International Seminar on

Promoting Rice Farmers' Market through value-adding Activities

June 6-7, 2018
Faculty of Economics
Kasetsart University, Thailand

Organized by

Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC)
Faculty of Economics, Kasetsart University
Agricultural Economics Society of Thailand under Royal Patronage
The Thailand Research Fund (TRF)

Promoting Rice Farmers' Market through Value-adding Activities

Proceedings of the International Seminar on
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Welcome Remark
Dr. Kuo-Ching Lin
Director, FFTC

Honorable Professor and Vice President for Research of Kasetsart University, Dr. Siree Chaiseri, Professor and Dean of the Faculty of Economics of Kasetsart University Dr. Vijitsri Sanguanwongse, to all our 14 speakers representing 11 countries from Cambodia, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Taiwan, Thailand and Vietnam, honorable guests, local participants, friends, ladies and gentlemen, a pleasant good morning to all of you.

I feel honored to deliver this welcome remarks for this seminar. Firstly, on behalf of FFTC, I would like to extend my gratitude to Professor Orachos Napasintuwong for her great efforts in organizing this seminar. I would also like to thank the Faculty of Economics, Kasetsart University, the Agricultural Economics Society of Thailand Under Royal Patronage and the Knowledge Institute Network of Thailand to co-organize this seminar.

Our international seminar on "Promoting Farmers' Market through Value Adding Activities" comes at a very appropriate time especially now that food security is one of the biggest issues facing agriculture in the Asian and Pacific region. Rice, being the major staple food in Asia, has to be marketed innovatively through value-adding activities. Today we have with us rice experts who are willing to share their knowledge and experiences in the production, processing and marketing of rice. And through our exchange of experiences and knowledge hopefully we can identify and articulate the major issues and come up with some suggestions and recommendations to help rice related institutions and agents, and our policy makers improve rice farmers' market through value-added activities in their countries.

I would also like to use this opportunity to explain why our organization, the Food and Fertilizer Technology Center or FFTC, an international organization, is sponsoring activities and workshops like what we are doing today. In line with the United Nation's Sustainable Development Goals or SDGs, our mission is to promote the sustainable agricultural development and to increase the income and welfare of farm households in the Asian and Pacific Region. We believe that today's topic is an important topic and consistent with our mission.

Currently we have three major ways to carry out this mission. First is to spearhead the transfer of matured and adequate technologies and information including agricultural policies. Second is to promote the sharing and exchange of information among countries, and third is to bridge the technology and policy gaps that exist between developed and developing countries.

It is therefore important to us to partner with academic institutions like Kasetsart University to help us in the collection and dissemination of information. Through our technology transfer mechanism which involves the identification of current problems and issues in agriculture, collection, sharing and exchange of information and dissemination and transfer of practical and adequate technologies, we hope these kinds of seminars will help in transferring the relevant and useful experiences and technological information to the rest of the agriculture community in the region.

On behalf of FFTC, I would like to welcome all of you to today's international seminar. We hope that whatever information that you can pick up from this exchange and sharing of information, you would be able to transmit this knowledge to your colleagues when you return to your own respective countries.

It is my sincere hope that the information gathered from this seminar will bear fruits—something that would be beneficial to our farmers.

Again, thank you very much for coming here and accepting our invitation. I wish you all a happy, meaningful and productive day!

Welcome Remark
Dr. Chongrak Wachrinrat
Acting President, Kasetsart University

Good Morning! It is my great honor to welcome you, on behalf of Kasetsart University, to the International Seminar on Promoting Rice Farmers' Market through Value-adding Activities.

I wish to give a special welcome to Dr. Kuo-Ching Lin (Director of Food and Fertilizer Technology Center for the Asian and Pacific Region–the FTTC); Dr. Vijitsri Sanguanwongse (Dean of the Faculty of Economics Kasetsart University); Dr. Pitipong Phungbun na Ayutthaya (President of the Agricultural Economics Association of Thailand Under Royal Patronage); Dr. Kwanchai Gomez (Executive Director of Thai Rice Foundation under Royal Patronage). And, to our Distinguished Speakers and every Guest. Welcome!

