

**Data Collection Survey
on
Selecting the Processed Foods to be
Focused On and Promoting Foreign Direct
Investment in the Food Business
in
The Kingdom of Cambodia
Final Report**

January 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

**INTERNATIONAL DEVELOPMENT CENTER OF JAPAN INC.
OVERSEA MECHANIZED INSPECTION CO., LTD.**

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Summary

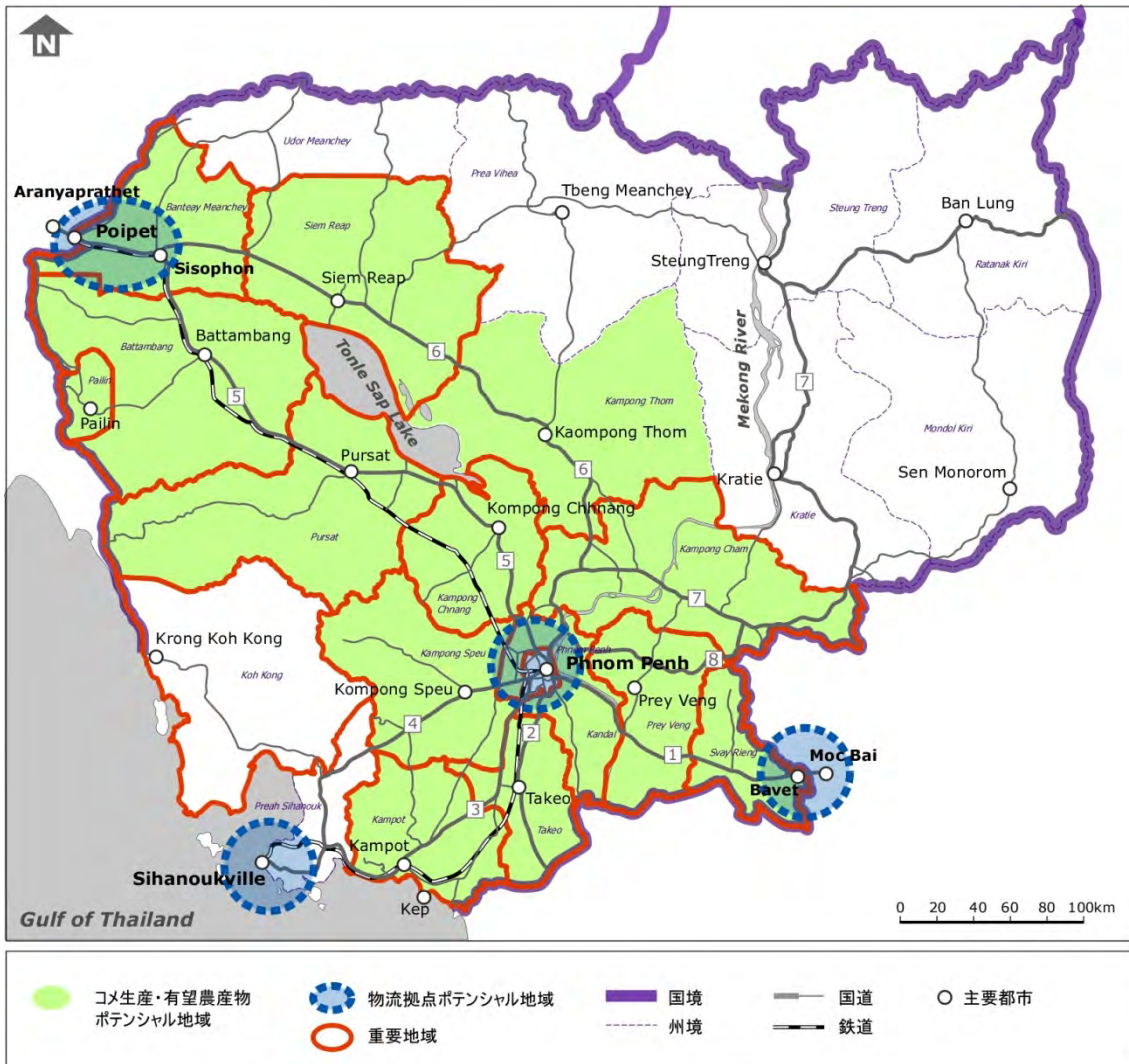
1. The purpose of the survey

In response to this situation, the Government of Japan dispatched a preparatory study team in July 2011 to contribute to Cambodian agricultural export promotion in the areas of rice policy and crop diversification.

As specified in the terms of reference, this survey focuses on

- 1) Providing a simplified picture of the Cambodian agriculture and food sector;
- 2) Proposing conditions for promoting expansion of Japanese food-related business

2. Study Area



3. Situation of Agriculture Production

Rice is the most important crop as staple food. Rice cultivation is the main economic activity as well as providing a source of food and income for the people in rural areas where 80% of the population reside. 30 % of GDP is from agriculture; a half of this is from rice. Rice accounts for 70 % of the cultivation area of crops.

For the cash crops, there are subsidiary crops and industrial crops in Cambodia. For the subsidiary crops, maize, cassava, mungbean, sweet potato, and vegetables are the main crops. For the industrial crops, peanuts, soybeans, sugarcane, sesame, tobacco, and jute are the main crops.

Of these, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) identifies maize, cassava, mungbean, and soybeans as priority crops. In addition, fruits, cashew, and rubber are also priority crops among fruits and perennial crops.

Type		Main Crops
Food crop		Rice
Cash crop	Subsidiary crop	Maize, Cassava, Mungbean, Sweet Potato, Vegetables
	Industrial crop	Peanuts, Soybeans, Sugarcane, Sesame, Tobacco, Jute
	Perennial crop	Fruits, Cashew nuts, Rubber

Source: JICA Study Team

4. Potential Crops to be Supplied as Raw Materials for Strategic Processed Foods

Screened by criteria of government policies, production potential, processing abilities, potential in world markets, development impacts and business feasibilities, it can be said as follows:

Rice, cassava, maize and soybeans are potential crops as materials for strategic processed foods. Above all, rice has the largest potential. Starting with rice could accumulate technologies, capital and knowhow, which could pave way for other crops. The crop with the greatest potential after rice could be cassava.

Group	Crops	Supply Side			Demand Side	Development Impact	Business Feasibility	Total
		Policies	Production Potential	Processing	Market Potential			
Main crops	Rice	A	A	B	A	A	A	A
	Cassava	B	B	B	B	B	B	B
	Maize	B	B	B	C	B	B	B
	Soybeans	B	B	B	C	C	C	B
Subsidiary and Industrial Crops	Vegetables	B	B	C	C	B	C	C
	Pepper	B	C	C	B	C	C	C
	Sesame	B	B	C	C	C	C	C
	Cashew	B	B	B	B	C	C	C
	Fruits	B	B	C	C	C	C	C

Note: A: Good/High, B: Fair, C: Bad/Low

Source: JICA Study Team

5. Potential of Food Processing Business

(1) Rice

The superiority of Japan in rice processing; and sustainable potential of Cambodia in rice processing and utilization.

Processed Food		Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization	
			Short-Term	Med- & Long-Term
Milled Rice	Ordinary Milled Rice	◎	◎	◎
	Parboiled Milled Rice	◎	○	◎
	Husked Rice (Cargo Rice)	◎	△	◎
Processing and Utilization of By-product	Straw	Restore to Soil, Compost, Spreading Material, Animal Feed, Straw Product	◎	◎
	Husk	Fuel (for Power Generation, Drying, etc.)	○	◎
		Restore to Soil, Compost, Spreading Material, Insulator, Building Material, Culvert	◎	○
	Rice-bran	Rice Bran (Cooking Oil) De-oiled Bran (Animal Feed)	◎	○
Bed for Pickles making, Wax for Soap, etc.		◎	○	
Processed Food made from Milled Rice	Confectionery	Rice Cracker, Rice Cake, etc.	◎	◎
	Rice Flour	Rice Noodle, Pho, Rice Paper, Bread, Sweets, etc.	◎	◎
	Alcoholic Beverage	Distilled Spirit, Sake, Rice added Alcohol	◎	◎
	Retort Pouch Food	Cooked Rice, Congee, Rice-based cooked Meal	◎	○
	Frozen Food	Rice Ball, Rice burger, etc.	◎	○
	Rice Vinegar		◎	◎

Source: Study Team

(2) Maize

Processed Food		Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization	
			Short-Term	Med- & Long-Term
Animal Feed	Compound Feed (Main Material)	◎	◎	◎
Processed Food (Flour Milling)	Steamed / Baked Bread (Bun)	◎	◎	◎
	Congee	◎	◎	◎
	Cornflakes	◎	◎	◎
	Corn Soup	◎	◎	◎
	Confectionery (Dough)	◎	◎	◎
	Rehydrate-able Noodle	◎	△	◎
	Pet Food (Main Material)	◎	◎	◎
Non-processed Food	Boiled / Grilled Corn	◎	◎	◎
By-product	Corn Starch (Kernel/ Cob/ Leaves): For Ethanol, Paper making, Paste, etc.	◎	△	◎
	Corn Oil (Germ)	◎	△	◎
	Compost (Cob/ Leaves)	◎	◎	◎
	Cob Meal: Synthetic Resin, Sweets, Building Materials, etc.	◎	△	◎

Source: Study Team

(3) Soybeans

Processed Food		Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization	
			Short-Term	Med- & Long-Term
Soybean Oil	Tempura Oil	◎	△	◎
	Salad Oil	◎	△	◎
	Mayonnaise	◎	△	◎
	Frying Oil for Confectionery, etc.	◎	△	◎
Meal (De-oiled Soybean)	Animal Feed	◎	△	◎
	Soy Sauce	◎	◎	◎
Processed Food made from Soybean	Soy Milk	Bean Curd Grilled Bean Curd, Frozen Bean Curd, Deep-fried Bean Curd, etc.	◎	◎
		Soy Milk Skin	◎	◎
	Bean Curd Refuse	For Food	◎	◎
		For Animal Food	◎	◎
	Boiled Soybean	Bean Paste	◎	◎
		Natto (Fermented Soybean)	◎	◎
	Roasted Soybean	Toasted Soybean Flour	◎	◎
	Green Soybean		◎	◎
Soybean Sprout		◎	◎	

Source: Study Team

(4) Cassava

Processed Food			Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization	
Primary Processing	Secondary Processing			Short-Term	Med- & Long-Term
Chips	Animal Feed		△	⊙	⊙
	Biomass Ethanol		△	○	⊙
Pellet (Molding Chips)	Animal Feed		△	⊙	⊙
	Biomass Ethanol		△	○	⊙
Starch	Processed Food (Natural Additives)	Various Desserts, Ice Cream, Noodles, Canned Foods, Synthetic Seasoning, Sweets, Tapioca Pearl (granular product), Pudding, Material for making pre-washed rice, Liaison,, Fish/Meat-Paste Products, Sauce, Confectionery, etc.	⊙	△	⊙
	Non-Food Use	Paper making, Textiles, Plywood, Paper coating, Spinning, Various Bonding, Medicines	⊙	△	⊙
By-Product from Starch making	Cassava Pulp	Animal Feed	△	⊙	⊙
Processed Food from Cassava Root/ Leaves: Fried Chips, Dried Cassava, Cassava Flour, Paste, Leaves Paste, etc.			△	⊙	⊙

Source: Study Team

(5) Other Prospective Commodities

Other than the four (4) commodities described before, many potential commodities are conceivable, such as:

- Fruits (Coconut, Mango, Dragon fruit, etc.)
- Nuts (Cashew nut)
- Palm
- Commodities suitable for alcohol fermentation (Alcoholic Beverages)
- Organic vegetables
- Spices (Pepper, etc.)
- Sesame
- Secondary & tertiary processed foods of cereal grains
- Seasoning (Fish-sauce, etc.)
- Various preserved foods

6. Food inspection and quarantine system

In terms of production and distribution of processed food in Cambodia, there are the following issues for quality standards:

- The quality and production standards for processed food are not yet well established; it is difficult to point out the discrepancy for trading, and it may contribute to risk for the buyer.

- In the case of price formation, the quality standards and their inspection methods are not yet defined, so the trading system is not clear.
- Some processors do not have their own quality objectives and quality standards, and cannot ensure their quality. Therefore, they cannot maintain quality constantly.
- Though the quality of raw materials is low, some processors do not make efforts to improve the quality of processed food as final products.
- Some small and medium food processing enterprises do not have the necessary equipment for quality control, so they cannot check the product quality.
- Government inspection institutes do not have enough equipment and lack human resources; it is difficult to conduct reliable inspections.

After setting quality standards for processed food, the quality and price for the grade will be formulated, and effective and fair-trading can be carried out; clarifying the price with the quality increases the product reliability. Additionally, if the inspection methods for quality standards are standardized, all stakeholders can use the methods, and the processors can have self-imposed tests with the quality standards.

In the case of setting quality and grade standards, it is important to consider that the standards should be the minimum followed as a nation and if the standards can be accepted by the customers. After establishing the standards, it is necessary to require that they show the standard in the customer sector and to promote the standards with the prices.

The Study Team recommends technical cooperation to establish the quality and grade standards for processed food, and more detailed ideas will be mentioned later.

7. Logistics System

It is very important for the improvement of the logistics system to create diversification of transport network for strengthening industrial competitiveness, especially for the food processing industry in Cambodia. The railway rehabilitation project supported by the ADB and other donors will contribute to streamlining the logistics system by increasing the transport options, in particular the Southern Line will connect to Sihanoukville Port directly. Furthermore, the F/S on railway development between Phnom Penh and Ho Chi Minh has been completed with the support of the Chinese Government in 2010, and now the Cambodian Government is looking for a donor to conduct the railway development. This railway project will also contribute to the growth of agricultural and food processing production through the improvement of logistics system in Cambodia.

For the diversification of the transport system, it is very important to develop the logistics centers (logistics nodes), for instance, the development of the agricultural central market in not only Phnom Penh but also regional centers with information facilities and network connecting to each other to share market information.

There is development potential of inland water transport in Cambodia. Particularly, when the inland water route between Mekong River and Tonle Sap Lake is developed as a domestic logistics network, market accessibility of agricultural products for farmers in rural areas would be improved and the food processing industry would take advantage of raw procurement more easily, consequently the food processing industry in Cambodia would achieve price competitiveness for the international market. The development of a country-elevator system¹ at appropriate points together with the re-development of the inland water system might contribute considerably to not only enhancement of domestic agricultural productivity and distribution but also increased exports of milled-rice mentioned in the Rice Policy.

In regard to sea transportation, currently the Sihanoukville Port is being developed step by step. It is necessary to develop larger container berths alongside the pier for over 10,000 DWT vessels with the aim of expanding milled rice exports as mentioned in the Rice Policy.

In the long term, the development of the cold chain system will be needed to heighten the high-value added level of agricultural products and processed foods for export. However, the limit of electricity capacity generation blocks the development of the cold chain system due to lack of electrical power and low development of power grids. In around 2013 – 2015, the capacity of power generation will be improved drastically due to the support from the donors and international agencies, and then the condition of cold chain system development will be met, hence now the needs of the feasibility study and future plans for the development of the cold chain system is soaring.

8. Business Potential for Japanese companies

To promote the food processing business in Cambodia, agricultural production, storage pickup, food processing, along with public support at every stage of export logistics is strongly needed. In addition, import of capital and technology transfer from the private sector are also important conditions for promoting expansion of Japanese companies business.

In particular, Cambodia has potential for agricultural investment using the advantage of the long-term international food market in free trade with ASEAN countries (tariff elimination) and technology transfer. Therefore Cambodian business potential is expected to expand in the future with the ODA.

As for the situation faced by the Japanese food markets, there are raw materials prices rises due to international trade fluctuations, and shrinking domestic demand due to aging. This situation is expected to continue over the near future. To overcome this situation, domestic food makers are focusing on overseas growth markets particularly in Asia through the acquisition of new land.

The purpose of the business expansion of food related companies in Asia, ‘securing the local

¹ It is kind of silos and grain storage facilities, called a grain elevator terminals in allotted areas. Huge silos (bins) and loading grain elevators, and preparation plants including grain drying facilities. New Orleans in the USA is a major center for grain exports, which are often set up in many terminals. For example, when the rice was harvested, and brought to the elevator, storage silo and prepared dry, and when needed, rice with sliding rice plant is to be shipped.

market’, ‘production network’, ‘exporting products to the growing market’, ‘ensure use of the labor force’, is considered large. Thus, basic investment conditions such as infrastructure and cold chain developments are urgently needed for business.

In the case of frozen food in Thailand by Japanese firms to establish a Joint Venture with local companies, there has been success, which has become a import base for Japanese food processing. However, product supply to the domestic market in Thailand has not been achieved even in this successful case.

Once a stable supply of cheap labor in Cambodia with the improvement of quality, it considered to establish a frozen food processing zone as well as cases in Thailand. Cambodia can develop into a long-term supplier of products to neighboring countries, i.e. Thailand and Vietnam.

Similarly, there is a trend of seasoning products such as tapioca export to neighboring countries i.e. Thailand. If Cambodia can supply raw material cheaper than Thailand, Cambodia can presumably join the same trend.

In Vietnam, the young average age of the population is around 20 at present. According to the estimation of the national economy, the amount of sweets consumed by a high proportion of young consumers is said to have remained for 10 years from 2.5 times in 2002.

The major players of confectionery products can be divided into foreign companies and local companies. Foreign companies, Mars (U.S.), Lotte (Korea) are famous for gum and chocolate products in general; on the other hand local companies such as Kind and Bibika mainly produce biscuits and candy.

Japanese confectionery makers currently have not made the business of local production; exports and sales have remained only a local product that is manufactured in Thailand or Singapore.

However, if Cambodia can clear a certain level of hygiene and quality control in the field, is considered a business model holds that manufacture of imported raw material and export products to neighboring countries.

9. Supporting Strategy for Food Processing Business

Thus, Cambodian food processing industries will grow from Cambodian agricultural products, such as raw materials like rice, soybean, cassava, maize, etc., and will maximize the development benefit for farmers. This should be fostered in the short term.

In the middle to long term, Cambodia should aim at expansion of exports to the international market and of import substitution in the domestic market with usage of domestic fruits, organic vegetables, pepper, sesame, etc. as a raw material for the food processing industry in Cambodia through cost reduction by mass production, quality improvement, and the other factors.

In addition, in the long term, the dairy and pastoral sector should be developed and develop a new market of processed meat and dairy products.

<Phased Development Strategy>

Short Term :	To aim at producing processed food (high-value added of agricultural products) by utilizing the irregularly exported agricultural products without value-added and expanding processed food exports regularly.
Middle Term :	To aim at further expansion not only of exports to the international market by the cost reduction and upgrading of quality control but also of supply to the domestic market by import substitution.
Long Term :	To aim at gaining new market sectors.

10. Proposed Projects

Based on the above evaluation, the eight proposed projects are selected according to high priority support items. The project summaries are shown as follows.

