA was to have a domestic organisation where Cambodian stakeholders, especially those from the private sector, take leadership in promoting organic agriculture in Cambodia (in contrast to an organic agriculture movement mainly promoted by donors).

COrAA is involved in certification, marketing support, awareness training and advisory support. Considering the multiple facets covered in this Value Chain Analysis with respect to organic rice and organic rice-based products, the organisation should have an important role to play in any initiatives aimed towards promoting organic rice or organic rice-based products.

International Organisations/Projects

International Finance Corporation (IFC)

In Cambodia, the IFC helps to improve the competitiveness of the Cambodian rice export sector through a holistic approach targeting interventions relating to key processes along the value chain, covering farming, milling and exporting practises. After completion of the RSSP project, the organisation has scaled its presence in the sector down a bit, but continues to be closely involved in the SRP platform as a technical advisor and as an investor in two of the companies that are wholeheartedly taking up SRP contract farming production.

Food and Agriculture Organisation of the United Nations (FAO)

The FAO's programme in Cambodia has three key pillars:

- country output 1: increased productivity, diversification and commercialisation of agriculture, including livestock and aquaculture for poverty reduction and food and nutrition security;
- country output 2: equitable and sustainable management of natural resources;
- country output 3: reduction of vulnerability and improved resilience to shocks at national, community and household level

Only the first output touches upon the topic of this VCA, and this output has a stronger focus on other crops, fish and meat sectors than on rice. However, the FAO is also working on

Agriculture Development and Economic Empowerment. This could affect or complement certain aspects of the chain of diversified rice product exports.

Whilst there is little overlap, the FAO is a very dependable partner with considerable knowledgeable of the rice sector and plays an important role as one of the partners in the SRP.

Cambodia Agricultural Value Chain Program (CAVAC)

The CAVAC programme is funded by Australia and aims to increase productivity and incomes for smallholder farmers in Cambodia by building partnerships with their suppliers and regulators, the government and the private sector, and by using a market systems approach to spread knowledge about new agricultural techniques. A major part of the project is invested in the development of community-run irrigation schemes that increase yields by ensuring a year-round water supply.

CAVAC aims to increase farmer incomes in rice-based farming systems by accelerating growth in the value of agricultural production. To increase their incomes, farmers need to increase the quantity or quality of the rice and vegetables that they produce. To do this, they require understanding of modern techniques, more information, reliable access to inputs such as water, seeds, fertiliser and pesticides and better opportunities for selling their produce.

CAVAC provides assistance in four areas:

- agribusiness and extension;
- irrigation and water management;
- research;
- business enabling environment.

CAVAC tries to devise partnerships and other activities in which all players benefit from the adoption of innovations that eliminate the constraints to growth. Innovations within the private sector help to improve their business and at the same time help farmers to access better solutions for farming.

In this way, CAVAC can play a role in multiple stages of the rice value chain, although primarily at farmer level.

CAVAC has an interest in seeing diversification work and has been providing technical support for revision of the rice policy. This makes CAVAC an important partner within the rice chain at the enabling environment level.

United Nations Industrial Development Organisation (UNIDO)

UNIDO's expertise and mandate are highly suited to support the Cambodian rice sector with the necessary technical expertise on developing industries for processing rice products. UNIDO's selected priority in Cambodia is not connected with rice or processed rice, however, since it instead focuses on creative industries, fish and tourism.

7.6.3 Governance in the Value Chain

Millers/exporters have a very central role in the chain. They were key in growing the sector, were the pioneers in developing higher-value rice and will now likely be the pioneers in developing diversified products. Furthermore, as they increasingly engage in contract farming, they will again be the key influencers and drivers of the sector.

Millers/exporters are of course guided by policy, and efforts from within the supply chain to support farmers are largely driven by the various ministries and agencies in the enabling environment. Even so, millers/exporters are the real movers and shakers of the sector, which is why any intervention would need to give them primary attention.

7.6.4 Sustainability in the Chain

The Cambodian rice sector has a good reputation in terms of sustainability, with low levels of pesticide residues. As the sector modernises and more and more contract farming and market-imposed social and environmentally sustainable conditions start to permeate through the chain, it is likely that its reputation will continue to improve, both at milling level and at farmer level. Contract farming in itself does not guarantee sustainable and socially responsible practices, but it is a step towards transparency and acts as a platform on which standards like SRP and blockchain can take root and gain the potential to become mainstream.

The International Labour Organisation (ILO) conducted an evaluation on the IFC's RSSP project mentioned earlier. This project had an impact at both farmer level and miller and exporter level, and the evaluation is a good benchmark for an assessment of sustainability. At miller level, the evaluation observed that, as companies moved towards modern management systems of Total Quality Management (TQM), labour management relations improved, and as companies followed systems like HACCP, staff required more training and greater motivation. The assessment also observed good Health and Safety Management and good compensation for professional work delivered. Also, the evaluation included a positive outlook with regard to gender equality, with more women in offices, in professional, technical and administrative positions.