My hope is that all of you will benefit from insights provided by the experts who have consented to talk with us for the next two days. We look forward to your participation and your contributions to this important discussion.

The Food and Fertilizer Technology Center and Kasetsart University have a long history of collaboration. Our staff have co-organized and participated in several FFTC international seminars in previous years, and this year, Kasetsart University is once again honored to collaborate in the planning for this impressive program.

This year, Kasetsart celebrates its 75th Anniversary. In 1943, Kasetsart was first created as the dominated agricultural college in Thailand, and since those early years the university has expanded to become a comprehensive university offering courses in many different disciplines.

Kasetsart University enjoys a strong reputation in Thailand and throughout the world -- for its academic programs, teaching, and research -- focusing on food production (including agriculture, aquaculture, fisheries); food processing (and related agro-industries); agriculture; agricultural economics; and agri-business.

We are honored that in 2018, the QS World University Rankings ranks Kasetsart 40th in the world and 5th in Asia for Agriculture and Forestry.

In all instances, the University's primary mission and outreach goals continues to provide leadership and serves to advance human resource development for our Country and for the region.

The International Seminar on Promoting Rice Farmers' Market through Value-adding Activities is an excellent opportunity to learn about and discuss the most critical issues in the rice sector, which are now confronting Asia and the Pacific region. Rice is one of the most important commodities in Asia. Thus, the issues discussed here during this seminar -- how to enhance rice farmers' productivity and expand the rice market through value-adding activities -- are vitally relevant.

We are honored that Distinguished Speakers from 11 Asian countries representing governments, academic institutes, civil service organizations, non-profit organizations, and commercial bank have joined together here. This diversity of participants, representing a wide scope of stakeholders in the rice industry, reflects the importance of the issues to be addressed.

I hope that all of you will gain great benefit from the seminar. And, I wish each of you a very pleasant stay during your time on our beautiful campus.

Thank you.

Welcome Remark

Assoc. Prof. Dr. Vijitsri Sanguanwongse

Dean, Faculty of Economics, Kasetsart University

Distinguished Delegates, Ladies and Gentlemen:

It is my pleasure to welcome you to the International Seminar on Promoting Rice Farmers' Market through Value-adding Activities. The program is hosted by the Faculty of Economics Kasetsart University, with the collaboration and sponsorship of the Food and Fertilizer Technology Center for the Asian and Pacific Region (FFTC); the Agricultural Economics Association of Thailand under Royal Patronage; and the Thailand Research Fund. The contributions and assistance of each has been generous.

The Faculty of Economics at Kasetsart University is one of the most prestigious Economics Schools in Thailand. The Faculty offers 13 different degree programs under the auspices of our 3 Main Departments: the Department of Economics; the Department of Agricultural and Resource Economics; and the Department of Cooperatives.

The Faculty of Economics seeks prominent in teaching; and undertakes to provide training and research in agricultural economics, agricultural policies, and cooperatives. The Faculty seeks to promote research that serves the need of our Nation and advances the economic development of the Region.

The Faculty is active and engaged. In 2010, the National Research Universities Program established KU's Agricultural and Food Economics Research Unit in order to promote high quality agricultural research. The Faculty of Economic's Center for Applied Economics Research publishes the *Applied Economics Journal*, which is listed in the Thailand Journal Citation Index and the ASEAN Citation Index. And, our professors regularly publish in internationally-recognized journals.

We have the primary aim of promoting subjects related to agricultural economics, through research, education, extension and outreach … and the issues addressed by this international seminar provide perfect examples of the issues that are central to the Faculty of Economics. Kasetsart University and the Faculty of Economics has long used its educational resources and research capabilities to assist Asian region to achieve sustainable development within agricultural sectors.

We are all aware of the special importance of rice sector within the Asian region, and we all share the common goal of enhancing rice farmers' income and their economic stability. But we also know that this cannot be done without better understanding the rice marketing system in different Asian countries, as well as the roles of farmers' groups, agricultural cooperatives, and private companies in promoting value-adding activities.