Proposed Project 1 : Vertical Integration for Securing a Volume of Quality Paddy (Financial and Technical Cooperation)

Target Commodity & Target Area	Target Commodity : Rice Target Area : Existing Rice Field and Tonle Sap lake
Supporting scheme	Loan Aid, Technical Cooperation
Budget	J. Yen 3 – 5 billion (3 – 4 years)*

Proposed Project 2 : Improvement of Postharvest Treatment and Processing Technology of Crops

Target Commodity & Target Area	<u>Target Commodities</u> Rice, Maize, Soybean and Cassava (hereinafter called four (4) commodities) <u>Target Areas</u> Main growing and processing areas of four (4) commodities
Supporting scheme	Technical Cooperation Project (with Preparatory Survey before the project)
Budget	J. Yen 400-500 million (for three years, 150-200 M/M) ※

Proposed Project 3 : Introduction assistance for organic production system

Target Commodity & Target Area	<u>Target Commodities</u> Target commodities are prioritized from cashew nuts, rice, corn, soybeans, cassava, and vegetables etc. after discussion with Cambodian side. <u>Target Areas</u> Main growing and processing areas of above commodities
Supporting scheme	Technical cooperation project, cooperation preparatory study
Budget	J. Yen 300-400 million (for three years, 150-200 M/M)

Proposed Project 4 : Quality and its inspection standards for processed food

Target Commodity & Target Area	<u>Target commodities</u> Target commodities are prioritized from rice, corn, soybeans, and cassava after discussion with Cambodian side. <u>Target areas</u> Main growing and processing areas of above commodities.
Supporting scheme	Technical Cooperation Project, cooperation preparatory study
Budget	J. Yen 300~400million (for three years, 150-200 M/M) ※

Proposed Project 5 : Establishment of Public Agricultural Market

Target Commodity & Target Area	<u>Target Commodities</u> Rice, Maize, Soybean and Cassava (hereinafter called four (4) commodities) <u>Target Areas</u> Target areas are assumed to be the major growing areas of the four (4) commodities, the areas bordering to neighboring countries (Vietnam & Thailand) and the areas along the major rivers, from the viewpoints of production and distribution.
Supporting scheme	Grant Aid (with Preparatory Survey before the project)
Budget	J. Yen 400-600 million (3-4 marketplaces, Roughly 2 years) ※

Proposed Project 6 : Inland water network development (including Country Elevator)

Target Commodity & Target Area	<u>Target Commodities</u> All agricultural products in Cambodia <u>Target Areas</u> Several river ports alongside Tonle Sap Lake and Bassack/Mekong river
Supporting scheme	Yen Loan (including F/S)
Budget	J. Yen 1-5 billion (for 2-3years)※

Proposed Project 7 : Development of SEZ specialized as Food Processing Industry

Target Commodity & Target Area	<u>Target Commodities</u> Paddy and the other grains <u>Target Areas</u> Phnom Penh Municipality and surrounding area
Supporting scheme	Yen Loan (including F/S)
Budget	J yen 3-10 billion (for 3-4years)※

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Abbreviation List

	Standard Nomenclature
ADB	Asian Development Bank
AFTA	ASEAN Free Trade Agreement
AFD	Agence Francaise Developpement
ASEAN	Association of Southeast Asian Nations
ASYCUDA	Automated System for Custom Data
AusAID	Australian Agency for International Development
BAAC	Bank for Agriculture and Agricultural Cooperatives (Thailand)
BOI	Board of Investment
BOT	Build, Operate and Transfer
CARDI	Cambodia Agricultural Research and Development Institute
CBTA	Cross Border Transport Agreement
CCAs	Common Control Areas
CCC	Cambodian Chamber of Commerce
CDC	Council for the Development in Cambodia
CFFA	Cambodia Freight Forwarder Association
CIB	Cambodia Investment Board
CNSL	Cashew Nut Shell Liquid
C/P	Counterpart
DANIDA	Danish International Development Agency
EDC	Electricite du Cambodge
FAO	Food and Agriculture Organization of the United Nations
FTA	Free Trade Area
EU	European Union
GDP	Gross Domestic Product
GMS	Great Mekong Sub region
HACCP	Hazard Analysis and Critical Control Point
ICD	Inland Container Depot

	Standard Nomenclature
IFC	International Finance Corporation
ILCC	Industrial Laboratory Center of Cambodia
ISC	Institute of Standards of Cambodia
IPP	Independent Power Producer
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
MAFF	Ministry of Agriculture, Forestry and Fishery
METI	Ministry of Economic, Trade, and Industry
MIME	Ministry of Industry, Mines and Energy
MOC	Ministry of Commerce
MOH	Ministry of Health
MOU	Memorandum of Understanding
MOWRAN	Ministry of Water Resource and Metrology
MRC	Mekong River Commission
MRD	Ministry of Rural Development
NL	Northern Line
NSDP	The National Strategic Development Plan
NZAID	New Zealand Aid Programme
ODA	Official Development Assistance
PPAP	Phnom Penh Autonomous Port
PP Bags	Polypropylene Bags
PRSP	Poverty Reduction Strategy Paper
QIPs	Qualified Investment Projects
RGC	The Royal Government of Cambodia
RUA	Royal University of Agriculture
RS	Rectangular Strategy
SAP	Sihanoukville Autonomous Port
SCM	Supply Chain Management

	Standard Nomenclature
SEC	Southern Economic Corridor
SEZ	Special Economic Zone
SIYB	Start and Improve Your Business
SME	Small and Medium Enterprises
SNEC	Supreme National Economic Council
SL	Southern Line
SPS	Sanitary and Phytosanitary Measures Agreement
UNCTAD	United Nations Conference on Trade and Development
UN-ESCAP	United Nations Economic Commission for Asia and Far East
UNIDO	United Nations Industrial Development Organization
USA	United States of America
VFA	Vietnam Food Association
WB	World Bank
WTO	World Trade Organization

Chapter 1 Introduction

Chapter 1 Introduction

1.1 Background of the Study

In recent years, food safety is an increasingly important public issue. In particular, the safety of imported food has become an important issue, of very great interest to the public. Also, if the country relies on imported food, the diversification of food imports in times of peace is considered important.

Cambodia is one of the largest agricultural countries in Southeast Asia and the majority of the population is engaged in rice cultivation. As rice is the dominant crop in Cambodian agriculture, the Cambodian government has positioned it as the most important agricultural export commodity.

Recognizing the strategic role of the rice sector in economic growth and food security, the Cambodian government has paid special attention to this sector. In August 2010, the Cambodian government launched the policy of paddy production and rice exports in a move to enlarge rice production and strengthen the strategy of increasing rice production with cross-ministry efforts and setting up long term agricultural development.

While great potential exists in Cambodian rice production, to realize such potential, the country needs to overcome a series of constraints such as lack of sufficient irrigation facilities, the low level of milling technology, and an inefficient distribution system.

In such circumstances, it is considered that to promote Japanese FDI toward the Cambodian agricultural sector may provide a positive and significant contribution to the home and host country's economic growth in terms of innovation and production increases, upgrading domestic production quality improvements, employment creation, and business expansion and food security.

1.2 The purpose of the survey

The purpose of this survey is to find possibilities to promote Japanese FDI toward Cambodia under the scheme of ODA. Japanese FDI is considered to promote Cambodian economic activities including promotion of agricultural product processing, market distribution and food products sales to stimulate growth in rural areas.

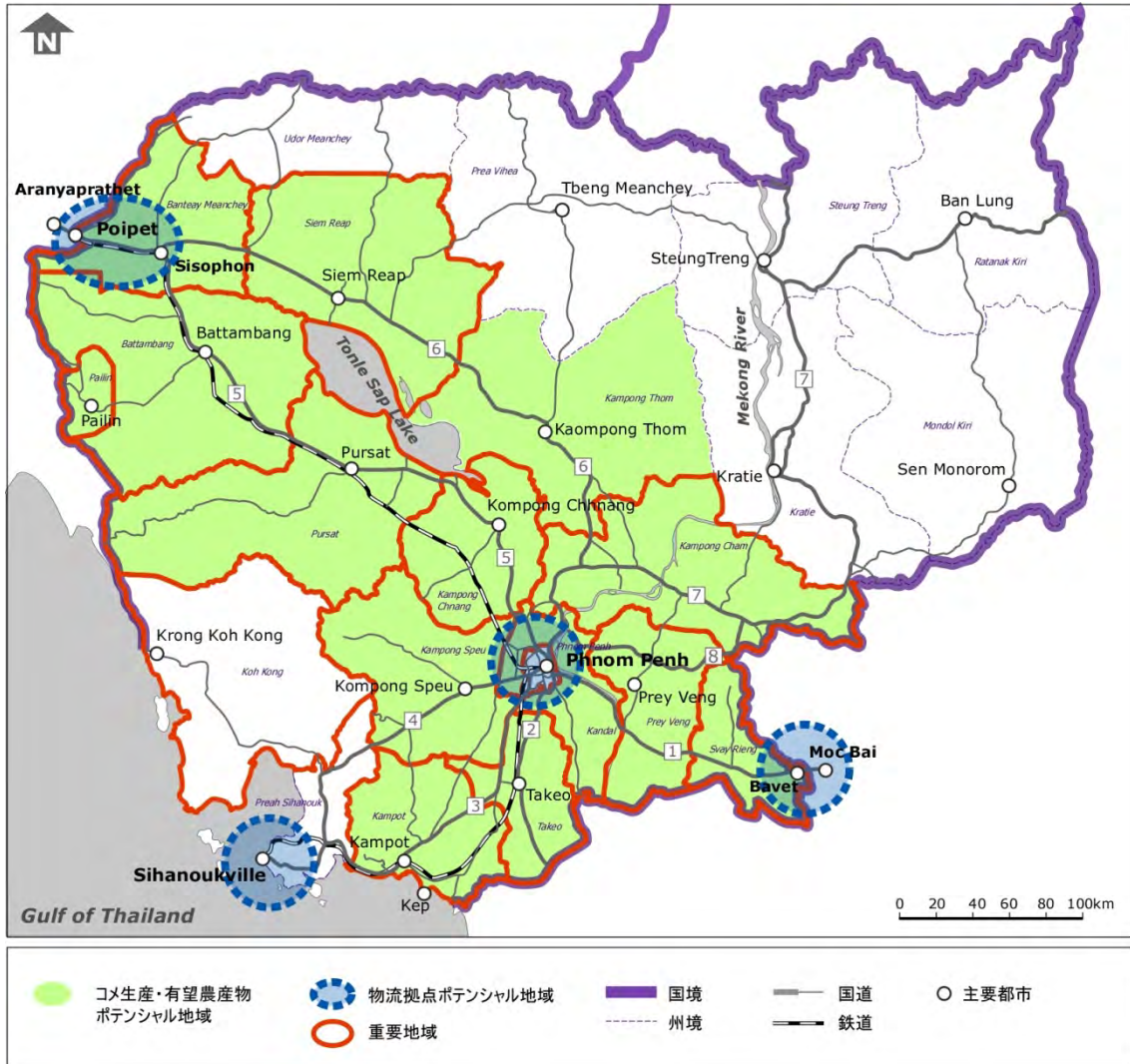
In response to this situation, the Government of Japan dispatched a preparatory study team in July 2011 to contribute to Cambodian agricultural export promotion in the areas of rice policy and crop diversification.

As specified in the terms of reference, this survey focuses on

- 1) Providing a simplified picture of the Cambodian agriculture and food sector;
- 2) Proposing conditions for promoting expansion of Japanese food-related business

1.3 Study Area

The target area of the study covers agricultural land comprising mainly paddy fields and upland fields. However, for efficient data collection the study is targeted on main agricultural areas, located in the country and consistent with active trading/business transactions such as National Road No1, 3, 4, 5 areas.



Source : JICA survey team

Chapter 2 Socio-economic conditions in Cambodia

Chapter 2 Socio-economic conditions in Cambodia

2.1 National Development Plan

Cambodia is largely an agrarian society, with rice forming the backbone of the country's agriculture. For most Cambodian farmers, rice is the major source of income and sustenance. The crop thus plays an integral part in the economy of Cambodia. Recognizing the important role of rice, the Cambodian government has paid special attention to this sector, as rice appears in government strategy and planning documents wherever agriculture is mentioned.

Since 1991, the Cambodian government has implemented several policies and strategies following the National Program to Rehabilitate and Development Cambodia(NPRDC), First Socio-economic Development Plan 1996-2000 (SEDP),Triangle Strategy, Second Socio-economic Development Plan 2001-2005(SEDP2), Rectangular Strategy, National Strategic Development Plan set a target for the Agricultural sector. Especially, the NSDP required a sector-specific strategy for Agriculture and Water, whose goal is "enhancing agricultural productivity and diversification and improving water resources development and management". In order to fulfill the targets, it is essential to improve rural people's incomes and living standards. For this, agriculture, irrigation, and rural developments have been highly intended. In addition, as a concrete national strategy to improve famers' income for poverty reduction,

- Capacity building for farmers
- Crop diversification
- Farmers organization

are mentioned on the strategy paper. Through them, strengthened cooperation among farmers and effective administration services are aimed.

In August 2010, the Cambodian government launched the policy of paddy production and rice export in a move to enlarge rice production and strengthen the strategy of increasing rice production with cross-ministry efforts to set up long term agricultural development. While great potential exists in Cambodian rice production, to realize such potential, the country needs to overcome a series of constraints such as lack of sufficient irrigation facilities, a low level of milling technology, and an inefficient distribution system.

2.2 Socio-Economic Conditions

(1) Geographical conditions

Cambodia is located in the southeastern part of the Indo-Chinese peninsular. The total area is 181,035 km² with fertile land and abundant water resources in the Mekong River system. The country to the northwest is Thailand, to the north is the Lao PDR, and to the east is Vietnam and Cambodia shares the Mekong with neighboring countries as a major corridor for commerce.

The climate in Cambodia is divided into the rainy and dry seasons under the influence of the monsoon. It is hot and wet in the rainy season from May to November, while in the dry season, it

is relatively cool during period from December to January, becomes hotter from February and hottest in April.

(2) Population

Cambodia has a population of approximately 13.4 million people (2008), and it's almost same as the population of Tokyo. The Capital City, Phnom Penh has a population of 1.33 million, and Siem Reap, a famous tourist city of Angkor, has a population of 140,000.

The current population growth (annual) rate in Cambodia is a relatively high 1.64 % (Vietnam at 1.15%, Thailand 0.69%, Japan -0.07%). Due to the prolonged civil war (1970-75, 1979-98), the Cambodian population is extremely young. Around 77 % of the population is under 40 years of age, and less than 30 years and 20 years of age are 65% and 46%, respectively. Therefore, it is very young country with 23 years the average age of the population.

(3) Economy

Cambodia is a largely agrarian society with agriculture representing the major share of GDP and most of the population living in rural areas, and making their livelihood from rice production activities.

In recent years, the average rate of economic growth in Cambodia has achieved a high level of plus 9.1 % in 1998 to 2008. The main driving force is the textile garment industry, and tourism.

However, GDP contracted slightly in 2009 as a result of the global economic slowdown, but climbed again in 2010, driven by renewed exports. With the 2005 expiration of a WTO agreement, Cambodian textile producers were forced to compete directly with lower-priced countries such as China, India, Vietnam, and Bangladesh. The garment industry currently employs more than 280,000 people and contributes more than 70 % of Cambodian exports.

Cambodia's agricultural sector in GDP, accounting for 33.5%, has increased since 2007. Whereas the industrial sector and service sector fell under the influence of the global financial crisis, agricultural production has continued to increase. Growth of the agricultural sector depends on the weather of the year, and from the fact that agricultural sector is said to be important for the Cambodian economy and people's lives.

Chapter 3 Agricultural Production

Chapter 3 Agricultural Production

Agriculture supplies raw materials for food processing. This chapter, firstly, identifies the potential agricultural products to be supplied as materials for strategic processed foods. Then, it identifies issues and challenges in the agricultural production stage for potential processed foods, followed by the proposed solutions.

3.1 Agricultural Policies

(1) Policy framework

Cambodia's policies are based on the two long-term national strategies:

- Rectangular Strategy II, 2008)
- National Strategic Development Plan: NSDP 2009-2013)

These strategies state that agriculture is one of the four growth poles and needs productivity improvement and diversification.

Based on these strategies, Agricultural Strategic Development Plan (ASDP 2009-2013) identifies productivity improvement, diversification and commercialization of agriculture as strategic objectives.

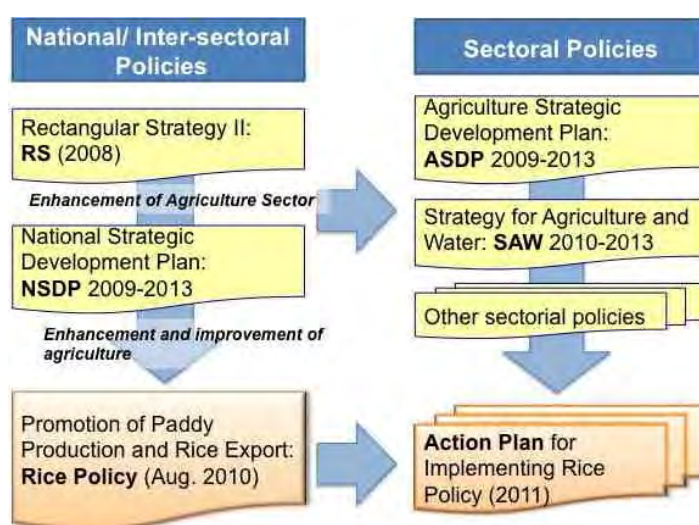


Figure 3-1 Policy Framework

(2) Rice Policy

The Royal Government of Cambodia (RGC) announced Rice Policy (The Promotion of Paddy Production and Rice Export) in 2010. This policy states that rice production and export promotion are potential growth industries following the apparel industry.

Rice Policy specifies quick-win and long/ medium-term policy measures in the four stages. Those are 1) production and collection, 2) production, 3) distribution, and 4) marketing. Following Rice Policy, sector ministries have developed action plans for implementation of the Rice Policy in their respective sectors.

Outline of Rice Policy (2010)

Vision: Transforming Cambodia to an export country for rice - “White Gold” in the near future.

By 2015:

- Surplus: 4 million tons
- Export: 1 million tons
- Establish recognition of Cambodian rice in the international market

Quick-win measures

- Converting informal paddy exports to formal rice exports
- Investment in rice production
- Encouraging private sector entry to rice processing and exports
- Streamlining export procedures, transport facilitation, elimination of informal fees

Long/ Mid-term measures

- Strengthening competitiveness of rice exports

Source: Rice Policy

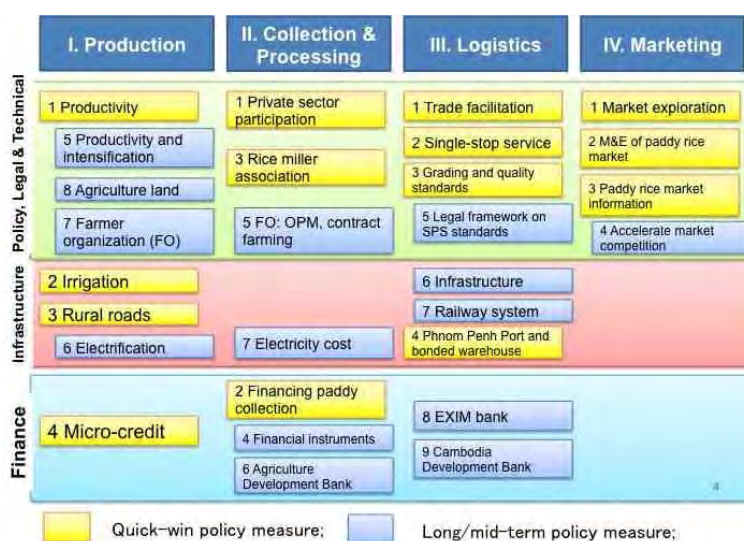


Figure 3-2 Rice Policy Framework (Left) and its Measures (right)

3.2 Situation of Agriculture Production

(1) Agro-ecological Conditions of Cambodia

The agro-ecological area of Cambodia is classified into four regions: 1) Plain Region, 2) Tonle Sap Region, 3) Plateau and mountain Region, and 4) Coastal Region.

Various farming activities are practiced, adjusted to the agro-ecological conditions and climate. The rainy (wet) season starts in the middle of April and ends in the middle of October. The other is the dry season.