At the farmer level, the evaluation found that farmers had small margins and that contract farming had hardly developed at that time, with arrangements being largely informal. This left farmers vulnerable and in a poor position to dictate prices. With a shortage of labour and high migration to the urban areas, it appears likely that the majority of casual farm labour, especially the young labourers, will be replaced by machinery and service providers.

The ILO evaluation was conducted before the EU safeguard was in place. There is no doubt that the safeguard duties will put pressure on exporters to offer lower prices for higher-value rice. Consequently, price squeezing will occur in the chain and it is likely that the farmers will be squeezed the hardest.

With respect to climate change, the Cambodian rice sector, on which 3 million people depend, is a very serious concern, even without considering the consequences for the food supply. In 2013, Cambodia completed its first Climate Strategic Plan 2014-2023 guiding steps towards the implementation of measures to cope with climate change. Risks have been properly identified and objectives have been set out, with action plans to be implemented under stewardship of the National Climate Change Committee. This implies the country is taking active and progressive steps in order to cope with climate change.

8. Issues and possible solutions across the value chains

By means of two sessions held in Phnom Penh, issues across the value chains were mapped out. The identified issues have been laid out below along the different levels of the chain. Possible solutions to these issues have been provided in the "possible avenues to address the issue" column. The final column lists organisations whose involvement may be beneficial.

VC LEVEL	Issues	Possible Avenues to address the issue	Organisations to involve
FARMER	**General** ***Yield is hampered by the use of saved seed and inefficient seeding*** Yield is hampered by the fact that farmers use saved seed instead of buying certified seed: Farmers use saved paddy for seed rather than buying certified seed for rice production. In addition, Cambodian farmers use a large amount of seed, with an average of 230 kilograms per hectare for dry season varieties and 134 kilograms per hectare for wet season varieties. Some farmers use up to 400 kilograms of seed per hectare (CAVAC 2016). Using saved seed for many cropping cycles leads to poor quality of paddy. Moreover, because they apply a high seed rate, they have less incentive to buy certified seed for their production. The same study found that certified seed costs 0.75 USD/kg, while farmers' saved seed only costs them 0.3 USD/kg. ***Poor post-harvest storage***	CAVAC has introduced mechanical direct seeders for dry and wet soil conditions. These machines can potentially lower seed rate to 60 kg/Ha for the wet season varieties and 100 kg/Ha for dry season varieties. Application of SRP standards/guidelines An SRP standard is being implemented with contract farmers connected to two companies that are also working with IFC, Mars and Olam. Associated best practices	CAVAC CARDI MAFF Extension Services also SRP projects: Mars/BRICo/IFC, AMRU/IFC

	Poor storage after harvesting reduces the quality of paddy. ***Labour in agriculture is declining.*** The agriculture sector in Cambodia is facing a labour shortage due to migration to cities and to countries with higher wages. Garment factories in particular offer more attractive wages. According to CAVAC's paper on challenges and the way forward for the Cambodian rice market (2017), the labour in agriculture decreased from 80 percent in 1993 to 41 percent in 2018 and is projected to continue decreasing each year, to only 29 percent in 2030. ***Poor & unsafe application of fertiliser and pesticide*** The SRP addresses this issue as well, through the adoption of the standards connected with contract farming. Outside of this, current practices can be expected to prevail for the foreseeable future. ***There are limits to growth in organic rice production*** 1. There are limits to organic production areas. Organic rice production is taking off well in Cambodia, but there are limits at the horizon due to growing areas being flooded. This leads to difficulties in maintaining assurance of organic. In order to be suited for organic production, areas therefore need to be isolated, but the availability of isolated areas is limited. 2. Yield is low, which affects the incentive for farmers to engage in organic. The choice is situation-specific and therefore does not apply for all production areas. In highland tribal areas, fewer alternative options are available, making organic farming	can be replicated. Zoning could be used to isolate new areas of land, rendering them suitable for organic production. There is, however, still considerable scope for intensification over expansion. Yield increases in organic production can be achieved, which would kill two birds with one stone, as it would incentivise farmers to carry out organic production. Technical expertise, such as from CERADIS, would need to be brought in to achieve such yield increases.	IFC, BRICo, AMRU, MAFF, Cambodian Organic Agriculture Association (COrAA)

	adequately attractive. In other existing growing areas, however, where conditions are well suited to growing other varieties, there is less of an incentive to grow organic. ***SRP – ready, but holding back*** The various key players are still holding back from taking the leap into the market. As of now, the SRP logo has yet to hit the shelves in markets. Until then, all parties are keen, but still holding back, waiting for others to make the first step. Millers/Exporters are at this stage and will not be driving the expansion of SRP production, so long as, in their view, the cost of production is higher and the export price does not offer a premium (though from a farmer's perspective, yields and profits are better). Only when the standard takes off on the market side will it offer an incentive in terms of volume. Until then, the waiting and seeing whilst needing to be ready to be the first is simply an additional cost. Having said all that, much work is still required on the producers' side in terms of training, implementation, auditing, etc. to reach SRP standards at a wider scale.		
COLLECTOR	There are of course many instances of millers and exporters buying directly from farmers – cutting out the middleman, in a sense – but this by no means happens across the board. The larger traders still heavily depend on collectors to collect from farmers covering a large area. **Control over traceability –** if rice is not purchased directly from farmers, via contract farming or otherwise, it is very challenging to ensure that	Large millers and global buyers are in the process of building their own "controlled" supply chains, from planting proprietary seed varieties and applying improved SRP cultivation concepts to the mill and the final pack/container. These supply chains	