I am confident that this International Seminar will create a forum for sharing knowledge and for creating a network for future collaborations. I look forward to additional opportunities to strengthen our relationship with the FFTC and with the many institutes sponsoring and participating in this important program.

Before I conclude, I would like to take this opportunity to warmly thank the FFTC, the Agricultural Economics Association of Thailand under Royal Patronage, and the Thailand Research Fund for financially supporting this seminar. Of course, I also thank the distinguished speakers and the participants. In particular, I thank the organizing teams for their excellent arrangements.

I warmly welcome you to our Faculty of Economics and to Kasetsart University, and wish you a pleasant stay in Bangkok. Welcome! Thank you very much.

International Seminar on

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June 6-7, 2018

EC 5205, 2nd Floor, Faculty of Economics

Kasetsart University, Bangkok, Thailand

June 6, 2018	Wednesday
8:30 – 9:00	Registration
9:00 – 9:30	Welcoming addresses
	Dr. Kuo-Ching Lin, Director, FFTC
	Dr. Chongrak Wachrinrat, Acting President, KU
	Dr. Vijitsri Sanguanwongse, Dean, Faculty of Economics, KU
	Photo session
9:30 – 9:45	Coffee break
9:45 – 12:00	*Session 1 Rice policies*
	Chair: Dr. Orachos Napasintuwong
	Rapporteurs: Dr. Isriya Bunyasiri and Dr. Uchook Duangbootsee
	Thailand's rice industry and current policies towards high value rice products
	Dr. Apichart Pongsrihadulchai
	Secretary, Agricultural Economics Society of Thailand Under Royal Patronage, Thailand
	Former Director General of the Rice Department and Office of Agricultural Economics
	Evaluation of policy and business performance of rice production and marketing zones in Taiwan
	Professor Min-Hsien Yang
	President, Rural Economics Society of Taiwan, Taiwan
	Rice farming in the Japan's matured market: Overcoming the shrinking domestic demand by value-adding and export-enhancing strategies
	Professor Katsumi Arahata
	Department of Food Economics, Faculty of Applied Bioscience
	Gifu University, Japan
12:00 – 13:00	Lunch
13:00 – 14:30	*Session 2: Rice value chain and institutional aspects*
	Chair: Dr. Orachos Napasintuwong
	Rapporteurs: Dr. Kanchana Sripruetkiat and Dr. Itthipong Mahathanaseth

	The value chain and new price policy in Indonesia
	Professor Muhammad Firdaus Vice Dean for Resources, Cooperation and Development, Faculty of Economics and Management, Bogor Agricultural University, Indonesia
	Value chain and cooperatives in rice production in large scale rice fields *Dr. Hoang Vu Quang*
	Institute of Policy and Strategy of Agriculture and Rural Development (IPSARD), Vietnam
14:30 – 14:45	Coffee break
14:45 – 16:00	Economic potentials of rice industry in India: Opportunities and challenges
	Dr. Aldas Janaiah
	International Rice Research Institute, New Delhi, India
	Bank for Agriculture and Agricultural Cooperatives' rice value chain
	Mr. Surasak Sompadung
	Vice President: Customer and Rural Development Department
	Bank for Agriculture and Agricultural Cooperatives (BAAC), Thailand
	18:00 – 20:00 Welcoming dinner (invited speakers only)
June 7, 2018	Thursday
9:00 – 10:30	*Session 3: Trends in rice market, demand and standards*
	Chair: Professor Matthew Downs
	Rapporteurs: Dr. Apichaya Lilavanichakul and Dr. Ravissa Suchato
	Gastronomic system of rice consumption for urban Filipino consumers
	Dr. Rosa Paula Cuevas
	International Rice Research Institute, Los Banos, Philippines
10:30 – 10:45	Coffee break
10:45 – 12:00	Overview of the Cambodian Rice Market: Challenges and the Way Forward
	Ms. Heng Sola
	Cambodia Agricultural Value Chain Program (CAVAC)-Australian Aid Cambodia
	Consumer Preferences on Speciality Rice in Malaysia
	Ms. Rosnani Binti Harun
	Economic and Social Science Research Centre
	Malaysian Agricultural Research and Development Institute, Malaysia
12:00 – 13:00	Lunch
13:00 – 14:30	*Session 4: Value adding activities for rice products*
	Chair: Prof. Matthew Downs
	Rapporteurs: Dr.Thanasin Tanompongphandh and Dr. Orachos Napasintuwong