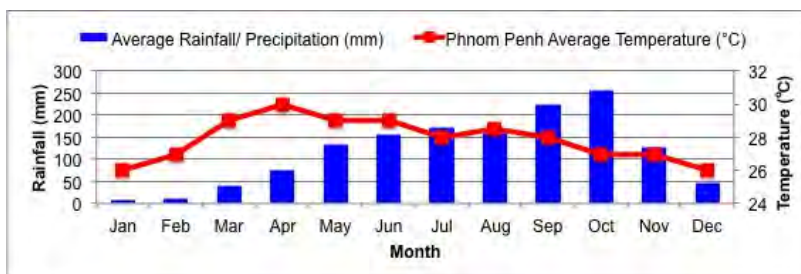
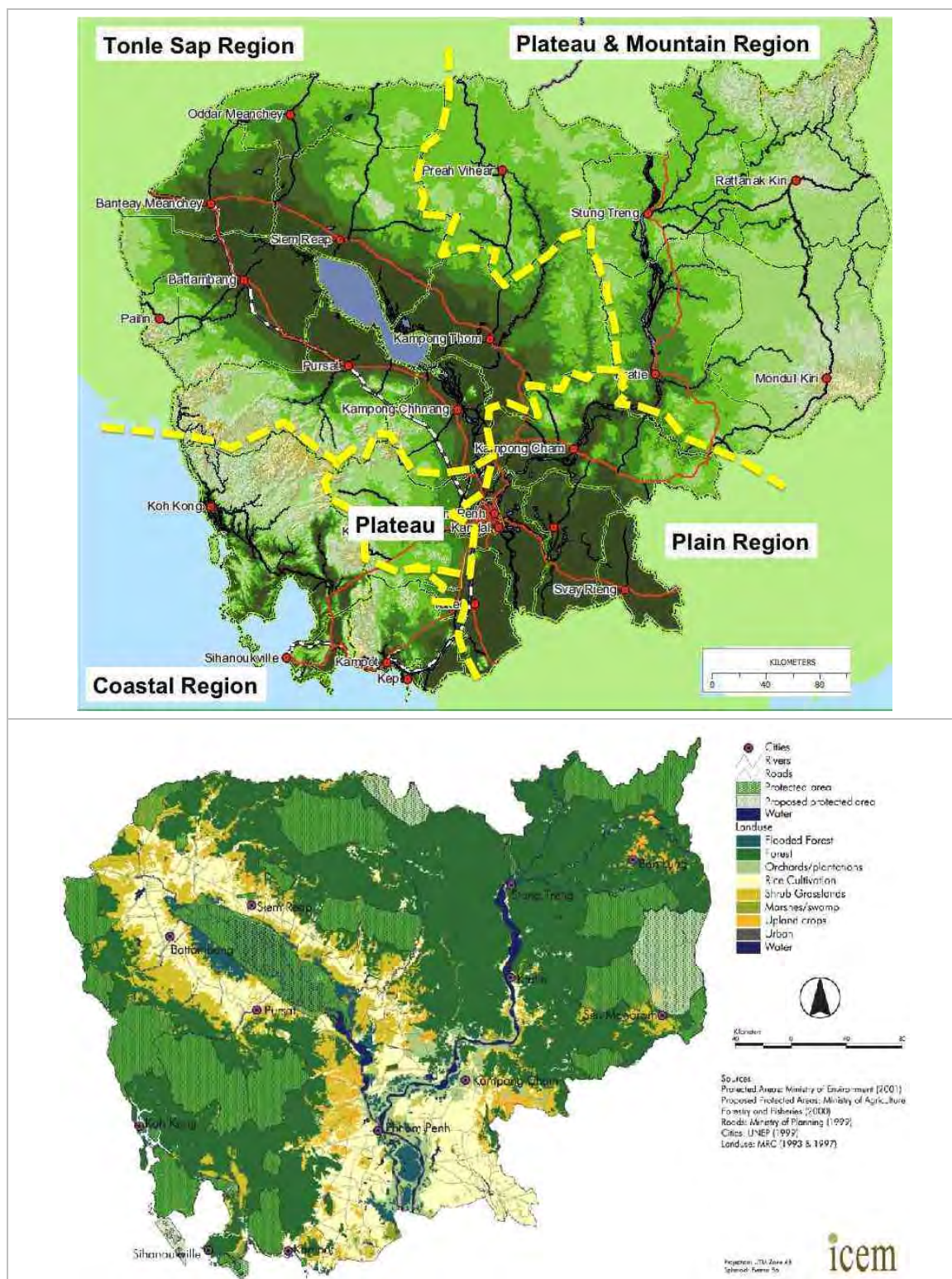


Figure 3-3 Average Temperature and Precipitation in Phnom Penh



Source : Danida

Figure 3-4 Geographical Map (Upper side) and Land Use Map (Lower side)

In the Plain and Tonle Sap Regions where water resources are abundant, rice cultivation is the main farming activity. Upland crops are cultivated in the areas surrounding those water abundant areas. Fruit crops and perennial crops are cultivated along the Mekong River and in the mountainous area.

(2) Production of Major Crops

Rice is the most important crop as staple food. Rice cultivation is the main economic activity as well as providing a source of food and income for the people in rural areas where 80% of the population reside. 30 % of GDP is from agriculture; a half of this is from rice. Rice accounts for 70 % of the cultivation area of crops.

For the cash crops, there are subsidiary crops and industrial crops in Cambodia. For the subsidiary crops, maize, cassava, mungbean, sweet potato, and vegetables are the main crops. For the industrial crops, peanuts, soybeans, sugarcane, sesame, tobacco, and jute are the main crops.

Of these, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) identifies maize, cassava, mungbean, and soybeans as priority crops. In addition, fruits, cashew, and rubber are also priority crops among fruits and perennial crops.

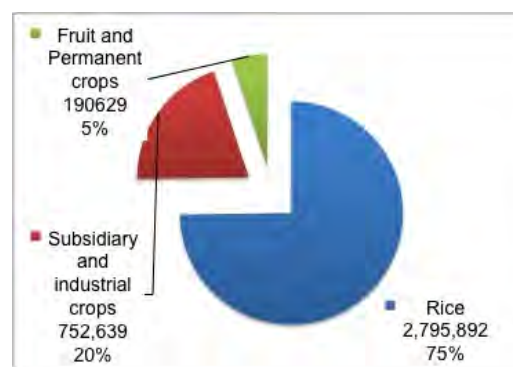
Table 3-1 Main Crops in Cambodia

Type		Main Crops
Food crop		Rice
Cash crop	Subsidiary crop	Maize, Cassava, Mungbean, Sweet Potato, Vegetables
	Industrial crop	Peanuts, Soybeans, Sugarcane, Sesame, Tobacco, Jute
	Perennial crop	Fruits, Cashew nuts, Rubber

Source: JICA Study Team

The production/cultivated area of rice is 2.8 million ha accounting for 75% of the gross production area. The cultivated areas of subsidiary and industrial crops are 0.75 million ha (20%), and those of fruits and perennial crops are 0.19 million ha (5%)¹.

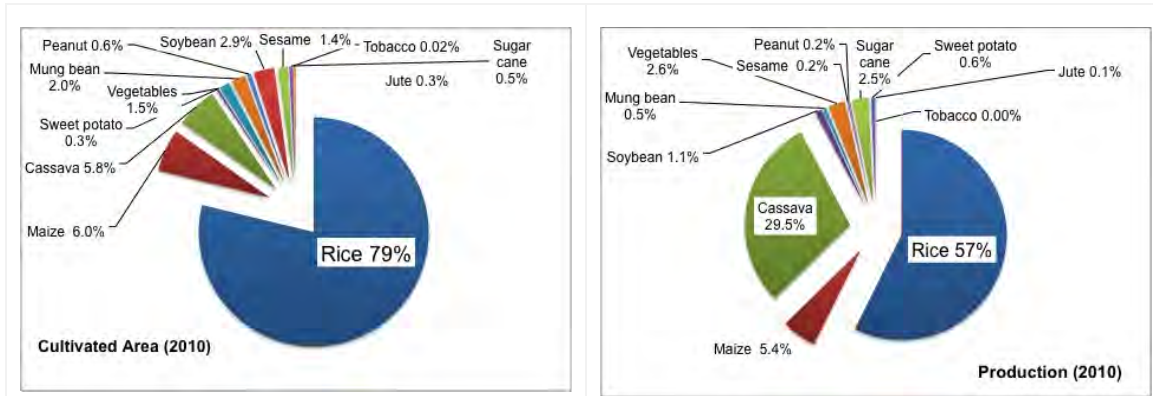
Rice accounts for 80% of the production area and 60 % of production volume among annual crops including food crops, subsidiary crops, and industrial crops. Maize, soybean, and cassava follow rice in cultivated area and volume.



Source: MAFF

Figure 3-6 Cultivated Area (%)

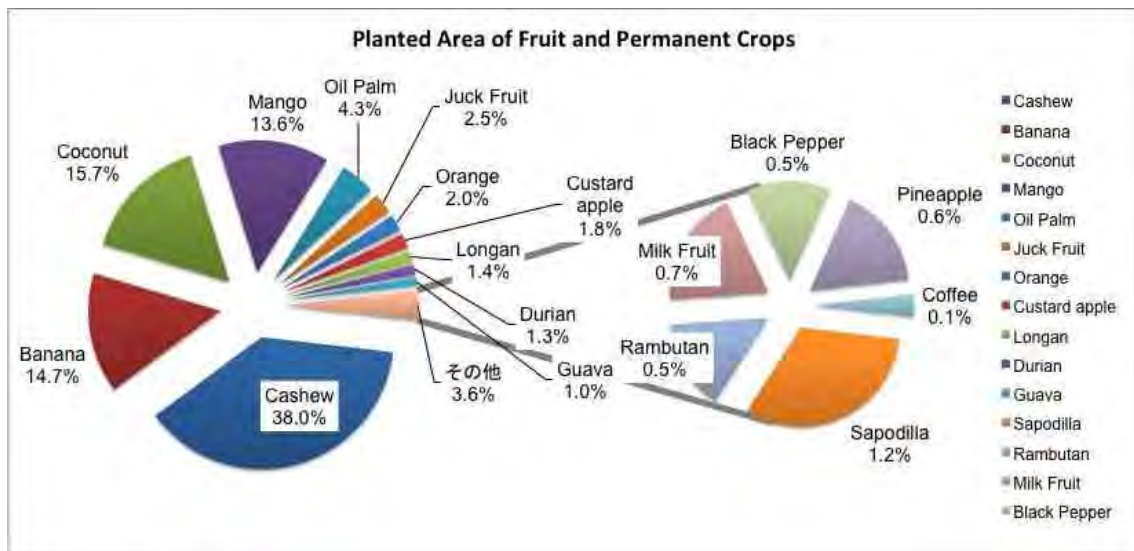
¹ Gross cultivated areas for annual crops



Source: MAFF

Figure 3-7 Share of Main Crops among Production Area and Volume

Cashew accounts for 38% of the production areas for fruits and perennial crops. Following cashew, banana accounts for 15%; coconuts accounts for 16%; and mango accounts for 14%. Cashew covers the largest area among perennial crops. Production area of cashew is 69, 000 ha, as large as that of mungbean.

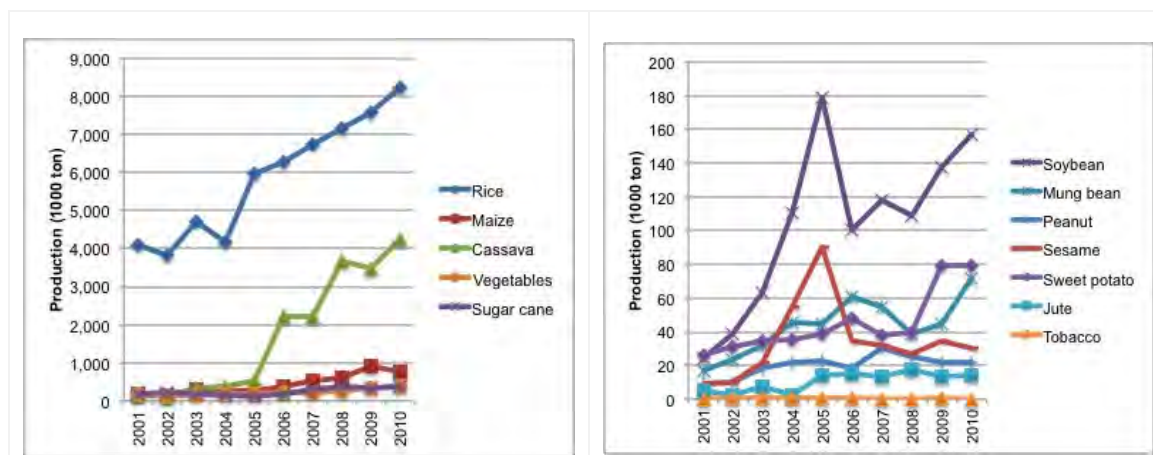


Source: MAFF

Figure 3-8 Cultivated Area of Fruits and Perennial Crops (2010)

Production Trends for Main Crops: Responding to the rise of international market prices

Production of main crops rapidly increased in the middle of 2000s. Rice increased after 2005, soybean after 2004, cassava and maize after 2006.



Source: MAFF

Figure 3-9 Production Trends of Major Crops

Rice production became self-sufficient in the 2000s. A large surplus of rice is produced, far beyond domestic demand. This surplus is exported to neighboring countries informally.

This is a demand-pull production increase. International market prices of crops sharply increased in the middle 2000s. Responding to that, the demand for paddy as raw material increased from neighboring rice-exporting countries, i.e., Thailand and Vietnam.

This induced production increase in Cambodia.

This is also the case for the other crops. Price signals in the international markets spreads over Cambodia through Thailand and Vietnam, which induced production increases in Cambodia. As a result, farmers benefit owing to the informal trade without suffering price decreases due to abundant crops.

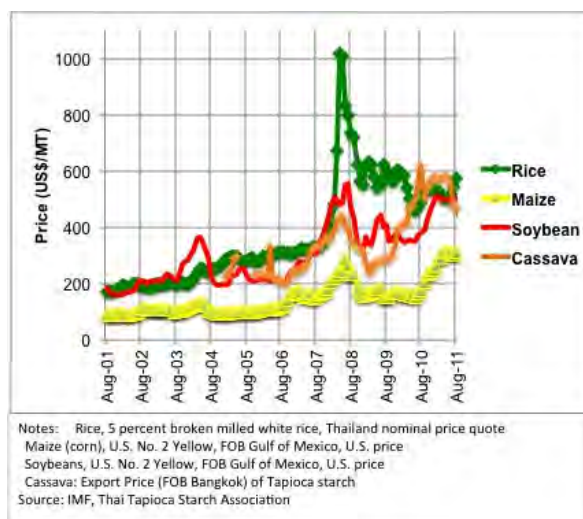
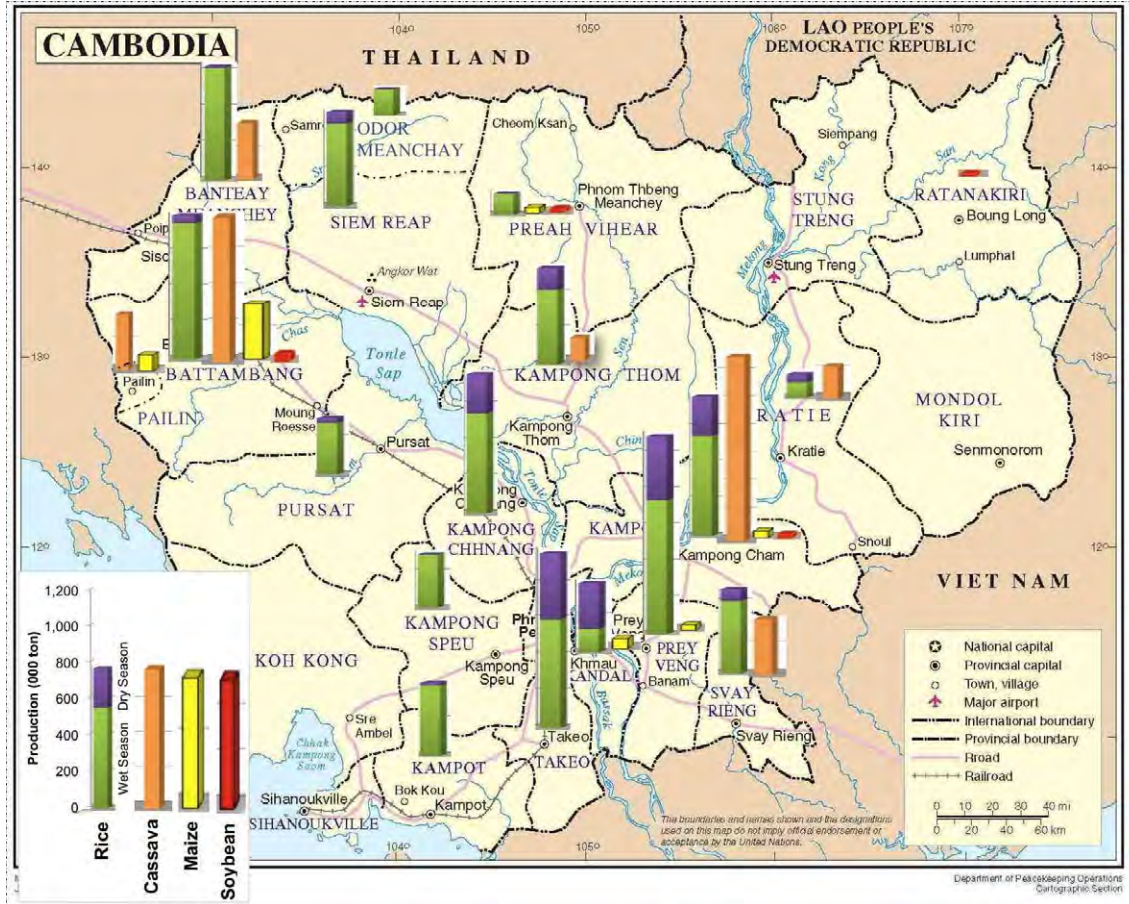


Figure 3-10 International Market Prices of Main Crops

Main Crops and Production Areas

Rice is mainly produced in the Plain Region along the Mekong – Bassac River Basin and Tonle Sap Region. Production in the dry season in the Plain Region is large since water is available in the area even in the dry season.

Cassava is mainly produced in Battambang, Pailin, and Banteay Meanchey adjacent to Thailand; Svay Rieng next to Vietnam; and Compong Cham which is a traditional cassava production area. Maize is produced in Battambang and Pailin, border provinces to Thailand. Soybean production is not as large as those crops. Soybean is produced in Battambang and Compong Cham.



Source: JICA Study Team Based on MAFF

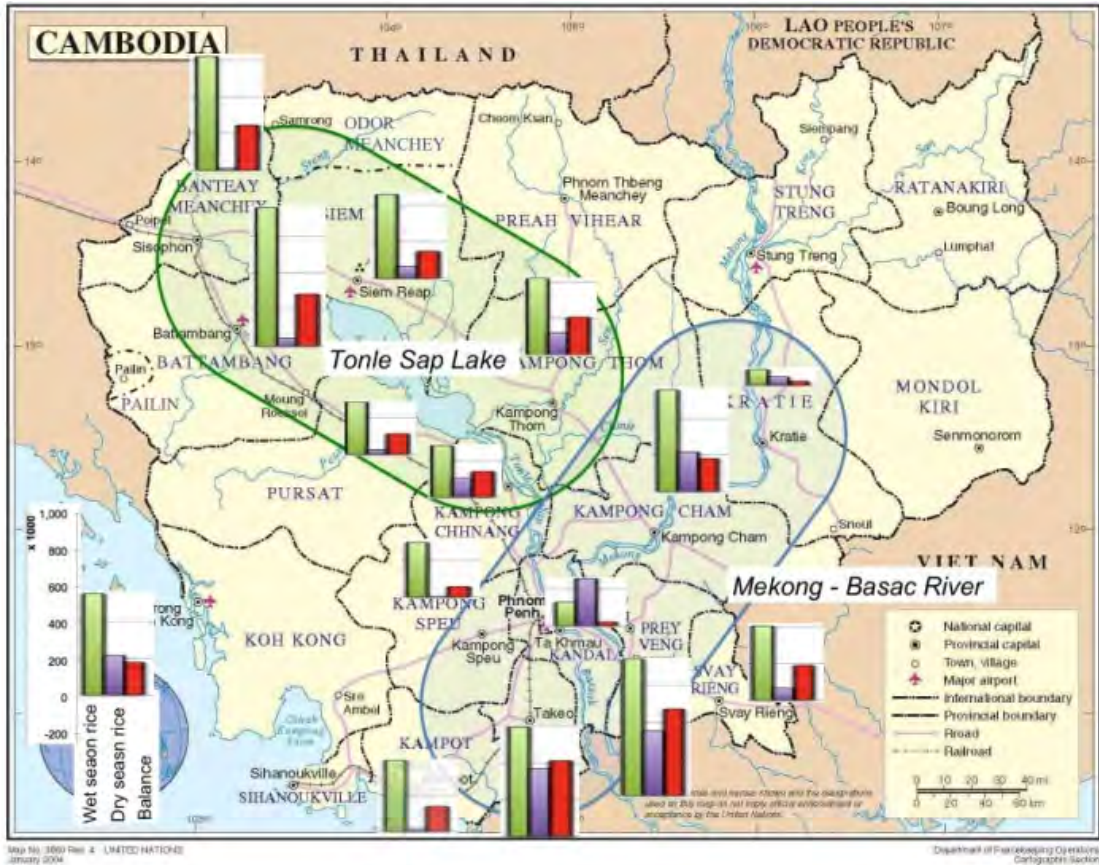
Figure 3-11 Production Area of Main Crops

(3) Flow of the Surplus Crops

Rice production and consumption balance in areas is shown in the figure. The surplus of rice produced in Plain and Tonle Sap Regions flows to Phnom Penh and neighboring countries as informal trade.