	collectors abide by strict tracing rules to help determine the origin of the rice at a later point in the supply chain. No mechanisms or incentives are in place for collectors in this regard.	will include contract farming with Agricultural Cooperatives (these ACs still have to be set up and their capacities built) and high-end technologies to monitor farming practices (including satellite systems, e.g. Sat4Rice and drones)	
MILLER	***Energy costs*** Electricity costs per kWh are high at approximately 14 cents. Cambodia's competing neighbours – Thailand, Vietnam and Myanmar – only pay around 5 cents. This has a significant effect on milling costs. ***Shorter grain of parboiled required to circumvent EU safeguard measure*** Whilst European demand of parboiled is robust and buyers are increasingly looking to buy from elsewhere, Cambodia appears to have lost this opportunity due to the introduction of the EU safeguards. The advantage of parboiled offering a higher milling yield with a significantly lower rate of brokens is not enough to offset the €175/tonne import duty against an FOB price of around €380/tonne. Brown parboiled is not high in demand, so this is not an option either. Buyers are turning to Myanmar, where the rice has a shorter grain. For parboiled, this means the classification switches from length >3 times the width of the grain to between 2&3 times the width. This slight difference in length puts the parboiled in a different category, CN 10063025, which falls outside the safeguard. Moreover, a 0 percent duty applies to this category.	The millers are lobbying hard for night and day costs to be balanced, to arrive at a price closer to 10 cents, but this is still under negotiation. This would make an estimated difference of around $7 per tonne. Millers and farmers will need to seek a shorter grain to continue selling parboiled to Europe. The rice expert we spoke with observed that much of the rice sold as paddy to Vietnam is slightly shorter, yet of exactly the same content, and perfectly suited for parboiling. This could offer just the right value-addition incentive for farmers not to sell paddy to Vietnam. Introduce the required technology –	SNEC MAFF, Millers

	The colour of parboiled also presents an opportunity for Cambodian parboiled suppliers to stand out vs Thailand and Myanmar in parboiled with respect to the European market. European consumers have a preference for a darker coloured parboiled, which is more difficult to achieve with grains of rice from Southeast Asia. However, techniques are available, using closed boiling systems to arrive at higher temperatures of around 120 degrees Celsius, that result in a darker colour. An expert pointed out that only a handful of the Thai leading parboiled producers have achieved this.	Giribaldli, an Italian industrial machinery brand, has developed a process technology for closed boiling systems.	
PROCESSOR	**All Diversified products** ***Lack of expertise (market)*** Since the focus up to now has largely been on selling rice in its basic form, very little attention has been dedicated to understanding markets for diversified products. There is a significant gap in this area at both private and public level. ***Lack of expertise (technical)*** In addition to a lack of market knowledge, there is also a distinct gap in knowledge amongst millers concerning how to process diversified rice products. One entrepreneur pointed out that the companies do not even know the difference between rice flour and starch. Beyond the necessary expertise, a certain shift in mindset is also required to get people fully involved in production – i.e. simply buying technology will not guarantee success. Technical advisors have often observed that millers/processors have a quick-fix mentality – i.e. only interested in the fix and not in analysis and the cause of issues	Conduct tailored market studies and organise study tours. Provide capacity building to guide product development and positioning. Develop courses at Institutional level with donor support (see below).	CBI/CAVAC CBI/CAVAC

	Noodles & Snacks (and, to some extent, Flour & Starch) ***Aging of Rice*** Aging rice for six months to a year is an important raw material requirement for rice noodles, snacks and certain applications in flour and starch. The aging process adjusts the properties of the rice, giving it increased hardness and changing physical and functional properties. These include changes in textural properties, pasting properties, thermal properties and cooking quality. In Cambodia, storage is relatively expensive, so the aging requirement adds a substantial cost. In other countries, like Thailand, noodles and snack producers benefit from a national food security reserve that needs to be replenished yearly. The "aged" reserve offers a good source of affordable aged rice. The Cambodian national food crisis reserve is set up in a different manner, in the form of contracts with suppliers. It is not a physical storage. ***Strict buyer standards – noodles/rice pasta*** Buyers/prospective JV partners in the noodles market have strict standards. They require suppliers to have certifications that generate confidence in suppliers' practices with regard to food safety, health and safety, the environment and ethics (e.g. ISO, BRC, SEDEX), as well as a thorough understanding of their supply chains, i.e. traceability. ***Technology for "Rice pasta"*** European consumers are very unfamiliar with the Asian concept of rice noodles. As a consequence, rice noodles remain a small segment for ethnic consumers – Asian and Middle Eastern communities in Europe and	The national emergency reserve approach could be reconsidered if motivated by a significantly strong drive for diversification. Work with processors to achieve this standard. Work with specialists that can help achieve the level of technology required	CBI CBI

	the adventurous few who have enjoyed rice noodles on a holiday in Vietnam or Thailand and make the daring step of trying to cook it. A different segment or niche is reaching out to pasta consumers with health concerns, either related to a gluten-free diet or simply due to being aware that rice contains fewer calories and more nutrients than pasta. Producers are responding to this group and their needs by offering "rice pasta" rather than rice noodles. In many cases, to further connect with European consumers' health concerns, they offer "organic brown rice pasta". The challenge, however, lies in reaching the level of technology required to create the special bouncy, chewy and mildly stretchy textures necessary. Reaching this level will be a big step for Cambodian noodle producers. Technical support will likely be required to get them to a level where they can compete with e.g. Thai and Italian rice pastas. ***Protein – large quantity of brokens required*** Significant quantity of raw material required. Rice contains approximately 6 percent protein, so 1 t of small brokens are required to produce a mere 60 kg of rice protein (when protein is produced as a by-product of starch). Only rice with a high amylose content can be used, making long grain rice essential. On average, this variety contains less brokens, approximately 15 percent, of which 8 percent are small brokens. As a consequence of the EU safeguard measures, long grain rice is no longer an option for Cambodian exports to Europe. Long grain exports will therefore need to be diverted to China. Indirectly, too much production of protein will be vulnerable to Chinese quotas. The significance of this issue strongly depends on whether protein is	to compete with "rice pasta", such as Avebe – www.avebe.com/quality-improvement-in-rice-noodles The other alternative is to produce protein, not as a by-product of starch, but from rice bran. This can also be done with fragrant rice bran. This does, however, involve a more complex production process.	

	considered a key pillar and driver for the Cambodian diversified rice sector or an incidental by-product that can be sold. With the demand for organic rice protein growing substantially in the coming years, another aspect that needs to be considered is the need for a large quantity of organic brokens to produce organic protein. The amount of organic paddy required is slightly less, as organic has a higher proportion of brokens. Nevertheless, the sheer volumes required for organic protein are not realistic at this time. Thirty-three tonnes of wet organic paddy need to be milled to produce the reasonable amount of 500 kg of organic protein powder per day (assuming only small brokens are used).	Assess the importance of protein and organic protein and conduct a feasibility assessment regarding how much raw material supply can realistically be achieved.	
EXPORTER	***The documentation process and the procedure for lab testing are slow*** Testing for aflatoxins and GMOs has to be done in Thailand. The process of sending, testing and subsequently approving samples increases the time to market. The process takes an average of seven working days, compared to two days for Thai exporters. ***Logistical challenges for shipping*** The distance to Sihanoukville by road is long, and its port is not very deep, so larger vessels cannot dock here. By contrast, Laem Chabang port in Chon Buri, Thailand, is deep enough to accommodate mother ships and offers Thai exporters significantly better shipping costs. It is also much closer to many of Cambodia's rice growing areas. The Cambodian government has for some time now been requesting their Thai neighbours to allow use of Thai ports. In addition to the seaport challenges, there are also difficulties with	Encourage Thai inspection companies to invest in setting up lab facilities in Cambodia.	

	regard to loading and unloading points between road and train transport, which result in additional time and costs (estimated at about 25 USD/t from Battamabang to PNH and another 25 from PNH to Sihanoukville, a total of 50 USD per t). ***<u>Post-shipment finance would significantly increase working capital</u>*** The long wait to receive payment from buyers further increases working capital constraints. Exporters point out that post-shipment finance could make a difference of 20 USD per tonne. ***Branding initiatives have lost steam*** After the establishment of Malys Angkor, promoting this variety at international fairs several years in a row and registering the DNA profile of Cambodian jasmine, good branding efforts have lost steam, and Thai Hom Mali still collects 200 USD/tonne more. Branding is not static. It is a dynamic exercise. The brand promotion needs to be revived and needs to be strategically managed. DNA testing of all shipments, which is now mandatory in Thailand for every export contract for their premium brand Thai Hom Mali, may also be required to help Cambodia maintain and continue to distinguish its own rice identity and brand and establish a price level at par.	Develop a follow-up branding strategy, phase 2, and integrate this into a CBI programme that offers a good promotion platform by means of a CBI pavilion at major trade fairs.	Credit Bureau Cambodia CBI, Exporters
ENABLING ENVIRONMENT	***Lack of technical and market expertise on diversified products*** This is holding back efforts to take action and lead the way by means of a clear course, priorities and incentives. ***Passive approach – absence of coordinated strategy or institution taking***	Develop courses to expand awareness and knowledge. Identify and invite guest speakers on a regular basis.	IoT, CAVAC CBI