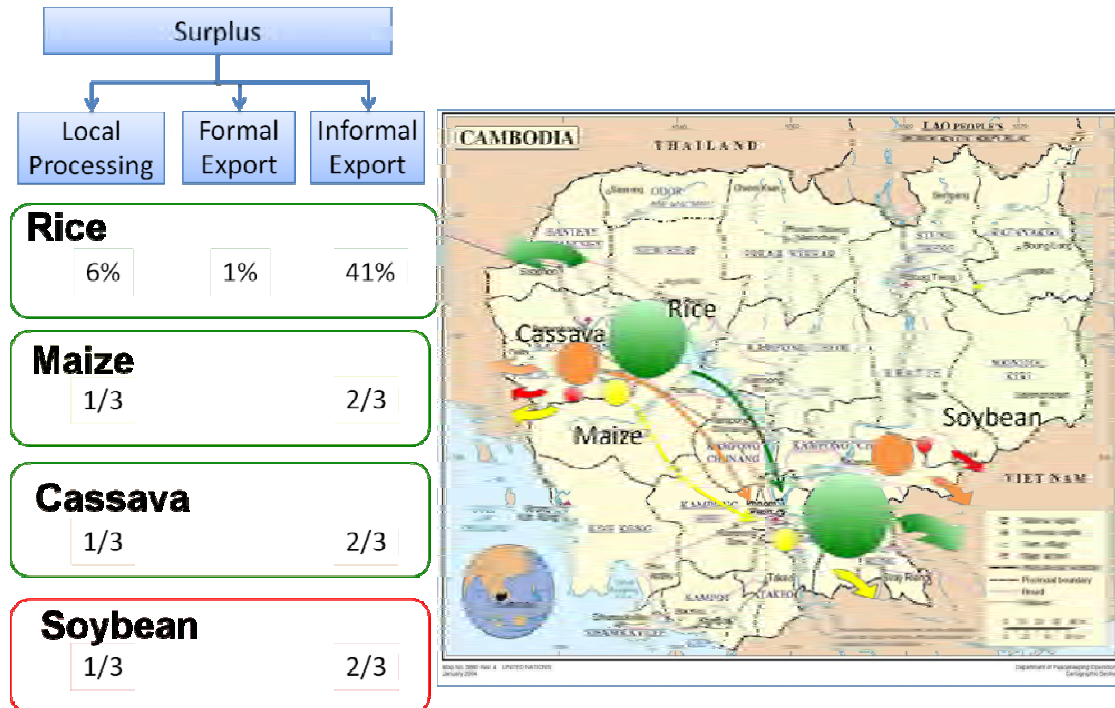
The flows of rice, cassava, maize and soybean are shown in the figure on the right. It is estimated that 40% of the rice surplus, one third of cassava, maize and soybeans flows to neighboring countries informally.

Crops other than rice are produced in the border areas and flow to neighboring countries.



Source: JICA Study Team based on MAFF

Figure 3-12 Rice Production Area and its Balance

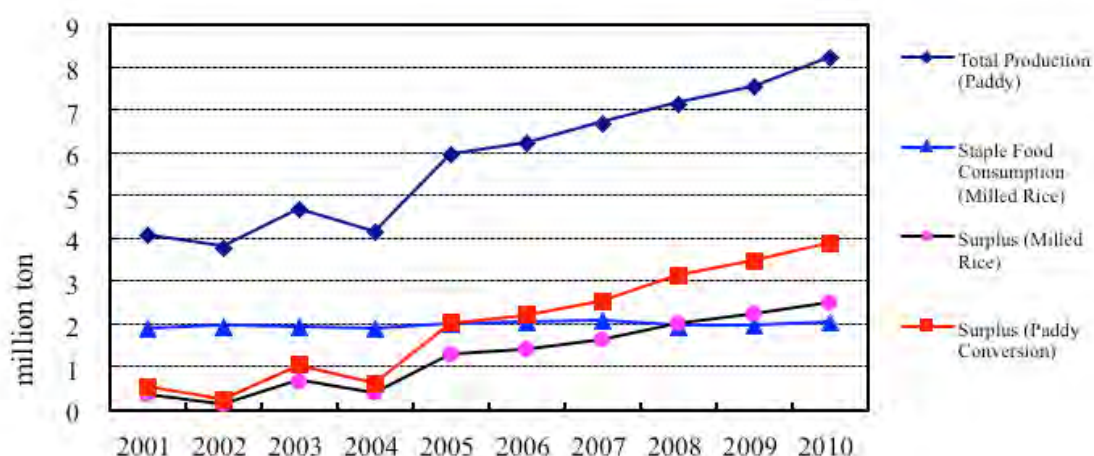


Source: JICA Study Team

Figure 3-13 Flows of Main Crops

In Tonle Sap Region centered in Battambang, fragrant rice such as Phkar Malis flows to Thailand. In Plain Region, IR rice such as IR 66 flows to Vietnam. There is the case that Vietnamese brokers introduce seeds of IR 504 (Nam Kom Bun) which is encouraged in Vietnam; they come to purchase at the harvesting time.

Most of the cassava and maize is sold to the companies invested in by neighboring countries. Those companies provide seeds and purchase products.



Source: JICA Study Team based on Rice Balance, Annual Report, MAFF, 2001-2010

Figure 3-14 Trends of Rice Production and Surplus

The trends of rice production and surplus are shown in the figure above. The rice surplus continues to increase every year. It started growing in 2005 reaching 2 million tons (paddy converted) and reached around 4 million tons in 2010. In 2010, it is estimated that 3.35 million tons of paddy (41% of total production) flowed to neighboring countries informally.²

The factors affecting the large amount of informal exports of paddy are 1) continuous surplus due to the production increase, 2) limited domestic markets, 3) not enough processing capacities to produce high quality rice demanded by foreign markets, and 4) increased demand for paddy from neighboring rice-exporting countries. Furthermore, also pointed out are the other causes of informal trade. Those are 1) neighboring countries' competitive terms of trade for purchasing paddy and 2) undeveloped secondary processing techniques for rice and their markets.

3.3 Potential Crops to be Supplied as Raw Materials for Strategic Processed Foods

The crops can be supplied as materials for food processing only if there is enough production volume and surplus far beyond domestic consumption. Crop production potential as raw materials are discussed above. In addition, potential crops are screened by criteria of creation of strategic processed foods and the potential for investment promotion by Japanese food businesses.

² It is assumed from the rice balance that no rice stockpile is created.

(1) Criteria for Screening the Potential Crops

Potential crops as food process materials are screened by following criteria.

Promotion of Strategic Processed Foods

- Supply side:
 - Government policies and priorities.
 - Material supply: Enough production potential to secure a certain amount and quality
 - Potential of processing in Cambodia:
- Demand side of processed foods: advantages of Cambodia and market potential
- Development impacts : Development impacts expected such as poverty alleviation

Investment Promotion of Japanese Businesses

- Business viewpoints:
 - Enough volume for business
 - Serving many uses of processed foods
 - Possibility of wide range of utilization of byproducts
 - Business feasibility

(2) Crop Potentials as raw materials for processed foods

The potential of the prioritized crops is as follows.

Supply side

- Policies: Rice is the first priority. Starting with rice paves the way for other crops.
- Production: Rice, cassava, maize and soybeans have the potential of production. Above all, rice has the biggest potential. Formalizing informal exports. Cashew has a large production volume.
- Processing: Only rice has a certain level of processing. The processing of other crops are at cottage industry level.

Demand side (Table 3-2)

- The ratio of traded to production volume is low for rice and cassava among rice, maize, soybeans and cassava. Competitors of export for rice and cassava are neighboring countries. Informal export of rice is 2 million tons (3 million tons as paddy). This would be top 5 in the world if formally traded. Informal export of cassava is around 1.3 million tons (dried cassava), which could be second in the world if formally traded.
- The markets for soybeans and maize are matured. Competitors are large countries in North and South America. Informal exports of maize and soybeans are 0.5 million tons and 0.1 million tons respectively, which are placed in the lower positions.

Table 3-2 Potential Crops in World Markets (2009)

	Rice			Maize			Soybean			Cassava		
		Amount	%		Amount	%		Amount	%		Amount	%
World production (000 ton)	Paddy	689,140			826,718			231,392			233,359	
World export (000 ton)	Milled rice	24,131			102,114			79,016		Dried	4,152	
% of exported	Milled equivalent	5.4%			12.4%			34.1%		Dried equivalent	1.8%	
Exporting countries	Thailand	8,672	36%	USA	54,094	53%	USA	33,996	43%	Thailand	2,883	69%
	Vietnam	4,735	20%	Argentina	15,383	15%	Brazil	24,500	31%	Viet Nam	753	18%
	Pakistan	2,599	11%	Brazil	6,433	6%	Argentina	11,733	15%	Netherlands	234	6%
	India	2,474	10%	France	6,138	6%	Paraguay	3,689	5%	Indonesia	130	3%
	USA	1,706	7%	India	3,537	3%	Canada	1,851	2%	Costa Rica	76	2%
Importing countries	Philippines	2,500	13%	Japan	16,460	16%	China	39,531	50%	China	2,004	50%
	UAE	1,278	6%	Mexico	9,146	9%	Netherlands	4,013	5%	S. Korea	900	22%
	Iran	1,125	6%	S.Korea	9,021	9%	Japan	3,711	5%	Spain	272	7%
	Saudi Arabia	926	5%	Spain	5,442	5%	Mexico	3,507	4%	Belgium	239	6%
	Malaysia	883	4%	China	4,231	4%	Germany	3,485	4%	Netherlands	116	3%
						Thailand	1,723	2%	Thailand	85	2%	
									Japan	37	1%	

Source: FAO

Development impacts

- Rice has the largest development impact since 80% of farmers cultivate it. Cassava, maize and soybeans have some effects. Cashew and pepper have limited impact since the number of growers is limited.

Business viewpoints

- According to verbal investigation of Japanese trading companies (food processing companies), they focus primary on the production capacity of agricultural surplus because the capacity realizes reliable supply of raw material and market price as well.
- Rice, cassava, maize and soybeans have enough production volume and wide range of processing uses. Especially, rice is produced in large enough quantities and traded in many forms (Table 3-3).

Table 3-3 Trade of Rice-related Products

Varieties	Share in export volume	Share in export value	Traded to
Milled rice	81%	85%	Asia, Africa, Europe
Broken rice	7.6%	5.4%	Africa, N&S America, Europe
Husked rice	4.8%	4.7%	Europe, Asia, N&S America
Paddy	6.7%	4.4%	N&S America, Asia
Flour	0.15%	0.18%	Europe, N&S America
Bran oil	0.09%	0.17%	Japan
Beverages	0.04%	0.38%	N&S America, Asia

Source: FAO

- Common bottleneck to export is high cost of distribution. Business potential depends on how to breakthrough it.
- Crops with limited production volume like cashew and pepper have limited potential for business. Only a limited number of companies can enter the markets.

Screened by criteria of government policies, production potential, processing abilities, potential in world markets, development impacts and business feasibilities, it can be said as follows:

Rice, cassava, maize and soybeans are potential crops as materials for strategic processed foods. Above all, rice has the largest potential. Starting with rice could accumulate technologies, capital and knowhow, which could pave way for other crops. The crop with the greatest potential after rice could be cassava.

Table 3-4 Potential of Crops as Strategic Processed Food Materials

Group	Crops	Supply Side			Demand Side	Development Impact	Business Feasibility	Total
		Policies	Production Potential	Processing	Market Potential			
Main crops	Rice	A	A	B	A	A	A	A
	Cassava	B	B	B	B	B	B	B
	Maize	B	B	B	C	B	B	B
	Soybeans	B	B	B	C	C	C	B
Subsidiary and Industrial Crops	Vegetables	B	B	C	C	B	C	C
	Pepper	B	C	C	B	C	C	C
	Sesame	B	B	C	C	C	C	C
	Cashew	B	B	B	B	C	C	C
	Fruits	B	B	C	C	C	C	C

Note: A: Good/High, B: Fair, C: Bad/Low

Source: JICA Study Team

3.4 Challenges in Agricultural Production to Supply Raw Materials for Processed Foods

(1) Challenges in production

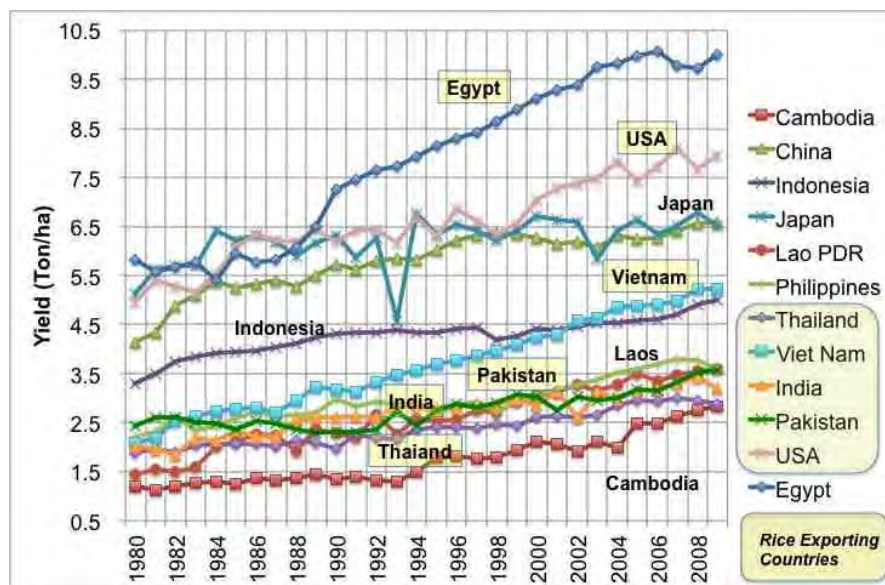
Potential crops for strategic processed foods are crops that are able to be supplied as raw materials with a certain quality and volume. Food processing industries cannot survive if raw materials are not available and factories are idle. Consequently, the following is the most important challenge in crop production to be supplied as raw materials for food processing.

- ***To ensure a certain quality and volume of crops to be supplied as raw materials for food processing***

Taking rice - the largest potential crop -as an example, this main issue is detailed below. Many of these factors below are also applicable to other crops.

The production of rice increased rapidly in the 2000s. The surplus is informally exported now.

As mentioned before, production increased due to the demand-pull factor. On the other hand, factors enabling the increase in production are yield increase and expanding areas. Especially, yield has been steadily increased. In comparison with the yields of major rice producing and exporting countries, the yield of Cambodian rice reached as the same level as that of Thailand or other major exporting countries.



Source: FAO

Figure 3-15 Comparison with Major Rice Producing/ Exporting Countries

To promote industry as a whole, the improvement and equalization of quality is far most important. By doing so, it paves the way to formalize the current informal exports.

Challenges for Ensuring Quality and Quantity

In order to export rice at a higher price in foreign markets, it is necessary to secure a certain quality and volume of rice to meet the requirements of markets. To secure a certain level of quality of rice, an amount of uniform quality of paddy as raw material should be collected at rice mills. Otherwise, it deteriorates in quality, causing a loss in the processing and broken rice.

The reasons for non-uniform paddy quality at the collecting stage are 1) mix of varieties and 2) inappropriate drying practices by farmers. In addition, in spite of the uniform quality of paddy available, it is difficult to collect a certain volume of uniform quality paddy.

1. Mix of varieties: cause of processing losses and quality loss

In Cambodia, there are more than 2,500 varieties of rice planted. MAFF selected 10 priority varieties and encourages farmers to produce them (Table 3-5).

Table 3-5 Ten Priority Varieties Encouraged by MAFF

Type	Varieties	Type	Aromatic	Photoperiod -sensitivity	Maturity/ Date of flowering	Market Type
Early	Chul' sa		No	No	95-105 days	2nd
Early	IR 66	IR	No	No	105-115 days	Premium
Early/ Dry	Sen Pidao	Fragrant	Scent	No	110-120 days	2nd
Medium	Phka Rumduol	Fragrant	Scent	Yes	10-25 Oct.	Premium
Medium	Phka Rumdeng	Fragrant	Scent	Yes	10-25 Oct.	Premium
Medium	Phka Romeat	Fragrant	Scent	Yes	10-25 Oct.	Premium
Medium	Phka Chan Sen Sar		No	Yes	25 Oct. - 5 Nov.	1st
Late	Riang Chey		No	Yes	5 Nov. -18. Nov.	1st
Late	CAR 4		No	Yes	5 Nov. -18. Nov.	1st
Late	CAR 6		No	Yes	5 Nov. -18. Nov.	1st

Source: JICA Study Team based on MAFF and CARDI

The Cambodian Agricultural Research and Development Institute (CARDI) breeds priority varieties of seeds. CARDI sells foundation/registered seeds to companies and the government, who propagates the registered seeds and produce commercial seeds for sale to farmers. MAFF has an extension program to disseminate these priority seeds to farmers. In the program MAFF delivers priority seeds to farmers free of charge. However, it is far from achieving its objective, due to the limits of budget and capacities of extension system.

The Agricultural extension system had been capacitated with Australian cooperation for a decade. Agricultural extension officers are assigned at Provincial and District levels. Rectangular Strategy states that agricultural extension officers are to be assigned at Commune and Village level. In fact, even at Regional and District levels, the capacities, number and activities of extension officers are too limited to fulfill it.

Once farmers introduce the priority seeds, they often mix varieties in the following planting season.

Furthermore, even if farmers produce uniform varieties of paddy at the production stage, the varieties are mixed at the collection stage. Agents of rice mills or collectors collect paddy from the farmers. The mix of varieties often happens at this stage.

2. Inappropriate drying by producers: a cause of broken rice

Inappropriate drying practice by producers causes broken rice. It deteriorates the quality of rice at processing. It is necessary to dry paddy to reduce moisture content down to 13-14 % from 25-30% at the collecting stage.

3. Securing the volume of uniform quality of paddy

Collecting a large amount of paddy through groups like cooperatives is difficult.

It is said that farmers are not willing to take collective action such as agricultural cooperatives. This is, it is said, because of the difficulty of building mutual trust among people in Cambodia due to their historical background.

The Agricultural Extension Department of MAFF promotes the development of agricultural cooperatives. Currently, 244 cooperatives and 14,000 farmers organizations are registered.

In most of these cases, those organizations are registered only for the purpose of receiving subsidies and/or support from donors. After cooperation ends, no more active group activities are seen. This is the case even for one of the so-called most successful cooperative cases.

Challenges faced by producers

4. Difficulty of access to credit with low-interest rates

Producers/farmers need a certain amount of cash in advance to introduce priority seeds, practice appropriate cultivation and post-harvest such as drying. Currently, farmers can access microfinance with an interest rate of more than 20 % a year, however, large millers can access finance with the rate of around 5% a year.

Financial institutions need to set the reasonable interest rate with consideration of risks for farmers. It is necessary to introduce a mechanism where farmers can access credit at a lower rate with risk hedge.

5. Weak bargaining power of producers

Currently, brokers from Thailand and Vietnam purchase paddy at higher prices, which creates seller's markets. This is only the case for the current seller's markets.

In general, the bargaining power of farmers is weak compared with that of rice millers. Millers are usually powerful local stakeholders who have accumulated capital. In addition, farmers are not willing to take collective action.