	on a leadership role. Whilst the pressure to diversify is felt more strongly than ever and this option is frequently discussed, a well-planned strategy, coordination and a motivated party to drive the process are essential.	Provide expertise and guidance in designing a strategy and implementing it in collaboration with multiple stakeholders.	CSI, CBI
	More standards are required It is commendable that standards have already been developed for rice starch and rice noodles and that Cambodia has a great track record in acquiring international recognition and achieving rapid implementation of standards for rice. However, steps need to be taken soon to develop standards for other priority diversified products.	Identify priorities and initiate the development of new standards for additional diversified products. Outside assistance can be sought to fast-track the standard development process.	
	Investment incentives – further alignment with rice diversification is required Attracting foreign investment and encouraging domestic investment will be critical. Various incentives have already been set up for attracting FDI, but may require further packaging to more emphatically prioritise the rice diversification industry. Affordable finance will be necessary to facilitate domestic investment by millers/exporters, for the purpose of financing new plants for processing diversified products. Current loans for "agro-machinery" are rather expensive at around 8 percent.		MEF, ADB, IFC
	Contract Farming – lack of laws and policies Whilst contract farming has taken off quite well in collaboration with several millers and exporters, there is a need for laws and policies on contract farming before further expansion can be achieved. The best way	PPPs	PPPs: MAFF with leading millers/exporters supported by global buyers/catalysed by development agencies

	to ensure farmers do not supply contracted produce to a third party (and whether this is fair) is currently a topic of discussion. ***Import taxes on raw materials and machinery and alignment of the processes required for rice diversification*** Establishing new diversified rice product industries will also result in import requirements for raw material input, such as chemicals and enzymes that are necessary for various processes. The enabling environment can help by ensuring that these materials are free of duty and that the procedures around acquiring these duty exemptions are not cumbersome. Many of the exemptions are already in place, such as duty exemptions for agricultural machinery, but a careful assessment, in which all the input requirements for the various diversified product industries are considered, remains necessary. ***Uncompetitive energy costs*** Electricity costs per kWh are high at approximately 14 cents. Cambodia's competing neighbours – Thailand, Vietnam and Myanmar – only pay around 5 cents. This has a significant effect on processing costs. ***Other enabling environment/infrastructure costs****:* Irrigation issues, costs of transportation, road and weight capacities, formal and informal fees, export procedures and fees		

. Conclusions and Recommendations

The Cambodian rice sector's performance over the last seven to eight years has been very impressive. Pioneering innovative companies are continuing to make great strides forward and it is truly remarkable how organic has taken off and how well the sector is prepared for SRP.

The safeguard measure imposed by the EU is a significant setback. However, it boosts the urgency to find additional value, which Cambodia must do anyway due to its disadvantageous position compared to its competing neighbours, who win in terms of both volume and costs of energy and logistics. Cambodia must build on its strengths, mainly in relation to its reputation for using significantly less residues, better quality, sustainability and organic. Having won the world's best rice award four times in a row is a key asset for driving this clean, green reputation. A revamped branding effort could reap additional benefits.

Weighing diversification options is an interesting exercise and reveals many different perspectives that might otherwise be overlooked. After considering the European market and CBI's role, a number of products were given lower priority, including rice bran oil, silica, rice milk and rice syrup. Rice protein and rice noodles were given higher priority over rice flour, rice starch, rice snacks and rice paper, after taking into account market size, competition and market protection. None of these options are guaranteed to result in success, however, since each product faces potential difficulties in terms of competition, volume, market access, manufacturing complexity or raw material supply. Each of these options will need to be worked out carefully in further detail and weighed against other options from different companies' perspectives. The views on diversification of the different companies will also be an important positioning consideration. Do the companies simply view diversification as a side activity of milling to get some more value out of waste, or do they consider it a core activity. To win on advanced markets, there would ultimately need to be a focus on e.g. producing only starch, as Lily Food does with snacks.

The study has identified a series of issues across the value chains at multiple levels. Many of these issues are connected to Cambodia's relative disadvantages in relation to its neighbouring competitors, with regard to costs of energy and logistics, for example. This highlights more clearly than ever that Cambodia needs to optimally leverage its differentiated position by offering cleaner, sustainable and organic rice and by-products and needs to ensure that it acquires the necessary brand recognition. None of this can be achieved without a solid strategy and a well-informed and coordinated sector that includes both the private sector and the enabling environment. The striking lack of awareness and expertise regarding diversified products on both company and enabling environment level is a gap that needs to be filled; this is a high priority. The lack of a coordinated effort and an

entity that will take the lead and drive the diversification process is another shortcoming that urgently needs to be addressed if the sector wants to advance in this area.

The threat of possible loss of EBA privilege or LDC status for diversified products further increases the urgency; Cambodia may only benefit from a very brief incubation period before entering a very competitive playing field. Having said this, many pieces of the puzzle are already in place – a series of companies with a very innovative spirit have a determined appetite for diversification and incentives are in place for FDI and for duty-free import of machinery. Moreover, several big players are ready to join hands in SRP and existing trade channels for rice will open many doors for diversified products. This means the circumstances are already favourable, but a coordinated effort involving all relevant parties will be required to succeed. A passive approach will not suffice .

In line with the identified issues and proposed solutions, a series of possible CBI interventions have been worked out. These suggested interventions were also presented and discussed at a validation workshop where the findings and recommendations of this study were presented. The interventions addressed the following issues:

- the lack of expertise on diversified products;
- the lack of a coordinated effort and strategy to drive diversification;
- the need to leverage organic rice and diversified products and simultaneously intensify production;
- the need to make significant product adaptations to meet European consumers' preferences in rice noodles and snacks.