It is necessary to introduce such a mechanism as strengthening farmers' bargaining power since the current seller's market will not last for a long.

6. Unstable prices and demands depending on informal exports

Currently, brokers from Thailand and Vietnam purchase paddy at higher prices informally, which benefits farmers.

Farmers depend on unstable demands of informal trades. Farmers are just waiting for the brokers from those countries. Paddy price rises when brokers come, and the price goes down in the waiting period.

Formalizing exports by facilitating the entry of domestic processors and exporters could raise their market awareness of international markets. Formalizing exports also gives us information of the border trades and prices as well as international markets. In doing so, market signals and information on the international markets could be transmitted to producers. The more available market information would allow more stable production.

7. Cannot utilize byproducts

Currently rice is exported in the paddy form. No byproducts of processing like rice bran and husk are utilized. Husk is utilized as fertilizer and fuel, and rice bran is utilized as animal feed.

Current practice prevents the rice industry's linking to related industries utilizing byproducts such as feed industries. Byproduct utilization could allow more industrial linkage, which promotes industries as a whole.

Challenges faced by the industry

8. Unavailable information on the crop flow from production to export

Informal trade cannot allow the markets and us to know the necessary information on the crop flows - from production to export - trades. The information, if available, is beneficial in many ways. Policy makers can prepare appropriate policies responsive to the actual situation. Business opportunities are also created.

It is necessary to collect information to show the actual crop flows from production to export. In addition, the collection and analysis of market information is necessary.

(2) Possible Solutions to Challenges

Possible solutions to secure a certain amount quality rice are as follows:

1. Promoting vertical integration of market players into large-scale millers for collecting a certain amount of quality rice, then strengthening the competitiveness of the industry.

It is not easy for the farmers to build mutual trust among each other, to take collective action and to organize themselves, due to the historical background. Therefore, it is desirable to collect a certain amount of quality rice by using the market mechanism.

In order to produce and sell rice to international markets meeting their requirements, it needs vertical integration into large-scale millers and/or exporters who know the export markets. It strengthens the competitiveness of the industry as a whole.

To facilitate integration, it is recommended to create a mechanism to finance the large-scale millers and/or rice exporters through financial institutions, in which a mechanism of financing to farmers at low-interest is also included.

Farmers groups (community) could be created under the umbrella of major millers and exporters who provide farmers low interest credits. The major millers and exporters could create a mechanism to purchase a certain amount of good quality rice from farmers by providing good seeds, fertilizers, pesticides, rental equipment and technical assistance.

2. Consideration of farmers with weak bargaining power

Vertical integration to strengthen the competitiveness of rice industry is mentioned above. On the other hands, it is necessary to strengthen horizontal linkages among farmers to strengthen their bargaining power.

One of the measures is creating a mechanism to convey the views of the farmers. It creates a platform where representatives of the farmer communities can negotiate and explain their views to millers/exporters on a regular basis.

3. Studying the actual situation of crop flow

It is necessary to undertake periodical surveys of crop flows. Periodical collection and analysis of market information is also necessary.

4. Improving the business environment and strengthening support services

As well as promoting material production, it is necessary to strengthen support services and to improve the business environment for the development of the food processing businesses and strengthening its competitiveness.

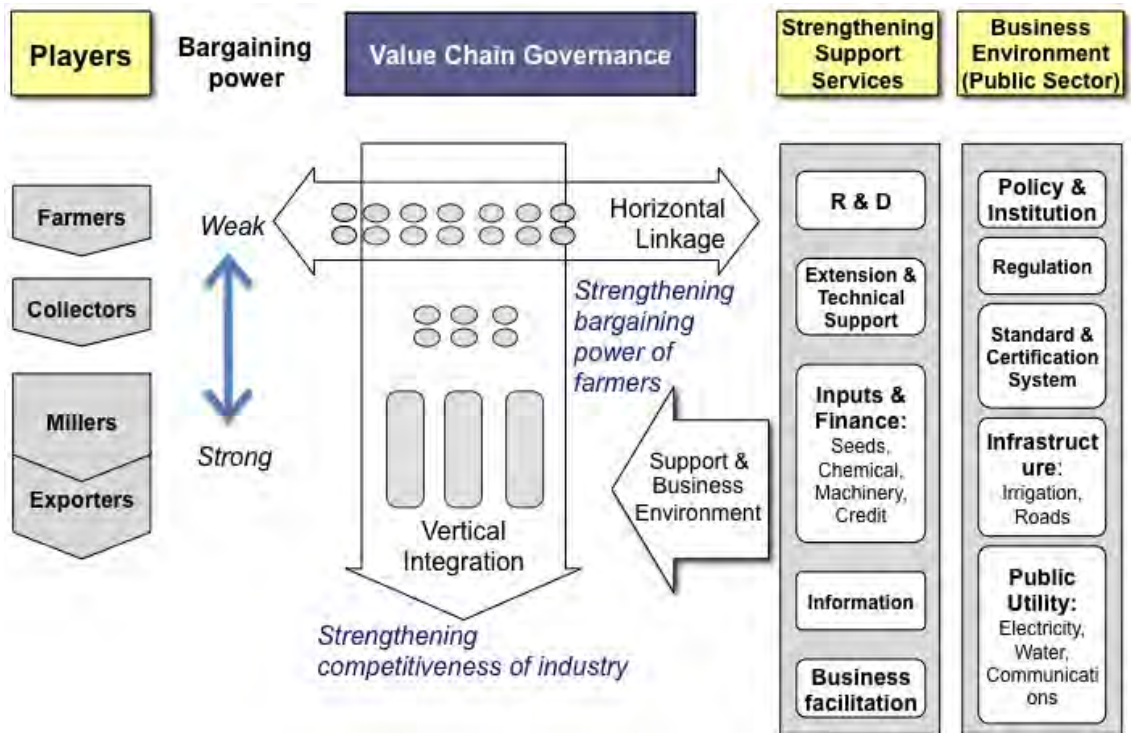
The following are examples of support services. Good quality seeds are required for the production of the raw materials for processed foods. Research institute plays a role in research and development of quality seeds.

For the dissemination of quality seeds, it needs to improve the system to educate farmers and disseminate those seeds to farmers. Based on the education of the farmers by extension officers, actors such as seed companies, agricultural extension offices, inputs distributors, and millers purchase quality seeds and supply these seeds to farmers.

Agricultural extension officers and millers provide technical assistance to farmers at each stage of cultivation. They also provide necessary pesticides, fertilizers, agricultural machinery and other equipment. In addition, the credits for equipment and inputs are to be provided. Strengthening such support services is necessary.

It is also necessary to improve the business environment. It contains the system improvement and infrastructure development. System improvement includes policies and institutions, rules, standards, and certification system. Infrastructure development includes irrigation network, rural roads and power supply.

The figure below shows the overall picture and direction of strengthening support functions and improving the business environment, from the production to marketing stages, in order to strengthen the competitiveness of the industries as a whole.



Source: JICA Study Team based on Yoshimura (2009) , Profitable Agriculture Under the Globalization in Africa.

Figure 3-16 Direction to Strengthening Competitiveness of Industries

Chapter 4 Food Processing Industry

Chapter 4 Food Processing Industry

4.1 Current Status

This section gives an overview of the food processing industry in Cambodia, and then summarizes the current status of the food processing by commodity, focusing mainly on four (4) prospective commodities: Rice, Maize, Soybean and Cassava.

(1) Overview of Food Processing Industry in Cambodia

Shown below are the data for food processing enterprises (mostly of large-scale¹) registered under the MIME in the past 17 years (Table 4-1), and also for food processing SME (Table 4-2). Although figures on the tables seem to be somewhat inaccurate², a general feature of the food processing industry in Cambodia may be observed as follows:

- The majority of food industry of Cambodia is SME, which accounts for 99% in the number of enterprises and 89% in the number of employee of whole food processing enterprises.
- Of various categories of business (SME), rice milling dominates the industry, occupying 90% of the number of enterprises and 85% of the number of employees. Trends of the rice milling, therefore, will give a great impact on whole food processing industry in Cambodia.
- Relatively high shares, next to the rice milling, are had by alcoholic beverages; drinks; bakery; ice making, etc. that may have a big domestic demand.
- In large-scale enterprises, either foreign or local capital, the businesses requiring massive investment are targeted, such as; tobacco; alcoholic beverages; animal feed; sugar; and flour milling.

¹ The definition of enterprise's scale (employee/ asset) = "Large": 100 number or more / US\$ 0.5mil or more; "Medium": 51-100 number / US\$ 0.25-0.5 mil; "Small": 50 number or less / US\$ 0.25mil or less (Source: MIME)

² Table 4-1 may not include non-registered enterprises, while may include the ones already closed. Figures on table 4-2 (the number of rice mills) are considered to be far over actual situation (the detail described later).

Table 4-1 Large-scale Food Processing Enterprises (registered in 1994 to 2010)

Investment Source: Foreign		Investment Source: Cambodia	
Product	Company (number)	Product	Company (number)
Water / Soft Drink	5	Tobacco	7
Alcohol	5	Alcohol	4
Tobacco	4	Sugar / Salt	3
Animal Feed	3	Flour	3
Sugar	2	Confectionery	2
Flour	1	Instant Noodle	2
Confectionery	1	Fish Sauce	2
Frozen Shrimps	1	Animal Feed	2
Seasoning	1	Water / Soft Drink	2
Soya Milk	1	Frozen Shrimps	1
Dry Corn	1	Rice Milling	1
Sausage	1		
Chicken Packing	1		
Total (Company)	27	Total (Company)	29
(Employee)	7,355	(Employee)	4,313

Source: Compiled by the Study Team, based on the statistic data "Factories registered under the Ministry of Industry, Mines and Energy, from the year 1994 to 2010" (MIME)

Table 4-2 Food Processing SME by Category of Business (as of 2010)

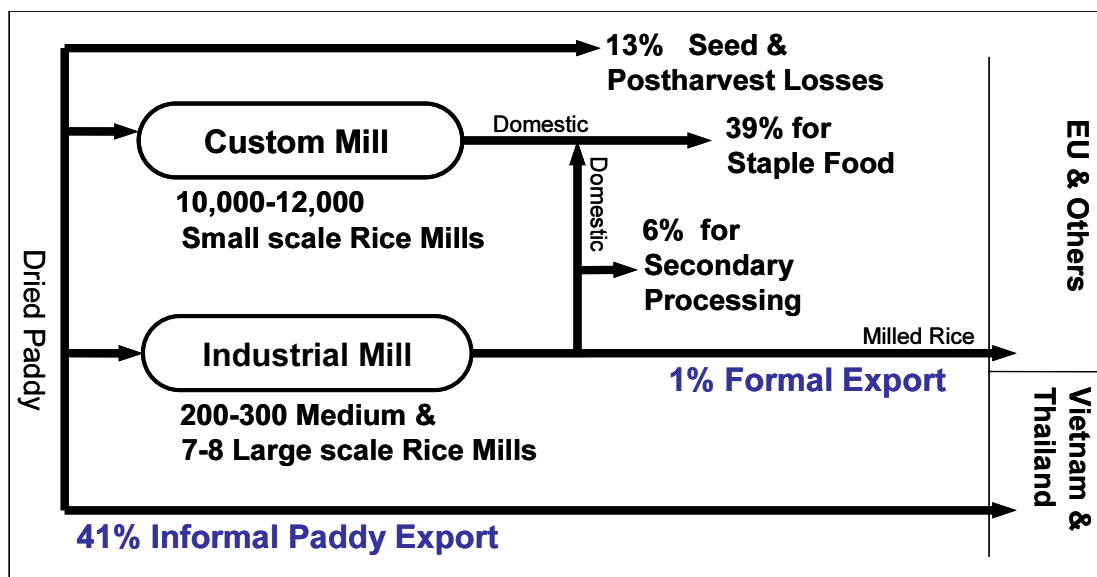
Processing Sector/ Sub-sector		Number of Establishment	Number of Workers
1	Grain Mill Products	28,696	80,189
	Rice Milling	28,474	79,323
	Milling rice powder	137	351
	Milling potato powder	20	158
	Milling bean	14	66
	Others	51	291
2	Spirits	1,238	2,567
3	Bakery Product	314	1,867
4	Soft Drink and Water	307	2,750
	Pure water	245	2,205
	Soda water and soft drink	17	81
	Sero	3	9
	Others	42	455
5	Canning/Preserving of Fruit & Vegetables	107	595
	Soy sauce	57	328
	Soybean sauce	11	39
	Chili sauce	11	51
	Others	28	177
6	Canning/Preserving/Processing of Fish and Crustaceans	71	523
7	Wine	70	446
8	Tobacco	63	326
9	Meat	14	51
10	Animal Feed	6	53
11	Confectionary	5	24
12	Vegetable & animal oil & fats	4	21
13	Dairy product	3	7
14	Sugar	3	34
15	Others	578	4,251
	Ice	331	2,166
	Salt & salt product	59	954
	Teas	9	33
	Others	179	1,098
	(Total)	31,479	93,704

Source: Compiled by the Study Team, based on the statistic data "2010 SMEs Sector and Sub-Sector", MIME.

(2) Current Status of Rice Processing

a. Proportion by Channel

Figure 4-1 and Table 4-3 below show distribution channels of rice in Cambodia.



Source: Compiled by the Study Team, based on various statistic data and survey reports (2010-2011).

Figure 4-1 Current Status of Rice Processing

Table 4-3 Distribution Channels of Rice (2010)

Description		Value	%
<1>	Population	14,521,276	
<2>	Production (metric ton, paddy)	8,249,452	100%
<3>	Seed, Animal Feed and Postharvest Losses (metric ton, paddy)	1,072,428	13%
<4>	Staple Food Consumption (metric ton, milled rice)	2,076,541	
<5>	ditto (paddy conversion)	3,244,595	39%
<6>	For Secondary Processed Foods (metric ton, paddy)	500,000	6%
<7>	Formal Export in Milled Rice (metric ton, milled rice)	50,171	
<8>	ditto (paddy conversion)	78,392	1%
<9>	Informal Export in Paddy (metric ton, paddy)	3,354,035	41%

Notes:

- This table has been compiled by the Study Team, based on the following data:
 - ◆ Rice Balance Sheet by Province, Annual Report, MAFF (2010-2011)
 - ◆ Data from Department of Planning and Statistics, MAFF (2011)
 - ◆ Export Statistics Data (Custom-clearance basis), MOC (2010)
- Values on the table are on paddy conversion basis.
- Staple Food Consumption: <4> = <1> x 0.143
- Informal export value on the table has been derived by calculation: <9> = <2> - (<3> + <5> + <6> + <8>).
- Coefficients used in calculation are Milling Recovery 64%; Rice Consumption: 143kgs/capita, year; Seed: 4%; Animal Feed: 2%; and Postharvest Losses: 7%. These coefficients have been determined as a result of the field survey in "The Study on Improvement of Marketing System and Postharvest Quality Control of Rice in Cambodia (JICA/ 2001)", and thereafter, the government of Cambodia has adopted these figures for compiling the statistic data of rice balance every year.
- Depending on the calculation method, LSD values on the table do not necessarily coincide with the calculation result.

As shown in above figures and table, one of the prominent features (constraints) in Cambodian rice sector is a substantial and informal export in paddy, with little formal export in milled rice. Collectors, growers and millers are widely involved, as sellers, in informal paddy exports. Although the background has already been summarized in the preceding chapter, low-level postharvest treatment and processing technology in the aspect of processing, and also lack of paddy market in the aspect of distribution can be raised as core problems which lead to the export of paddy (Detail described later).

b. Operation of Rice Mills

Number, Capacity, Location and Function of Rice Mills by Scale

Table 4-5 indicates the number and employees of rice mills by province, and Table 4-4 summarizes the number, capacity, location and function of rice mills by mill scale.

Table 4-4 Scales, Number, Capacity, Location and Function of Rice Mills

Scale	Number	Capacity (Paddy, per Mill)	Location	Function
Small	10,000 ~ 12,000	0.1-0.3 t/h	All rice growing provinces	Custom mill (Milling service)
Medium	200 ~300	1-2 t/h	All rice growing provinces	Mainly milling for domestic demand (Below export quality)
Large	7~8	10 t/h or more	Battambang prov. Phnom Penh & Surrounding area (Kandal prov.,etc.)	Export-oriented milling (Complete with Equipment for export milling)

Source: Compiled by the Study Team, based on interviews, statistic data and relevant survey reports

Table 4-5 Number and Employees of Rice Mills by Province

	Province	Number of Rice Mills	Number of Employees
1	Banteay Meanchey	323	829
2	Battambang	355	1,237
3	Kampong Cham	2,134	3,440
4	Kampong Chhnang	888	962
5	Kampong Speu	5,339	29,623
6	Kampong Thom	5,516	14,376
7	Kampot	2,882	5,812
8	Kandal	1,364	3,121
9	Koh Kong	8	47
10	Kratie	520	1,269
11	Mondulkiri	13	516
12	Phnom Penh	20	126
13	Preah Vihear	36	370
14	Prey Veng	2,865	5,539
15	Pursat	1,748	3,560

	Province	Number of Rice Mills	Number of Employees
16	Rattanakiri	5	12
17	Siem Reap	1,517	2,641
18	Sihanouk Ville	-	-
19	Steung Treng	118	155
20	Svay Reing	2,001	3,998
21	Takeo	730	1,491
22	Odor Meanchey	53	120
23	Kep	38	76
24	Pailin	1	3
	Total	28,474	79,323

Source: 2010 Rice Mills Statistical Data, MIME

Difference in the Number of Rice Mills between Table 4.4 and 4.5

Official data on the number of rice mills are the figures on table 4-5. However, the actual number seems to be far below those figures, in view of a recent decreasing trend in the number of mills due to the shortage of paddies, particularly in the area bordering with Vietnam. As such, this report adopts the figures on table 4-4 as a close-to-real one, based on interviews³ and relevant survey reports⁴.

Whole Milling Capacity for Exportable Milled Rice

Assuming, based on table 4.4, that the number of large-scale rice mills complete with the equipment for export of milled rice is eight (8); the full capacity of each mill is 15 t/h (paddy) on average; and annual net operation is 2,200 h/y⁵, the whole annual process-able amount becomes 264,000 t/y on paddy (168,960 t/h on milled rice conversion). This value is nearly consistent with the aforesaid survey report and an interview to the relevant organization⁶, being far below the current informal export (more than three (3) million ton of paddy) and the export target in the Rice Policy (one (1) million ton of milled rice). Sizable increase in the whole capacity of modern rice mills needs to be realized for improvement of the situation.

Outline of Rice Mills by Scale

Outline of rice mills by scale is summarized in Table 4-6 below, based on Table 4-4.

³ Department of Agriculture in several provinces commented on the number of rice mills within each province that Battambang has more; Kandal approx. 100, etc. (Unclear information from some provinces omitted).

⁴ The Study on Improvement of Marketing System and Postharvest Quality Control of Rice in Cambodia (JICA, 2001); An Economic Survey of Rice Sector in Cambodia (AFD/ SNEC, Nov 2010)

⁵ Assumed as 10% more than the ordinary annual operation of rice mills in Cambodia (10h/d x 200d/y =2,000h/y).