Challenge – Lack of Expertise

Objective **– improving expertise on diversified alternatives at both enabling environment and entrepreneurial levels**

Possible CBI Intervention *– addressing the lack of market expertise: continued tailored market research and company coaching, institutional sharing, market missions.*

Other partner support required for technical expertise – e.g. CAVAC through academic institutions like IoT.

Challenge – Lack of a Coordinated Effort to Drive Diversification

Possible CBI Intervention *– leading a market-driven, diversified sector export strategy – design and implementation.*

Including:

- a branding strategy (key product to promote: Jasmine) (brand promotion efforts have lost steam) (encourage regular DNA certification) (goal: close gap with Thai price) ;
- coordinating the drive for diversification to access finances required for significant investment in e.g. starch plants;

- motivation through “matchmaking”: facilitating contacts with prospective buyers at trade fairs and in their markets and market missions.

Challenge – Product Adaptation for the European Market – Noodles and Snacks Required

Possible CBI Intervention:

- supporting exporters with exposure to the market and positioning for the appropriate segment: facilitating meetings with prospective buyers at trade fairs in the region (Thaifex) and in Europe;
- bringing in technical support towards product adaptation and development; e.g. Avebe solutions;
- encouraging government agencies to address the rice aging challenge using the Emergency Reserve (Food Security);

One key purpose of this Value Chain Analysis is to give CBI a foundation on which to build a business case, to justify funding of interventions that would strengthen Cambodia’s rice sector.

Based on the findings of this study, CBI is advised that investing in a full traditional CBI programme would be a risky proposition for the following reasons:

- ***The foundation is rather thin from several angles***.

Firstly, the number of companies that have started production of diversified products is very limited. Secondly, only a limited number of companies fit the CBI profile and have shown a motivated interest in starting with diversified products. Furthermore, several of these companies may still choose to invest in other diversified products than have been identified by this analysis as good for the European market. For example, many have expressed an interest in rice bran oil production. CBI should also be aware of the fact that only two of the companies are currently involved in organic rice production and export. Any interventions that revolve around organic will entirely depend on these two companies, which may, for example, decide to focus on a different product.

- ***It may take a long time to set up production of diversified products.***

It is very unclear when these companies will finalise their decisions and get started with diversified products. They will also need at least a year to set up their facilities and properly set up the associated production process.

- ***The current lack of a motivated institution that could drive a coordinated diversification effort is a weak starting point***.

With respect to higher-value rice, the number of companies is less of a concern, as a large number are already well established in the European market. Instead, the

emphasis should be on organising coordinated efforts. This would require a good coordinating body that could bring the sector together, motivate the parties involved, coordinate efforts and represent the sector. There is currently no such body. While CBI's expertise could provide support in the form of strategies and plans, starting this process before an entity has volunteered to take on this role would be a risky proposition.

CAVAC's proposition is to start up a ***Diversification Committee*** represented by a pool of organisations and innovative companies that would carry the current conversation forward. This would be a platform that CBI could engage with. If the platform also included key decision-making bodies like SNEC, it would have the mandate to make swift decisions and take action where required. It would be prudent for CBI to hold back from any intervention before such an entity is properly in place with clear roles and responsibilities.

A CBI intervention on a smaller scale, along the lines of customised technical advice to companies or training activities, such as courses on conducting market research, might be more appropriate. Given the limited amount of time before European duties might be increased for diversified products, it is important for CBI to give second priority to long, drawn-out processes like sector strategies and plans.

Annex 1 – Referenced Material

Report/Article Title/Author	Institution/Journal	Year
Alkaline Extraction of Starch from Broken Rice of Pakistan – Muhammad Usman, M Tahir Ishfaq	International Journal of Innovation and Applied Studies	2014
An Analysis of Three Commodity Value Chains in Cambodia	USAID	2015
Assessment of GMS Economic Corridors	ADB	2018
Cambodia Trade Integration Strategy 2014-2018	MoC/EIF	2014
Cambodia Agriculture in Transition	AusAID/World Bank	2015
Cambodia Climate Change Strategic Plan 2014-2023	Ministry of Environment	
Cambodia Grain and Feed Annual Global Agricultural Information Network (GAIN)	USDA	2018
Cambodia Rice – Export Potential and Strategies	IFC	2015
Cambodia Rice Exports Position Paper	CAVAC	2017
Cambodian White Rice Compendium of Millers	CRF	2015
Case Study, Modernizing the Rice Sector in Cambodia	InfoDev/World Bank Group	2018
Climate smart rice cropping systems in Vietnam	CIRAD	2018
CMB_Export Promotion Review in 15 minutes – presentation – Martin Albani: Transforming Cambodia's Rice Sector: The Role of Export Promotion	IFC	2016
Comparative Study of Pilot Scale Rice Starch Production by an Alkaline and an Enzymatic Process – Hatairat Puchongkavarina, Saiyavit Varavinita, Wolfgang Bergthallerb	www.starch-journal.de	2005
Contract Farming in Cambodia: Different Models, Policy and Practice	CDRI	2015
Contract Farming for Organic Paddy supply in Preah Vihear – Case Study #2	SNEC	2018
Effect of rice storage on pasting properties of rice flour – Zhongkhai Zhou	Food Research International	2003

EU_Vietnam FTA Annex 2-A-1 – Tariff Schedule of the Union	EU	
EU_Vietnam FTA Annex 2A – Reduction or Elimination of Customs Duties	EU	
European Patent Specification EP 1 400 177 B1. Method for preparing a rice milk		2008
Evaluation Report: Cambodia Export Diversification and Expansion Program Part I: Milled Rice, High Value Silk and Monitoring and Evaluation Function	EIF	2016
Extraction of Silica from Rice Husk, Bajirao S. Todkar, Onkar A. Deorukhkar, Satyajeet M. Deshmukh	International Journal of Engineering Research and Development	2016
Gender Dimensions of the Adoption of the System of Rice Intensification (SRI) in Cambodia	Asian Institute of Technology	2014
Global climate changes and rice food security	FAO	2006
Guide to the Vietnam-EU Trade Agreement	EU	2017
Hexane Reduction in a Thai Rice Bran Oil Factory: A Cleaner Technology Approach	Thammasat International Journal of Science and Technology, Vol. 8, No. 4	2003
Impacting Jobs through Increasing Exports	ILO	2017
Investment_Case_AMRU_Rice_Cambodia	responsAbility Investments AG	2017
Overview of the Cambodian Rice Market Challenges and the way forward	CAVAC	2018
Parboiling in Thailand and the World – ppt	Ketsesart University	2011
Potential applications of rice husk ash waste from rice husk biomass powerplant	Renewable and Sustainable Energy Reviews	2015
Profit Efficiency of Rice Farmers in Cambodia – The Differences between Organic and Conventional Farming – Rada Khoy, Teruaki Nanseki & Yosuke Chomei	Journal of Sustainable Development, Vol. 9, No. 6;	2016
Prospect of Rice Bran Oil Production in Bangladesh – Rahman, Zaman, Saiful Islam	Journal of Agricultural Engineering, Bangladesh	2011
Review of the Rice Policy Draft Report – Francesco Goletti, Srey Chanthy	SNEC	2016

Rice Contract Farming in Cambodia: Empowering Farmers to Move Beyond the Contract Toward Independence	ADB Institute	2008
Rice Flour Production System – presentation	Satake Corporation	2019
Rice Value Chain Analysis	IFAT/EFTA/FLO	2005
Rice Value Chain Management in Thailand, Africa Rice 2018	MoAC, Thailand	2018
Rice value chain study in Mekong River Delta, Viet Nam	An Giang University	2015
Syrup production via enzymatic conversion of a by-product (broken rice) from rice industry – Spinosa et al.	Acta Scientiarum Technology	2016
The Analysis of Organic Rice Contract Farming in Cambodia: A Lesson Learned for Indonesia	Indonesia Institute of Sciences	2009
The Rice Situation in Cambodia	ADB	2012
Understanding Stagnation of Cambodia's Rice Export	CAVAC	2017

Title	**Website**
An interview with Joe Eisley, National Starch Food Innovation	https://www.candyindustry.com/articles/83448-an-interview-with-joe-eisley-national-starch-food-innovation
Beneo develops new 'natural and clean label' functional rice starch – FoodBev Media	https://www.foodbev.com/news/beneo-develops-new-natural-and-clean-label-functional-rice-starch/
BlockChain For Livelihoods From Organic Cambodian Rice (BlocRice) | Oxfam in Cambodia	https://cambodia.oxfam.org/policy_paper/blocrice
Cambodian rice farmers turn to blockchain to gain pricing power	https://asia.nikkei.com/Business/Technology/Cambodian-rice-farmers-turn-to-blockchain-to-gain-pricing-power
Food security in Cambodia: trends and policy objectives | International Journal of Development Issues | Vol 15, No 3	https://www.emeraldinsight.com/doi/abs/10.1108/IJDI-06-2016-0033?mobileUi=0&journalCode=ijdi