⁶ "Green Trade" (An organization under the umbrella of MOC)

Table 4-6 Outlines of Rice Mills by Scale

<p>Small-scale Rice Mills</p> <p>The majority of small-scale rice mills are so called "Custom Mills". Their business is mainly "Milling Service Provider", in which they receive paddy, mill it, return milled rice and receive by-products (husks and bran) for milling fee. Most of clients use this type of mills for their own consumption of rice. Typical mill components are pre-cleaner; husker; whitener; and sorter. Machinery is of secondhand, outdated and very low price (e.g. US\$ 2,000 for 300kgs/h mill, including building cost). Due to the type of business, they have no or little incentive for improvement of quality of milled rice. A recent trend in rice growing areas is an expansion of "Mobile Mills", a single husking & milling machine driven by a diesel engine and mounted on a small truck, in response to clients' needs and also millers' mobility.</p>
<p>Medium-scale Rice Mills</p> <p>These type of rice mills are equipped with a series of standard set of machinery, such as pre-cleaner; cleaner; husker; paddy separator; whitener; sorter, etc., with less capacity than large-scale mills. In many cases, they do not have polisher; color sorter; and dryer that are indispensable components for making export quality product. As such, the main destinations of their product are domestic channels. However, some linkage with large-scale mills is observed, where medium-scale mills do primary processing under large-scale mills, then send their product to large mills for final processing., thus partly playing a role for export (Battambang province, etc.).</p>
<p>Large-scale Rice Mills</p> <p>This category of rice mills is export-oriented, with a processing capacity of 10t/h or more, having a complete set of machinery for export of milled rice. Several mills are going to increase their mill capacity, in response to the Rice Policy. However, as described before, the actual exported amount (formal export in milled rice) is very little compared with their processing capacity. This suggests a low working efficiency and also a substantial portion of their product being destined for domestic channels. The underlying background will be (1) Difficulty in procurement of paddy; (2) Low-level postharvest treatment and processing technology; and (3) High energy cost. Difficulty in paddy procurement is caused by competition with neighboring countries for paddy procurement, lack of working capital, low paddy quality, varietal mixture, lack of paddy market & market information system, etc. Lack of paddy market leads to no quality standards, no linkage between quality and prices, and low paddy quality. High-energy cost is related to power dependence on imports and undeveloped alternative energy.</p>

Source: Study Team

Level of Milling Technology

Improper postharvest treatment (harvest, threshing, drying, storage, transportation, etc.) is directly linked with low quality of milled rice. For instance, improper storage or drying causes cracked or checked kernels, although it is invisible on paddy, which mostly leads to kernel breakage when milling. Also, characteristics for processing of rice differ by variety. Comparing two (2) representative varieties of IR and fragrant rice, the differences are observed in kernel-shape, kernel-weight, property of cooked rice and milling recovery⁷, as shown in Table 4-7. Particularly, the difference in head rice recovery is notable, suggesting that fragrant rice is more easily breakable than IR rice when milling. Different varieties of fragrant rice also have different kernel properties. There are many factors to be considered in milling, such as luster, milling degree, moisture content, etc. High level processing technology, therefore, is a must to produce the finished milled rice which complies with quality requirement.

Although a very limited number of rice millers understand the above points and try to apply it in processing, the majority of millers have no or little concern about this in Cambodia. One of the

⁷ Relatively higher milling recovery than ordinary rice mills is probably caused by sample milling under some favorable conditions on laboratory level.

underlying backgrounds may be behavior of general consumers in Cambodia. A result of the survey⁸, though slightly old data, indicates that variety, fragrance and price are the top three (3) criteria by which Cambodian consumers select the rice to buy, while broken rice percentage is the lowest of seven (7) criteria. In terms of quality of rice, Cambodian consumers seem to care about fragrance more than kernel breakage. Broken rice percentage is the most important factor of quality in export of rice, but not so much for the domestic market.

Table 4-7 Characteristics of Rice Kernels for Processing by Variety

Variety	IR66	Pkar Rumduol
Type	IR	Fragrant Rice
Yield (t/ha)	4.0-6.5	3.5-5.5
Grain Length (mm)	7.2	7.5
Grain Width (mm)	2.0	2.1
L/W Ratio	3.6	3.6
Brown Rice Shape	Slender	Slender
100 Grain Weight (g)	2.22	3.0
Milling Recovery (%)	69.0	67.7
Head Rice Recovery (%)	64.0	52.8
Amylose Content (%)	23.6	23.4
Raw Rice Appearance	Translucent	Translucent
Raw Rice Acceptability	Very Good	Excellent
Cooked Rice Acceptability	Good	Very Good
Aroma scent	None	Scented / Soft Texture

Source: "Rice Varieties released by the Varietal Recommendation Committee of Cambodia (1990-2000), Cambodian Agricultural Research Development Institute (CARDI), 2001"

Notes: Comparing IR and fragrant rice varieties (IR66 and Pkar Rumduol) in the above table, the following features are observed: <1> Fragrant rice kernel is slightly bigger and much heavier, but both varieties are similarly slender; <2> Milling recovery is lower in fragrant rice, particularly in head rice recovery (fragrant rice more easily breakable); <3> Fragrant rice has slightly lower amylose content, showing some stickier texture after cooking. <4> fragrant rice is more superior in appearance, taste and aroma.

Milling Recovery, Quality, Before-/ After-Milling Processes, By-product

As mentioned before, the government of Cambodia has adopted the value of 64% as the milling recovery for compiling the statistic data of rice balance every year. Also, comparison data by country is available as shown in Table 4-8. The milling recovery in Cambodia is generally lower than many other rice producing countries. Lower milling recovery is equivalent to more milling losses and mainly caused by lower milling technology than other factors.

⁸ The Study on Improvement of Marketing System and Postharvest Quality Control of Rice in Cambodia (JICA/ 2001)

Table 4-8 Milling Recovery by Country

Country	Milling Recovery (%) (Milled Rice / Paddy by weight)
Japan	73
Taiwan	73
China, PR	70
Thailand	66
Vietnam	65
Cambodia	63
Myanmar	62
Lao PDR	60

Source: MOC (TARP Project, Cambodia's Export Promotion in Post-WTO Accession, 2007)

In addition, the head rice recovery⁹ is also relatively low, although no official nationwide survey data is available at the moment. One of the representative rice millers and exporters in Cambodia, according to their comments in interview, indicates that the milling recovery is 65% and the head rice recovery is 40% (equivalent to 38% of broken rice against whole milled rice). The ratio of broken rice to whole milled rice in Cambodia is therefore presumed to be at least some 40-50% on average, which seems to be worse than Vietnam¹⁰. As described before, kernel breakage is closely related with paddy quality and postharvest treatment, not just with milling technology. Assuming that the quality of milled rice is assessed only by kernel breakage percentage, it is possible to produce better quality finished product from lower quality milled rice, by sorting and blending process after milling (Naturally, more kernel breakage in milling leads to lower commercialization rate). Actually, many rice millers in Vietnam are said to produce higher-grade milled rice from lower quality paddy imported from Cambodia, using the after-milling processes as mentioned above¹¹.

Frequency of exchange of consumable spare parts for the essential machines (husking & milling) seems to be generally low. This is probably because some adjustment is made in operation of rice mills for less wear of the parts to save cost (spare parts are totally dependent on import). This sort of action makes the husking ratio lower, and eventually produces more non-uniform quality milled rice with more kernel breakage. Also, the before-milling processes (cleaning) seem to malfunction, incompletely removing immature grains, foreign matters, etc. to minimize weight-losses (transactions are usually conducted just on weight basis), thus lowering the quality of finished product.

It should be noted that improvement to the quality of finished product could be attained by well functioning of the before-/ after-milling processes, in addition to milling process.

By-products of rice processing are not sufficiently utilized in Cambodia at the moment. Usually, rice-bran from the milling machines is sold as it is for animal / fish feed. Husks are sold as fuel

⁹ Milling recovery = Ratio of all milled rice against paddy by weight / Head rice recovery = Ratio of milled head rice (non-broken rice) against paddy by weight

¹⁰ Several sources suggest that the ratio of broken rice to whole milled rice is usually 35-40% in Vietnam.

¹¹ Source: MAFF and Cambodia-based Japanese enterprises (Aug 2011)

for brick making / grain driers (by the majority of medium & small scale rice mills), or used as fuel for paddy driers or boiler for power generation (by a part of large scale rice mills). Usually, the selling price is 600-700 riel/kg for rice-bran and 50-100 riel/kg for husks on average. In some areas near the border with Vietnam, dealings at much higher prices are observed, reflecting supply and demand.

Processing Costs and Mill Maintenance

Shown below is an example of the breakdown of processing costs¹² (after paddy procurement, up to milling and export) of rice mills in Cambodia



Source: Compiled by the Study Team, based on the recent survey report
(Data for 5t/h rice mill, export-oriented, milling fragrant rice, 2011)

Figure 4-2 Rice Processing Cost Breakdown (Example)

The above figure, the survey data for a rice mill with capacity 5t/h, milling fragrant rice and diesel power generation, shows the following points:

- The proportion of three (3) items (fuel; interest of working capital; and export procedure cost) to total processing cost is sizable, accounting for 75%.
- Fuel is for driving the rice mill. Due to difficulties in availability of power, many rice mills use diesel engine driven power generator or diesel engine driven belt transmission mechanisms, as a power source.
- Loan terms (interest rate/ payback period/ amount) still burden rice millers, although some improvement has been made recently in response to the Rice Policy.
- High export procedure cost is mainly caused by a complicated, non-transparent and inefficient system.
- Of the maintenance cost, consumable parts of essential machinery, particularly husking rubber rollers, occupy a lot. These parts are dependent on import from Vietnam and Thailand at the moment.

¹² Processing and Marketing Cost per type of rice for 5t/h mill; An Economic Survey of Rice Sector in Cambodia, AFD/ SNEC, Nov 2010

- Packing materials (PP, etc.) for final shipment of milled rice are also imported from Vietnam. The undeveloped packaging material industry in Cambodia is a serious constraint for marketing many processed foods, although rice is usually sold by weight in traditional markets. Packaging materials, such as glass bottles, plastic bags, and the like, are generally inferior in terms of strength, appearance and supply, and therefore very dependent on imports, increasing food processors' cost.

Constraints on Rice Processing

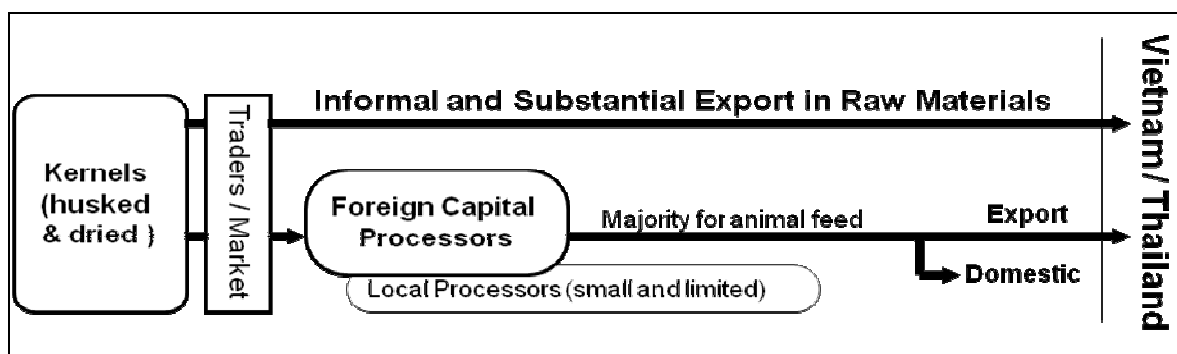
From the analysis made so far, constraints related to rice processing are summarized as follows:

- Low level postharvest treatment and processing technology (Improper postharvest treatment; Low performance of processing equipment; Lack of equipment for producing high quality milled rice; and inexperience with milling technology)
- Inferior quality of milled rice (Low milling recovery; Non-uniformity in quality of milled rice; Sizable kernel breakage; Low whiteness degree & luster; and Low milled rice quality far below international standard)
- Varietal mixture
- Low working efficiency of modern rice mills producing high quality milled rice
- High energy cost (Low self-sufficiency rate of energy; High cost; and Undeveloped alternative energy)
- Underdeveloped secondary processing technology (Incomplete secondary processing technology; and Insufficient utilization of by-products)
- Sizable and informal paddy export (Saturated domestic market for staple food; Competition in paddy procurement with neighboring countries; and Strong demand for paddy in neighboring countries)
- Lack of paddy market (Difficulty in stable paddy procurement; Lack of quality standard; Incomplete market information system; Non-linkage of quality and prices; and Low paddy quality)
- Lack of capital for procurement of paddy (Ineffective financing system)

(3) Current Status of Maize Processing

a. Outline of Processing and Distribution

This section summarizes the current status on maize processing and distribution in Cambodia, based on various survey reports and information from traders, processors, each provincial department of agriculture and other relevant players, since no official data are available.



Source: Compiled by the Study Team, based on various survey reports and interviews to relevant players.

Figure 4-3 Current Status of Maize Processing

Figure 4-3 above shows distribution channels of maize. As in the case of rice, substantial maize is exported in an informal way and in the form of unprocessed raw materials (dried kernels) to Thailand and Vietnam. Various traders suggest that the export to neighboring countries accounts for 60-70% of the production, mainly destined for Vietnam. Another recent survey shows the following data.

Table 4-9 Destination of Maize

From \ To	Within Province	Thailand	Vietnam
Battambang	20%	20%	20%
Manteay Meanchey	60%	40%	-
Kampong Cham	10%	-	90%
Whole Country (Estimate)	16%	70%	14%

Source: Compiled by the Study Team, based on Agro-Product Processing Advisor Report (JICA, 2010)

The rest of the maize is processed in Cambodia, then distributed locally or exported. Foreign capital processors (Thailand, Korea, China, etc.) have a processing base in Cambodia, of which the Thai enterprise (International agro-business group) dominates the market. Local small-scale processors (mostly individuals and multi-players) also are in operation in various areas. The majority use of processed maize is animal feed (compound feed containing maize feed; or maize feed for making compound feed), while the processing for food is very limited. Many local players are acting among maize growers, Thai & Vietnamese buyers, and processors (local & foreign capital). In four (4) prospective commodities, local traders are basically categorized into two (2) types; one is handling only rice, while another dealing other three (3) commodities. Large-scale traders, however, in some cases handle many kinds of commodities including rice.

After harvest, local traders usually buy maize directly from growers or through village collectors, then after peeling skin, drying and picking kernels (these operation can be practiced by other individual players for fee), sell it to neighboring countries' (mainly Vietnamese) buyers or aforesaid foreign processors. When selling to Vietnam, local traders usually cross the border to Vietnam by road, and deal in some warehouse (transaction spot). Trading terms for selling to Vietnam are said to be easier (payment by cash, little quality requirement, etc.), while less easier for selling to foreign processors (payment by credit, strict quality demand, etc.). As

such, dealing with Vietnamese buyers is predominant, despite lower buying prices of Vietnamese. This trend is common to other commodities (rice, cassava, etc.), leading to the export of raw produce to neighboring countries.

b. Operation of Maize Processing Mills

As mentioned before, the majority use of processed maize is for animal feed (compound feed containing maize feed; or maize feed for making compound feed), while the processing for food is very limited.

Summarized below is an outline of operation of a typical small-scale local mill for maize processing (primary treatment).

Box 4-1 Maize Primary Processing Mill in Kampong Cham province (Field Survey)

This mill procures fresh maize directly from growers or through traders (collectors) at 600 riel/kg, then removes husks, picks kernels from the cob and dries it for selling. The product is destined for Vietnam (selling at 1,250 riel/kg) or foreign processor (s) based in Cambodia (selling at 1,300 riel/kg).

The mill owns kernel picker, dryer, aspirator and moisture meter, imported from Vietnam or China. The dryer is of batch / box type where kernels are spread on net screen through which warm air is sent upward. The heat source (fuel) for dryer is maize-cob or firewood, depending on the structure of furnace. When firewood is used as fuel, it should be bought (16 US\$/m³) and the cobs are disposed as a waste. Usually, maize is dried from 32% (fresh maize) down to 14%. The aspirator removes light foreign matter after the drying process.

Operation in the rainy season requires more cost due to the fuel for drying, making the profit less. Therefore, many processors conduct this business only or mainly in dry season when kernels are dried under the sunshine.

Source: Study Team

Several local processors making animal feed (either alone; or under the foreign capital group; or by JV with foreign capital) exist, although there was no chance to visit in the field survey. Also, some processors produce snack food from rice- and maize- flour. As a whole, however, maize processing for food is very limited, and the number of such processors is few. The following constraints are conceivable as the background.

- Lack of processing equipment (Dependence on imports)
- Lack of knowledge and experience of processing
- Low-level food safety and hygiene
- Underdeveloped packaging materials industry (Glass bottles, plastic bags, etc. are dependent on imports, increasing the processing cost)
- Costly and unstable electric power supply (leading to the high processing costs and lowering the working efficiency)
- Undeveloped market for processed food

- Lack of maize market (Lack of indicative prices; Non-linkage of quality and prices; Low maize quality)
- Lack of working capital (Ineffective financing system)
- Sizable and informal maize export (Competition in maize procurement with neighboring countries; Strong demand for maize in neighboring countries; and Less availability of maize for processing)
- Ineffective maize collection system (Lack of drying and storage facilities)

(4) Current Status of Soybean Processing

a. Outline of Processing and Distribution

This section summarizes the current status on soybean processing and distribution in Cambodia, based on various survey reports and information from traders, processors, each provincial department of agriculture and other relevant players, since no official data is available like the case of maize.



Source: Compiled by the Study Team, based on various survey reports and interviews to relevant players.

Figure 4-4 Current Status of Soybean Processing

Figure 4-4 above shows distribution channels for soybean. As in the case of maize, substantial soybean is exported in an informal way and in the form of unprocessed raw materials to Thailand and Vietnam. Various traders suggest that the export to neighboring countries is over 60% of the production. Another recent survey shows following data.

Table 4-10 Destination of Soybean

From \ To	Within Province	Thailand	Vietnam
Battambang	30%	30%	30%
Manteay Meanchey	30%	50%	20%
Kampong Cham	10%	-	90%
Whole Country (Estimate)	35%	40%	25%

Source: Compiled by the Study Team, based on Agro-Product Processing Advisor Report (JICA, 2010)

The rest of the soybean is processed in Cambodia and distributed locally. Many local players are acting between soybean growers and Thai & Vietnamese buyers. Compared with maize and cassava, traders handling soybean are fewer since the production is less due to some difficulty in cultivation. The majority of soybean processors in Cambodia are small-scale local enterprises, although a few foreign capital processors (USA, etc.) are in operation. More than 80% of processed food in Cambodia is said to be soy sauce, and the rest is bean curd, soy milk skin, etc. Soybean is also used as raw materials for compound feed, but the proportion of the use is uncertain. A specific feature of the soybean processing in Cambodia is that various products (soy sauce, bean curd, "SCAN" similar to Natto, soybean-based drinks, etc.) are widely made at the home industry level.

Soybean oil (cooking oil) is not produced in Cambodia due to high investment cost and lack of knowledge and experience of processing technology, although it is generally the major product from soybean (75% of the world production and 80% of the production of Japan is processed for cooking oil). Currently, cooking oil in Cambodia is totally dependent on imports, mainly importing palm oil and sunflower oil.

b. Operation of Soybean Processing Mills

As described before, the majority of soybean processing in Cambodia is for soy sauce by small-scale processors or home industry. Processed food from soybean is very limited at the moment. Various soybean-based drinks (popular in Cambodian citizen) available in local market are all imported.

Summarized below is an outline of operation of a typical local soy sauce mill.

Box 4-2 Soy Sauce Mill in Suburb of Phnom Penh (Field Survey)

This mill produces fish sauce and vinegar, in addition to soy sauce. Soybean as a material for making the soy sauce is procured directly from growers or through traders (collectors) nearby. The soy sauce is produced by "amino-acid added" brewery system (not "authentically-brewed" system), from whole soybean (not de-oiled soybean). The mill produces the soy sauce at 4,000 liters per month. Approx.100 mills of this type exist in Cambodia, of which this mill is ranked within top 3 in business-scale.

The process for making soy sauce is as follows:

Steaming of soybean (4 hours) → add amino-acid; sugar; caramel; Ajinomoto; seed malt → fermentation/ maturing (20 days) → filtering → Steaming → Natural cooling (1-2 days) →filling and capping of glass-bottles

The steaming equipment is also used for sterilization of bottles. Duration of fermentation/ maturing seems to be very short. Several workers sitting on the floor do bottling manually. Processing technology is home-industry level. Quality control and food safety management level are low. Color of the bottles is not uniform. Quality and supply of the locally procured bottles are one of the main constraints in the food processing industry in Cambodia.

Source: Study Team

As mentioned before, substantial amounts of soybeans are flowing out to neighboring countries. The majority of processed food is soy sauce, and variety of soybean-based food is very limited.

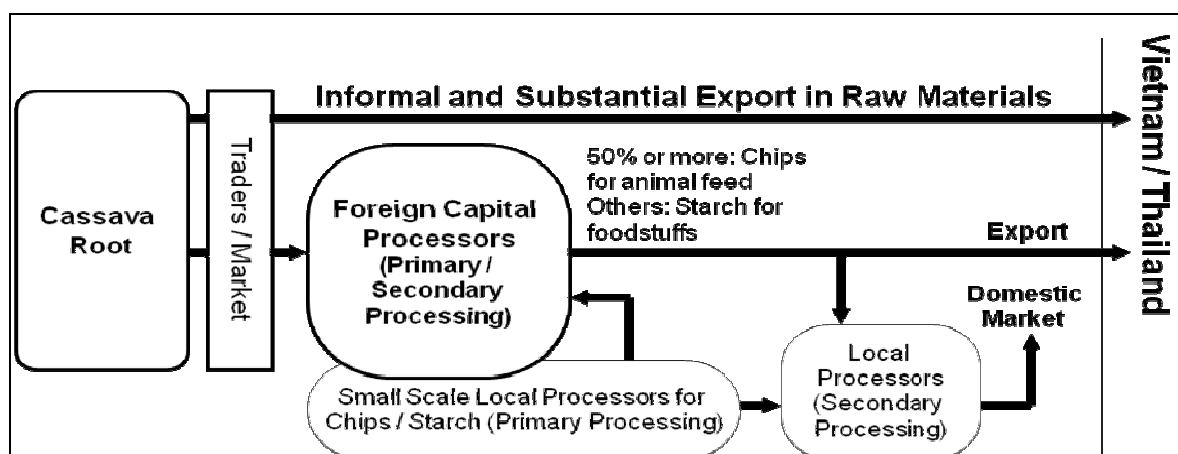
Many processed products from soybean are dependent on import. The following constraints are conceivable as the background, like the case of maize.

- Lack of processing equipment (Dependence on imports)
- Lack of knowledge and experience of processing
- Low-level food safety and hygiene
- Underdeveloped packaging materials industry (Glass bottles, plastic bags, etc. are dependent on imports, increasing the processing cost)
- Costly and unstable electric power supply (leading to the high processing costs and lowering the working efficiency)
- Undeveloped market for processed food
- Lack of soybean market (Lack of indicative prices; Non-linkage of quality and prices; Low soybean quality)
- Lack of working capital (Ineffective financing system)
- Sizable and informal soybean export (Competition in soybean procurement with neighboring countries; Strong demand for soybean in neighboring countries; and Less availability of soybean for processing)
- Ineffective soybean collection system (Lack of drying and storage facilities)

(5) Current Status of Cassava Processing

a. Outline of Processing and Distribution

This section summarizes the current status on cassava processing and distribution in Cambodia, based on various survey reports and information from traders, processors, each provincial department of agriculture and other relevant players, since no official data is available as in the case of other commodities.



Source: Compiled by the Study Team, based on various survey reports and interviews of relevant players.

Figure 4-5 Current Status of Cassava Processing

Figure 4-4 above shows distribution channels of cassava. Under the background of increasing international demand, substantial cassava is exported in informal way and in the form of unprocessed raw materials to Thailand and Vietnam. Various traders suggest that the export to neighboring countries is over 60% of production. Another recent survey indicates following data.

Table 4-11 Destination of Cassava

From \ To	Within Province	Thailand	Vietnam
Battambang	30%	30%	30%
Manteay Meanchey	60%	40%	-
Kampong Cham	10%	-	90%
Whole Country (Estimate)	15%	35%	50%

Source: Compiled by the Study Team, based on Agro-Product Processing Advisor Report (JICA, 2010)

The rest of the cassava is processed in Cambodia and distributed locally or exported. Many local players are acting between cassava growers and Thai & Vietnamese buyers. Foreign capital processors (Thailand, Korea, etc.) have a processing base in Cambodia, of which the Thai enterprise (International agro-business group) keeps a large market share. Local small-scale processors (mostly individuals and multi-players) also are in operation in various areas.

Nearly 50% of cassava production in Cambodia is locally processed to chips (primary processing) for selling to secondary processors which further processes it for animal feed or bio-fuel, while the rest of the cassava is processed to make starch for selling to secondary processors which utilizes it for snacks, noodles, etc.

Processing of cassava is widely conducted by foreign and local capital enterprises in Cambodia. Kampong Cham province has a cassava processing zone where many local cassava processors are located, mainly for making starch and its secondary processed products. One of the advantages of Cambodia for promotion of the cassava industry is that Thailand, a neighboring country, is the most advanced in the world in terms of production, processing and export of cassava. In processing cassava, it seems that making of starch requires some developed equipment and technology, while no highly developed technology is needed for making chips, as observed in Thailand. Cassava in Cambodia, therefore, is considered to have relatively high potential, although various constraints, as described later, are to be addressed.

Many local players are acting among maize growers, Thai & Vietnamese buyers, and processors (local & foreign capital). After harvest, local traders usually buy cassava-root directly from growers or through village collectors, then after or before drying, sell it to neighboring countries' buyers or aforesaid Cambodia-based foreign processors or local processors.

b. Operation of Cassava Processing Mills

Summarized below is an outline of operation of typical local cassava processing mills (Starch and Chips).

Box 4-3 Cassava Starch Mill in Kampong Cham province (Field Survey)

This mill processes cassava starch to make filiform-molded gelatin and granulated product (tapioca pearl) for selling. The mill owns a water feeder; oven; sorter; steaming equipment, etc. They also have the equipment for making starch (white powder) from cassava root, although there was no chance to see it in the survey since it was installed in a distant place. The power source is a diesel-engine-driven-generator and the heat source for drying is firewood. Fifteen (15) processors conduct the same business in this area (Soun commune), and the processors' association is organized. This area is said to be only cassava starch processing zone in Cambodia.

Annual production is 200 metric tons on a finished processed product basis. From 1,000kgs of cassava root, 270kgs of processed final product is obtained in the dry season. Product output becomes a little bit less in the rainy season. They procure cassava roots as raw material from rural collectors at US\$ 100/metric ton, and sell the processed final product to intermediary traders at 2,300 riel/kg for filiform-molded gelatin and 1,600 riel/kg for tapioca pearl. It is likely that the margin goes down to nearly nil with decrease of the handling volume, because of low-margin and high-turnover business. One of the constraints is the quality of cassava root. It sometimes deteriorates during cultivation or transportation. Either seller or buyer inspects the quality of crop by eye, splitting cassava root to see inside. The level of the mill seems to be generally low, in terms of maintenance of equipment; food safety; quality control; and mill hygiene.

Source: Study Team

Box 4-4 Cassava Chips Mill in Kampong Cham province (Field Survey)

This mill procures fresh cassava from rural collectors at 850-950 riel/kg (2010), then crushes it into chips and sun-dries for selling at 1,100 riel/kg (2010). Destination is mainly Vietnam. The mill owns a crushing-machine. The business is only in the dry season, because it cost more in the rainy season due to the fuel cost for mechanical drying. Sale to a foreign company (Phnom Penh) is at around US\$100 higher than for Vietnam, but with payment by one week credit, while Vietnamese buyers pay in cash and they do not mind quality so much. As such, the majority destination is Vietnam. They hire a truck and transport the product to the border to Vietnam for selling. The business is very dependent on demand in Vietnam, being of low-margins and high-turnover.

Source: Study Team

As mentioned before, the cassava processing industry in Cambodia seems to have relatively high potential. For advancement of the industry, however, the following constraints need to be overcome, like the case of other commodities.

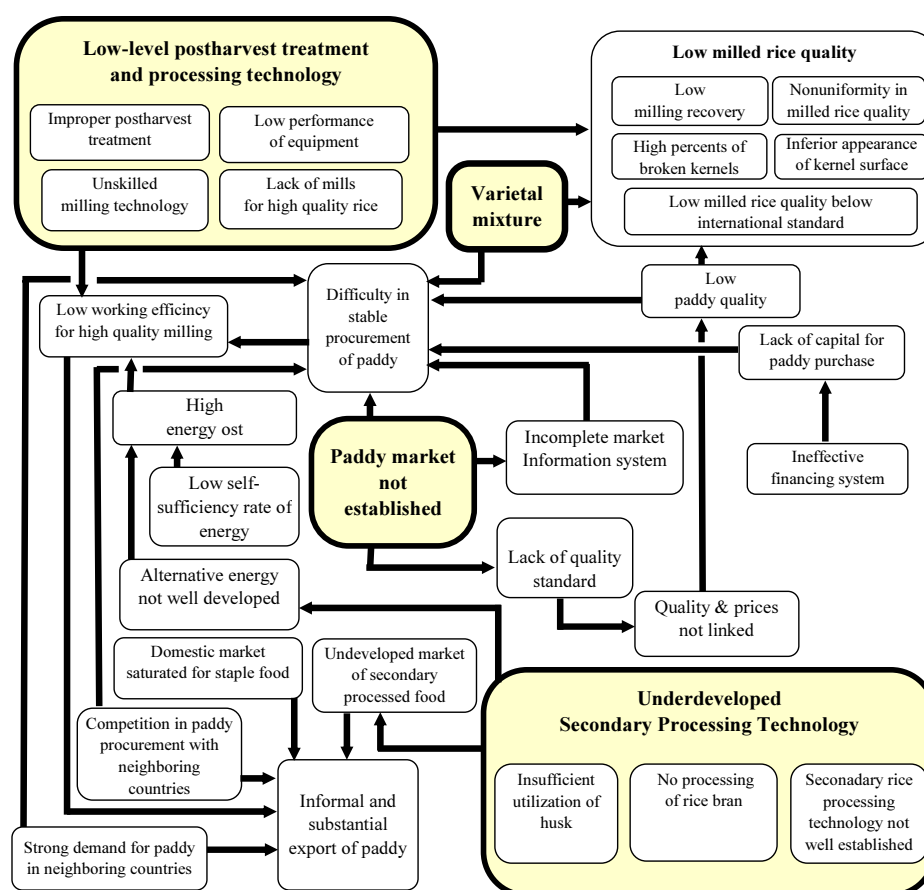
- Lack of processing equipment (Dependence on imports)
- Lack of knowledge and experience of processing
- Low-level food safety and hygiene
- Limited variety of secondary processed foods
- Underdeveloped packaging materials industry (Glass bottles, plastic bags, etc. are dependent on imports, increasing the processing costs)
- Costly and unstable electric power supply (leading to the high processing costs and lowering the working efficiency)
- Undeveloped market for secondary processed food

- Lack of cassava market (Lack of indicative prices; Non-linkage of quality and prices; Low cassava quality)
- Lack of working capital (Ineffective financing system)
- Sizable and informal cassava export (Competition in cassava procurement with neighboring countries; Strong demand for cassava in neighboring countries; and Less availability of cassava for processing)
- Ineffective cassava collection system (Lack of drying and storage facilities)

4.2 Constraints

In the preceding section, the current status of processing of four (4) prospective commodities has been summarized and various constraints have been shown. As those constraints closely correlate, this section identifies the core problems, through the process of problem analysis, by commodity.

(1) Rice



Notes:

1. This is a pattern diagram of representative issues and does not necessarily cover all the factors possible in processing and distribution.
2. Arrows' starting points indicate, "Cause", while ending points "Effect".
3. Issues surrounded with thick lines refer to "Core Problems" that seem to have more weight as cause than others.

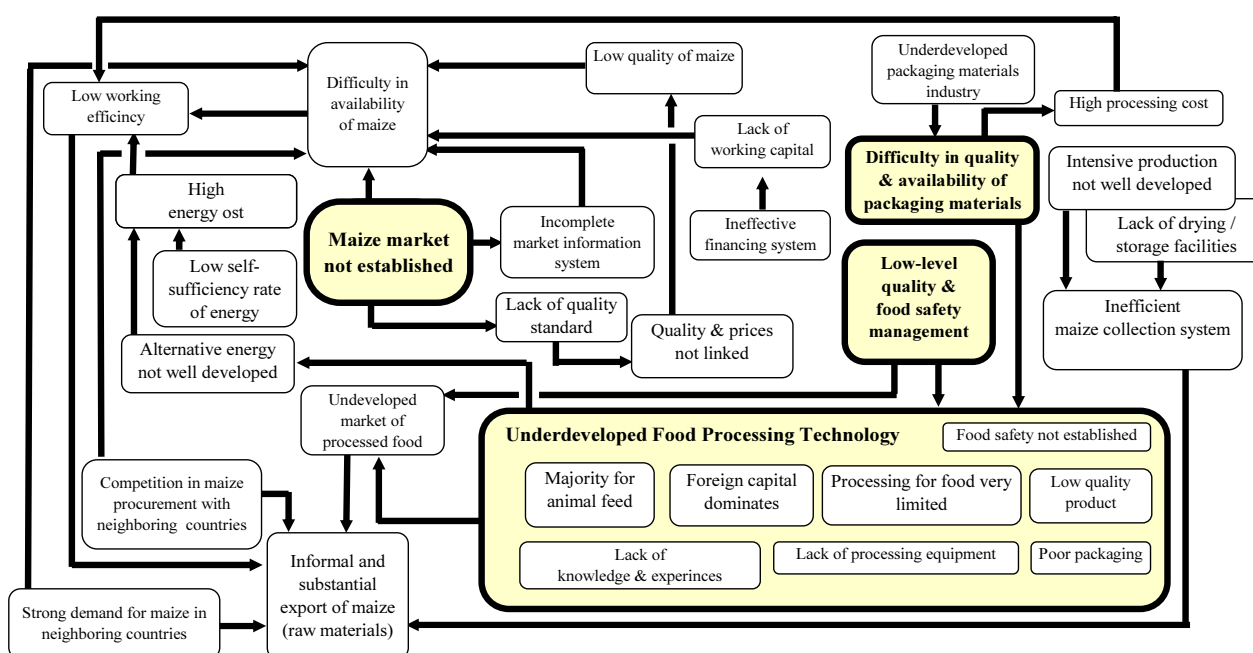
Source: Study Team

Figure 4-6 Problem Analysis (Rice Processing)

Figure 4-6 above shows the relationship of cause and effect among various constraints on rice processing so far discussed. Through this analysis, the following four (4) constraints (issues surrounded with thick lines in the above figure) have been narrowed down as the core problems that seem to have more weight as causes than others.

- a. Low-level postharvest treatment and processing technology
- b. Varietal mixture
- c. Lack of paddy market
- d. Underdeveloped secondary processing technology

(2) Maize



Notes:

1. This is a pattern diagram of representative issues and does not necessarily cover all the factors possible in processing and distribution.
2. Arrows' starting points indicate "Cause", while ending points "Effect".
3. Issues surrounded with thick lines refer to "Core Problems" that seem to have more weight as cause than others.

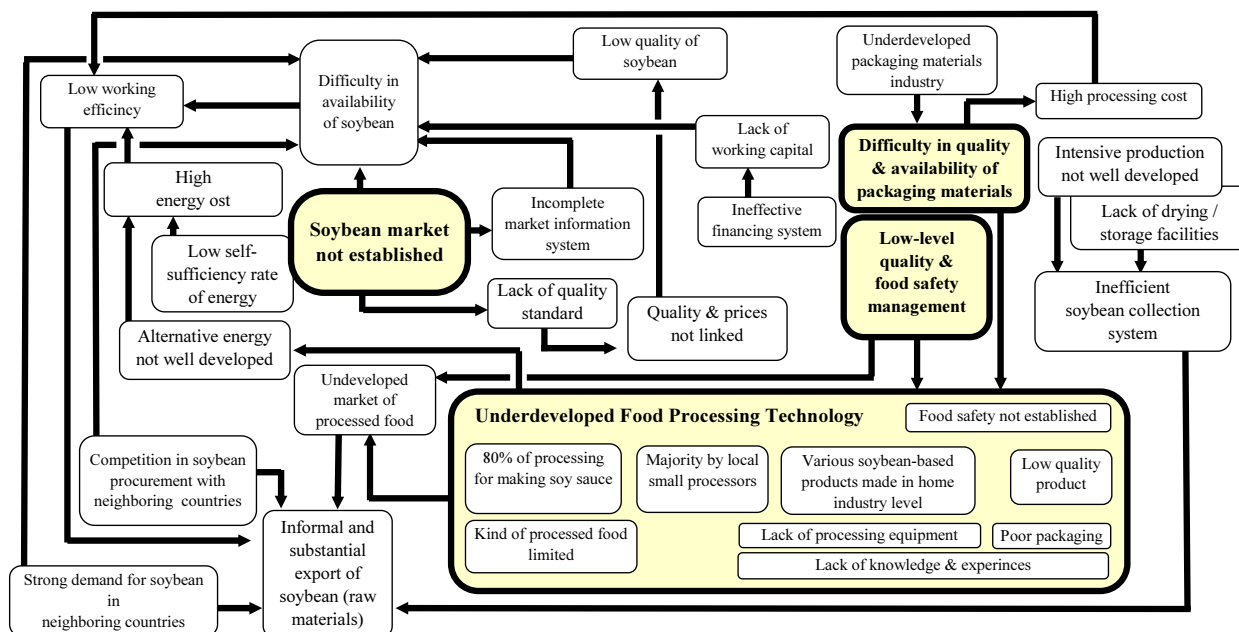
Source: Study Team

Figure 4-7 Problem Analysis (Maize Processing)

Figure 4-7 above shows the relationship of cause and effect among various constraints on maize processing so far discussed. Through this analysis, the following four (4) constraints (issues surrounded with thick lines in the above figure) have been narrowed down as the core problems that seem to have more weight as causes than others.

- a. Underdeveloped food processing technology
- b. Low-level quality and food safety management
- c. Difficulty in quality and availability of packaging materials (dependence on imports)
- d. Lack of maize market

(3) Soybean



Notes:

1. This is a pattern diagram of representative issues and does not necessarily cover all the factors possible in processing and distribution.
2. Arrows' starting points indicate, "Cause", while ending points show "Effect".
3. Issues surrounded with thick lines refer to "Core Problems" that seem to have more weight as causes than others.

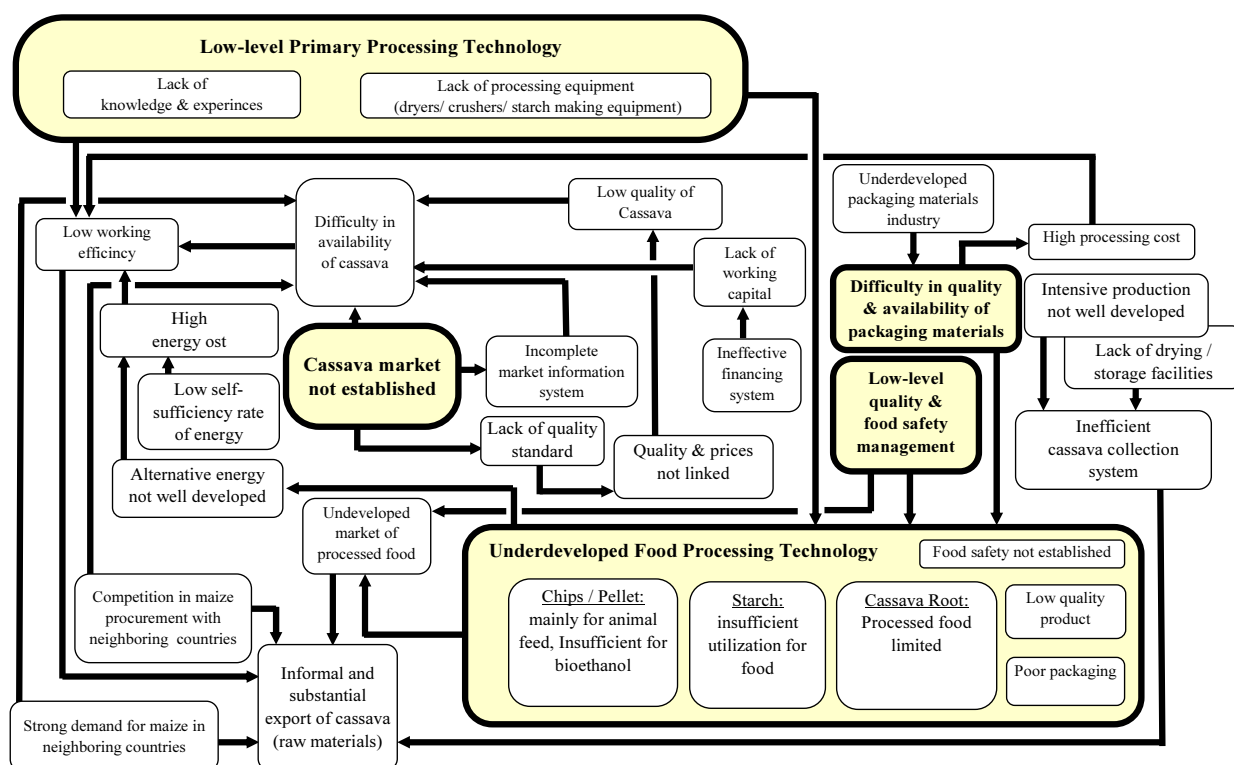
Source: Study Team

Figure 4-8 Problem Analysis (Soybean Processing)

Figure 4-8 above shows the relationship of cause and effect among various constraints on soybean processing so far discussed. Through this analysis, following four (4) constraints (issues surrounded with thick lines in the above figure) have been narrowed down as the core problems that seem to have more weight as causes than others.