Global Rice Bran Oil Market – Reuters	https://www.reuters.com/brandfeatures/venture-capital/article?id=21048
Green chemistry in Russia: Creating commerce out of rice husks – Russia Beyond	https://www.rbth.com/science_and_tech/2014/10/04/green_chemistry_in_russia_creating_commerce_out_of_rice_husk_40327.html
Impacting jobs through increasing exports: Evidence from Cambodia's rice sector. Evaluation summary – ILO LAB	https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---ifp_seed/documents/publication/wcms_583484.pdf
Implementing Regulation (EU) 2019/67 imposing safeguard measures with regard to imports of Indica rice originating in Cambodia and Myanmar/Burma – European Sources Online	https://www.europeansources.info/record/implementing-regulation-eu-2019-67-imposing-safeguard-measures-with-regard-to-imports-of-indica-rice-originating-in-cambodia-and-myanmar-burma/
Mars Food Announces First Global Rice Sustainability Standard in Partnership with the Sustainable Rice Platform	https://www.prnewswire.com/news-releases/mars-food-announces-first-global-rice-sustainability-standard-in-partnership-with-the-sustainable-rice-platform-300165786.html
Optimization of rice bran protein hydrolysate production using alcalase	https://www.researchgate.net/publication/242561194_Optimization_of_rice_bran_protein_hydrolysate_production_using_alcalase
Organic Farming in Cambodia – AMRU Rice presentation	https://cdnmedia.eurofins.com/european-east/media/1719120/organic-farming-of-rice-in-cambodia.pdf
Organic World – Global organic farming statistics and news	https://www.organic-world.net/country-info/asia.html
Quality Improvement in Rice Noodles – Avebe	www.avebe.com/quality-improvement-in-rice-noodles
Review on Recent Trends in Rice Bran Oil Processing	https://www.researchgate.net/publication/225480257_Review_on_Recent_Trends_in_Rice_Bran_Oil_Processing
Rice Flour – an overview | ScienceDirect Topics	https://www.sciencedirect.com/topics/food-science/rice-flour
Rice Flour | Baking Ingredients | BAKERpedia	https://bakerpedia.com/ingredients/rice-flour/
Rice Milk Production with Flottweg Decanters	https://www.flottweg.com/applications/chemicals-pharmaceuticals-food/rice-milk/
Rice Processing and Value Addition in India	http://www.blackseagrain.net/novosti/rice-processing-and-value-addition-in-india

Rice Protein and Rice Protein Products (Chapter 3 of Sustainable Protein Sources	https://www.sciencedirect.com/science/article/pii/B9780128027783000032
Rice starch as a unique, natural and invaluable food source	https://www.newfoodmagazine.com/article/33430/beneo-rice-starch/
Risilica. Presentation for APEC	https://www.slideshare.net/SergeyPissarenko/risilica-apec-2014for-pitchendpptm
Study on financial parameters of rice bran edible oil processing	https://www.researchgate.net/publication/308917991_Study_on_financial_parameters_of_rice_bran_edible_oil_processing
Sustainable Rice Platform (SRP)	http://www.sustainablerice.org/
The fast-growing market for rice starch – LMC International	https://www.slideshare.net/SaraGirardello1/the-fastgrowing-market-for-rice-starch
'We can achieve a more sustainable rice crop': Mars, Ebro join forces to advance sustainable rice sourcing	HTTPS://WWW.FOODNAVIGATOR.COM/ARTICLE/2018/07/17/WE-CAN-ACHIEVE-A-MORE-SUSTAINABLE-RICE-CROP-MARS-EBRO-JOIN-FORCES-TO-ADVANCE-SUSTAINABLE-RICE-SOURCING
What are the next major markets for gluten-free? - France the "sleeping giant" of the sector	https://www.just-food.com/analysis/what-are-the-next-major-markets-for-gluten-free-france-the-sleeping-giant-of-the-sector_id134558.aspx
World Instant Noodles Association	instantnoodles.org

Annex 2 – Organisations Contacted

Organisation	Position	Website
Alesie Food	Owner	www.alesierice.com
AMRU	Chairman	www.amrurice.com.kh
AMRU	CEO	www.amrurice.com.kh
Beneo	Purchasing Manger	www.beneo.com
Cambodia Rice Federation	Secretary General	www.crf.org.kh
Cambodia Rice Federation	Assistant to President & Deputy SG	www.crf.org.kh
CARDI		www.cardi.org.kh
CAVAC	Rice Export Manager	www.cavackh.org
CAVAC	Coordinator Milling & Export	www.cavackh.org
CAVAC	Stakeholder Relation Manager	www.cavackh.org
City Rice	City Rice	www.cityrice.com
Department of Agro Industry	Chief of Laboratory	http://web.maff.gov.kh
EU Delegation	Attaché Trade & PSD	https://eeas.europa.eu/delegations/cambodia_en
Herba Bangkok	Commercial Director	www.ebrofoods.es
Herba Bangkok	Compliance & Sustainability Director	www.ebrofoods.es
IFC	Cambodia Office Head	www.ifc.org
IFC	Regional Rice Market Development Adviser	www.ifc.org
Indochina Rice Mill	Managing Director	http://rice.com.kh

Institute of Standards Cambodia	Chief of Standards Development	www.isc.giv.kh
Khmer Foods	Chairman	http://khmerfoods.com
Lily Food	Managing Director	www.lylyfood.com
Lor Eak Heng Sek Meas Rice		www.lehsekmeasrice.com
Mercadero	Food Ingredient Expert	www.mercadero.com
Monita Group	Vice President	www.monita-group.com
Nutridant	Food Ingredient Expert	
Profound	Market Research Expert	www.thisisprofound.nl
Royal University of Agriculture	Vice-Dean	www.rua.edu.kh
Signatures of Asia	Export, Sales Manager	http://signaturesasia.com
Signatures of Asia	Production Manager	http://signaturesasia.com
SNEC		
Soma Trading	CEO	www.somatrading.com.kh
TCIS Inspection Thailand	Managing Director	www.tcisthailand.com
Urmatt Ltd	CEO	www.urmatt.com
Van Silevoldt	Purchasing Director	www.vsr-rice.com
WestMills	Sustainability Lead	www.westmill.co.uk
	Rice Expert	
5 Brothers and TCIS	Consulting Director	