- a. Underdeveloped food processing technology
- b. Low-level quality and food safety management
- c. Difficulty in quality and availability of packaging materials (dependence on imports)
- d. Lack of soybean market

(4) Cassava



Notes:

1. This is a pattern diagram of representative issues and does not necessarily cover all the factors possible in processing and distribution.
2. Arrows' starting points indicate, "Cause", while ending points show "Effect".
3. Issues surrounded with thick lines refer to "Core Problems" that seem to have more weight as causes than others.

Source: Study Team

Figure 4-9 Problem Analysis (Cassava Processing)

Figure 4-9 above shows the relationship of cause and effect among various constraints on cassava processing so far discussed. Through this analysis, the following five (5) constraints (issues surrounded with thick lines on above figure) have been narrowed down as the core problems that seem to have more weight as causes than others.

- a. Low-level primary processing technology
- b. Underdeveloped food processing technology
- c. Low-level quality and food safety management
- d. Difficulty in quality and availability of packaging materials (dependence on imports)
- e. Lack of cassava market

4.3 Potential

This section summarizes the potential of processed food by commodity, based on the results of analysis made in the preceding section and verbal investigation of Japanese companies (e.g., trading companies, food processing companies, machinery makers, etc.).

(1) Rice

a. Potential for Improvement

The following improvement can be expected by overcoming the core problems identified in the preceding section.

- Realization of Paddy Market to establish quality standards and a market information system, and also facilitate paddy procurement of rice millers. In addition, quality-linked prices of paddy are formulated. Through the market information system, dealing prices in the market are as indicative prices open to the public, which can be helpful for rice growers; millers; and exporters, to make a future business plan.
- It becomes possible to transform current informal paddy exports to the formal system, if the majority of buyers from neighboring countries participate in the newly established Paddy Market as buyers.
- If facilitation of paddy procurement, strengthening of rice mills, enhancement of working efficiency of rice mills, and improvement of milling technology are all attained, informal exports of paddy are reduced and formal exports in value-added milled rice would be increased.
- Low quality milled rice in Cambodia is dependent more on improper postharvest treatment and milling technology, than on milling equipment itself. Advances in the technology can lead to a remarkable improvement in the quality of milled rice.
- Promotion of secondary processing of rice contributes to expansion of rice-based processed food; development of import-substitutes (rice noodles, etc.); and reduction of informal paddy export.
- Full utilization of by-products of rice contributes to vitalization of relevant industry and improvement of the energy situation.
- Improvement of all the above issues eventually leads to an increase of rice growers' income.
- Technology and experience of Japan can be applied effectively to the areas of rice milling, secondary processing of rice and utilization of by-products.

b. Categories and Potential of Processed Food

Table 4-12 below summarizes variety of rice-based processed food; the superiority of Japan in rices processing; and sustainable potential of Cambodia in rice processing and utilization.

Table 4-12 Categories and Potential of Processed Food of Rice

Processed Food		Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization		
			Short-Term	Med- & Long-Term	
Milled Rice	Ordinary Milled Rice	◎	◎	◎	
	Parboiled Milled Rice	◎	○	◎	
	Husked Rice (Cargo Rice)	◎	△	◎	
Processing and Utilization of By-product	Straw	Restore to Soil, Compost, Spreading Material, Animal Feed, Straw Product	◎	◎	◎
	Husk	Fuel (for Power Generation, Drying, etc.)	○	◎	◎
		Restore to Soil, Compost, Spreading Material, Insulator, Building Material, Culvert	◎	○	◎
	Rice-bran	Rice Bran (Cooking Oil) De-oiled Bran (Animal Feed)	◎	○	◎
		Bed for Pickles making, Wax for Soap, etc.	◎	○	◎
Processed Food made from Milled Rice	Confectionery	Rice Cracker, Rice Cake, etc.	◎	◎	◎
	Rice Flour	Rice Noodle, Pho, Rice Paper, Bread, Sweets, etc.	◎	◎	◎
	Alcoholic Beverage	Distilled Spirit, Sake, Rice added Alcohol	◎	◎	◎
	Retort Pouch Food	Cooked Rice, Congee, Rice-based cooked Meal	◎	○	◎
	Frozen Food	Rice Ball, Rice burger, etc.	◎	○	◎
	Rice Vinegar		◎	◎	◎

Source: Study Team

(2) Maize

a. Potential for Improvement

The following improvements can be expected by overcoming the core problems identified in the preceding section.

- Realization of Maize Market to establish quality standards and a market information system, and also facilitate maize procurement of processors. In addition, quality-linked prices of maize are formulated. Through the market information system, dealing prices in the market are as indicative prices open to the public, which can be helpful for maize growers and processors to make a future business plan.
- It becomes possible to transform current informal maize exports to the formal system, if the majority of buyers from neighboring countries participate in the newly established Maize Market as buyers.
- If facilitation of maize procurement and development of processing technology are attained, the variety of processed food can be expanded with improvement in quality, and also

informal maize exports reduced.

- Full utilization of by-products of maize can contribute to vitalization of relevant industry and improvement of the energy situation.
- The technology and experience of Japan can be applied effectively to the areas of animal feed, processed food, non-processed food and utilization of by-products.

b. Categories and Potential of Processed Food

Table 4-13 below summarizes varieties of maize-based processed foods; the superiority of Japan in maize processing; and sustainable potential of Cambodia in maize processing and utilization.

Table 4-13 Categories and Potential of Processed Food of Maize

Processed Food		Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization	
			Short-Term	Med- & Long-Term
Animal Feed	Compound Feed (Main Material)	◎	◎	◎
Processed Food (Flour Milling)	Steamed / Baked Bread (Bun)	◎	◎	◎
	Congee	◎	◎	◎
	Cornflakes	◎	◎	◎
	Corn Soup	◎	◎	◎
	Confectionery (Dough)	◎	◎	◎
	Rehydrate-able Noodle	◎	△	◎
	Pet Food (Main Material)	◎	◎	◎
Non-processed Food	Boiled / Grilled Corn	◎	◎	◎
By-product	Corn Starch (Kernel/ Cob/ Leaves): For Ethanol, Paper making, Paste, etc.	◎	△	◎
	Corn Oil (Germ)	◎	△	◎
	Compost (Cob/ Leaves)	◎	◎	◎
	Cob Meal: Synthetic Resin, Sweets, Building Materials, etc.	◎	△	◎

Source: Study Team

(3) Soybeans

a. Potential for Improvement

The following improvements can be expected by overcoming the core problems identified in the preceding section.

- Realization of a Soybean Market to establish quality standards and a market information system, and also to facilitate soybean procurement by processors. In addition, quality-linked prices of soybean are formulated. Through the market information system, dealing prices in the market are as indicative prices open to the public, which can be helpful for soybean growers and processors to make a future business plan.

- It becomes possible to transform current informal soybean exports to the formal system, if the majority of buyers from neighboring countries participate in the newly established Soybean Market as buyers.
- If facilitation of soybean procurement and development of processing technology are attained, the variety of processed food is expanded with improvement of quality, and also informal soybean exports are reduced. Further, various soybean-based drinks, popular with Cambodian citizens but currently very dependent on imports, can be produced locally (import substitute).
- Full utilization of by-products of soybean can contribute to vitalization of relevant industries and improvement of the energy situation.
- The technology and experience of Japan can be applied effectively to the areas of soybean oil, meal (de-oiled soybean), and a variety of soybean-based processed foods.

b. Categories and Potential of Processed Food

Table 4-14 below summarizes varieties of soybean-based processed foods; the superiority of Japan in soybean processing; and sustainable potential of Cambodia in soybean processing and utilization.

Table 4-14 Categories and Potential of Processed Food of Soybean

Processed Food		Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization		
			Short-Term	Med- & Long-Term	
Soybean Oil	Tempura Oil	◎	△	◎	
	Salad Oil	◎	△	◎	
	Mayonnaise	◎	△	◎	
	Frying Oil for Confectionery, etc.	◎	△	◎	
Meal (De-oiled Soybean)	Animal Feed	◎	△	◎	
	Soy Sauce	◎	◎	◎	
Processed Food made from Soybean	Soy Milk	Bean Curd Grilled Bean Curd, Frozen Bean Curd, Deep-fried Bean Curd, etc.	◎	◎	◎
		Soy Milk Skin	◎	◎	◎
	Bean Curd Refuse	For Food	◎	◎	◎
		For Animal Food	◎	◎	◎
	Boiled Soybean	Bean Paste	◎	◎	◎
		Natto (Fermented Soybean)	◎	◎	◎
	Roasted Soybean	Toasted Soybean Flour	◎	◎	◎
	Green Soybean		◎	◎	◎
Soybean Sprout		◎	◎	◎	

Source: Study Team

(4) Cassava

a. Potential for Improvement

The following improvement can be expected by overcoming the core problems identified in the preceding section.

- Realization of a Cassava Market to establish quality standards and a market information system, and also facilitate cassava procurement by processors. In addition, quality-linked prices of cassava are formulated. Through the market information system, dealing prices in the market are as indicative prices open to the public, which can be helpful for cassava growers and processors to make a future business plan.
- It becomes possible to transform current informal cassava exports to the formal system, if the majority of buyers from neighboring countries participate in the newly established Cassava Market as buyers.
- If facilitation of cassava procurement and development of processing technology are attained, varieties of processed foods are expanded with improvements in quality, and also informal cassava exports are reduced.
- Full utilization of by-products of cassava contributes to vitalization of relevant industry and improvements in the energy situation.
- The technology and experience of Japan can be applied effectively to the areas of secondary processing of cassava starch.

b. Categories and Potential of Processed Food

Table 4-15 below summarizes varieties of cassava-based processed foods; the superiority of Japan in cassava processing; and sustainable potential of Cambodia in cassava processing and utilization.

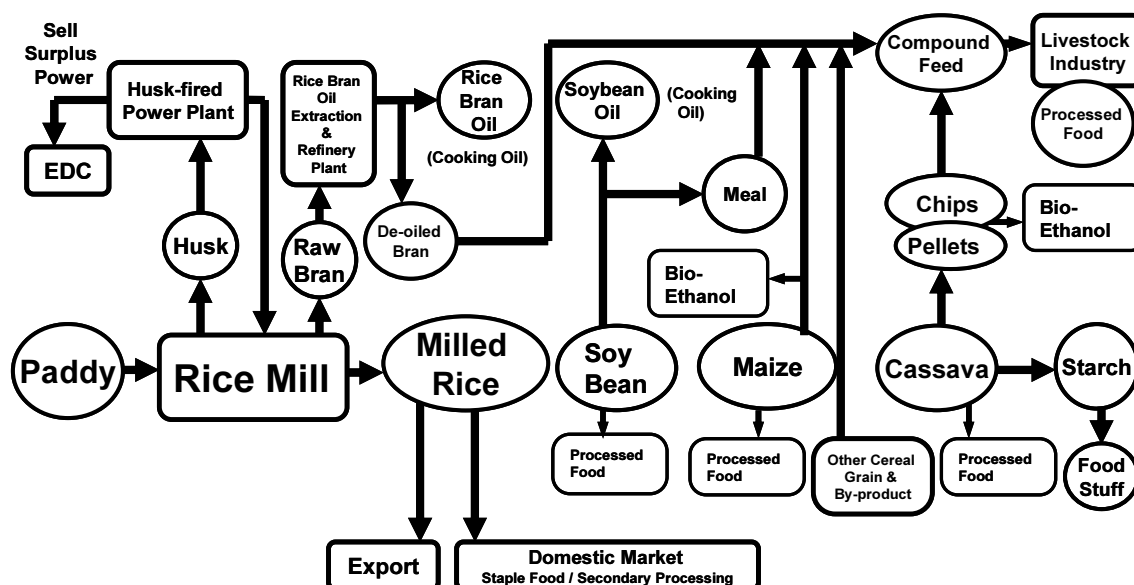
Table 4-15 Categories and Potential of Processed Food of Cassava

Processed Food			Superiority of Japan in Technology and Experiences of Processing/Utilization	Sustainable Potential of Cambodia in Processing/Utilization	
Primary Processing	Secondary Processing			Short-Term	Med- & Long-Term
Chips	Animal Feed		△	⊙	⊙
	Biomass Ethanol		△	○	⊙
Pellet (Molding Chips)	Animal Feed		△	⊙	⊙
	Biomass Ethanol		△	○	⊙
Starch	Processed Food (Natural Additives)	Various Desserts, Ice Cream, Noodles, Canned Foods, Synthetic Seasoning, Sweets, Tapioca Pearl (granular product), Pudding, Material for making pre-washed rice, Liaison,, Fish/Meat-Paste Products, Sauce, Confectionery, etc.	⊙	△	⊙
	Non-Food Use	Paper making, Textiles, Plywood, Paper coating, Spinning, Various Bonding, Medicines	⊙	△	⊙
By-Product from Starch making	Cassava Pulp	Animal Feed	△	⊙	⊙
Processed Food from Cassava Root/ Leaves: Fried Chips, Dried Cassava, Cassava Flour, Paste, Leaves Paste, etc.			△	⊙	⊙

Source: Study Team

(5) Combined System of Four (4) Prospective Commodities

Figure 4-10 below shows an idea of combined system of four (4) prospective commodities from the viewpoint of effective utilization of by-products. Realization of this idea will enable development of alternative energy (a countermeasure for current energy-constraint); local production of edible oil (import substitute); promotion of supply of local compound feed (vitalization of livestock industry) and so on. It is expected to tackle this system on a mid-/ long-term basis with the progress of strengthening the infrastructure of food processing in Cambodia so far discussed.



Source: Study Team

Figure 4-10 Combined System of Four (4) Prospective Commodities (Rice, Maize, Soybean and Cassava)

(6) Other Prospective Commodities

Other than the four (4) commodities described before, many potential commodities are conceivable, such as:

- Fruits (Coconut, Mango, Dragon fruit, etc.)
- Nuts (Cashew nut)
- Palm
- Commodities suitable for alcohol fermentation (Alcoholic Beverages)
- Organic vegetables
- Spices (Pepper, etc.)
- Sesame
- Secondary & tertiary processed foods of cereal grains
- Seasoning (Fish-sauce, etc.)
- Various preserved foods

This part takes up the following six (6) items to overview their processing potential from the viewpoint of production and process-ability, as summarized in Table 4-16.

- a. Coconut
- b. Mango
- c. Dragon fruit
- d. Cashew nut
- e. Palm
- f. Commodities suitable for alcohol fermentation.

One of the main constraints in processing of these commodities seems to be low-level processing technology, as in the case of the aforesaid four (4) commodities.

In addition, livestock industry and dairy farming in Cambodia may be another growing sector in the long run. Currently, however, the livestock (cattle, pigs and chickens) are raised in house-yards, not in any systematic way, thus leading to unsustainable supply. As such, local processing industry for meat and dairy products is not well developed as yet, remaining at home industry level. Livestock products locally available in supermarkets or convenience stores are mostly imported from neighboring countries. As observed in neighboring and other semi-developed countries, it is possible, with the progress of economic growth of Cambodia, that well-organized livestock industry/ dairy farming will be developed, realizing sustainable processing business for meat and dairy products.

To realize the above possibilities, it is essential to establish a local cold-chain system; systematized livestock industry/ dairy farming; and a food safety system. Dairy products should meet sanitary requirements, which are strict in terms of food safety and hygiene, compared with other processed food.

Table 4-16 Current Status and Potential of Other Prospective Commodities

Commodity	Current Status and Potential
Coconut	<p><u>Current Status</u> Available from coconut is mainly fresh juice. Variety of processed food is very limited. Only one (1) processor (enterprise) is in operation each for cookies and jam.</p> <p><u>Potential</u> Coconut has various potential for processing as exemplified below:am Fruit> Copra (Dried fruit)> Oil> Methyl ester / Edible oil / Fat Fruit juice> Vinegar/ Sugar/ Wine Shell> Solid fuel/ Charcoal Skin> Organic fertilizer/ Synthetic fiber</p>
Mango	<p><u>Current Status</u> Traditional products, such as "Mango sheet" (Dried mango); Mango juice, are made at farmers level. Currently, the variety of processed foods is very limited.</p> <p><u>Potential</u> High potential as food processing industry can be expected, assuming that a Cambodian brand is established with some specific features, and varieties of processed foods are greatly increased.</p>
Dragon Fruit	<p><u>Current Status</u> The bun red-colored with fruit juice has been developed, but is marketed only in local area. Fresh fruit available in markets in Cambodia are mostly from Vietnam and Thailand.</p> <p><u>Potential</u> Dragon fruit has various features, such as; attractive texture similar to kiwi fruit, abundant nutrient ingredients, natural coloring matter applicable for lip stick/ dyestuff, etc. Research on cultivation and processing is continued by the private sector in several areas. High potential can be expected, assuming that Cambodian brand is established with some specific features.</p>
Cashew nut	<p><u>Current Status</u> Most cashew nuts are exported with shell and imported back to Cambodia after shelling in destination countries, although shelling is done in limited areas of Cambodia. When shelling locally, shell is usually disposed of as waste. Cashew Nut Shell Liquid (CNSL) extracted from the shell, highly heat-resistive, can be used for making brake linings / epoxy coatings and also as a material of synthetic resin paint (substitute of lacquer). Some foreign processors try to collect and export the shell for extracting oil in destination countries.</p> <p><u>Potential</u> Processing & distribution with utilization of by-products can be expanded in Cambodia, if shelling with shell-oil extraction is conducted locally. Many kinds of processed foods can be produced from cashew nuts, such as; confectionery, alcoholic beverages, etc. Production of Cambodian cashew nuts is relatively plentiful, enhancing its potential.</p>

Commodity	Current Status and Potential
Palm	<p><u>Current Status</u> Processing of palm for producing alcoholic beverages, vinegar and sugar are conducted locally. The project for sugar processing is in progress under support of JETRO.</p> <p><u>Potential</u> In addition to above mentioned products; local production of palm oil is also considered possible as import-substitute. Currently, cooking oil including palm oil is totally dependent on import. One of the main constraints is packaging materials (glass bottles, cans, etc.), which are mostly imported at the moment due to poor quality and unstable supply of local products.</p>
Commodities suitable for alcohol fermentation	<p><u>Current Status</u> Alcoholic beverages making business is widely conducted in Cambodia, without regard to enterprises' scale, foreign or local capital, reflecting big local demand. At SME level, various projects or businesses are operating, such as Rice Shochu (distilled spirit from rice) in partnership with Nogoya University of Japan and RUA under the JICA project (Takeo province); Shochu from rice/ cassava/ fruit (Siem reap province), Cassava Shochu/ grape wine (Battambang province), etc.</p> <p><u>Potential</u> Many commodities can be targeted for business and demand seems large. High potential as food processing industry can be expected, assuming that technology development, quality and food safety improvement and industrialization are attained. One of the main constraints, as raised before, is packaging materials (glass bottles, cans, etc.), for which domestic production should be modernized.</p>

Source: Compiled by the Study Team, based on various survey reports.