	Promoting rice value-addition through inclusive business model
	Mr. Tanapat Sangaroon
	Trade Officer, Trade Policy and Strategy Office
	Ministry of Commerce, Thailand
	Rice breeding and mechanization for value addition in Laos PDR
	Dr. Phetmanyseng Xangsayasane
	Senior Rice Breeder, Deputy Director for Research
	Rice Research Center, National Agriculture & Forestry Research Institute, Ministry of Agriculture and Forestry, Lao PDR
14:30 – 14:45	Coffee break
14:45 – 16:00	Learning Alliance: Opportunities to move together to larger rice
	markets
	Ms. Reianne Quilloy
	International Rice Research Institute, Los Banos, Philippines
	Myanmar rice industry and policies towards value addition and export promotion
	Dr. Theingi Myint
	Department of Agricultural Economics
	Yezin Agricultural University, Myanmar
18:00 – 20:00	Dinner (invited speakers only)

THAILAND'S RICE INDUSTRY AND CURRENT POLICIES TOWARDS HIGH VALUE RICE PRODUCTS

Apichart Pongsrihadulchai
The Agricultural Economics Society of Thailand under Royal Patronage

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ABSTRACT

Thailand is, presently, ranked sixth in the world in terms of rice production and second in terms of rice export. The market share is about 20 %. Besides being a staple food for the Thai people, rice is also very important to the Thai economy. It shared about 15% of agricultural gross domestic product (GDP) and ranked second after rubber in exporting value of agricultural products.

About half of the agricultural land of the country is devoted to rice growing and most of rice farmers are small famers. The average paddy planted area is only about 3 hectares per household. About 33 % of rice farmers are above 60 years old with the average age of 56 years.

The current agricultural policies of the Ministry of Agriculture and Cooperatives (MOAC) include establishing the rice restructuring plan in order to reduce the over rice production to match with the demand. The cost reduction and product quality improvement as well as value creation programs are emphasized. Niche market products such as organic rice, nutritious rice and geographical (GI) rice are also promoted. The area – based extension approach is adopted to implement the above policies. The government incentives provided include equipment, technology transfer, soft loans, direct payment and assistance in market linkages.

Keywords: Agricultural policies, restructuring plan, cost reduction, product quality improvement, value creation, niche market, organic rice, GI rice, area – based extension

INTRODUCTION

Thailand is still considered as an agricultural country even though the share of agricultural sector in the gross domestic product (GDP) has declined continuously. Presently, the agricultural sector contributes less than 10% to its national GDP l. However, majority of the people still live on farm in the rural areas and depend on agricultural activities for their source of livelihood. Agriculture provides food not only enough for domestic consumption but also has a surplus for export to earn a significant amount of foreign exchange for the country. Furthermore, most of the economic progress has been derived, directly or indirectly, from agricultural development. In the old days, for many Thai farmers, rice farming is a way of life for them. A small piece of land, whenever they have, most of them think first about growing rice for household consumption regardless of the prices they will receive. However, keeping rice for household consumption has been decreasing nowadays due to the change in harvesting practice from manual to combine machine which the farmers, generally, sell all their paddies immediately to the local assemblers right after harvest. Apart from being an important crop that has significant impact on the national economy, rice farming has also contributed much to the national culture. The royal ploughing ceremony is organized in May of every year. Due to the importance of rice and rice farmers, in 2009 the government has decided to designate the fifth of June of every year as the "*National Rice and Rice Farmers Day*". This day was selected because in June 5, 1946 the late King Rama 8 together with the late King Rama 9 (then the brother of the King Rama 8) had visited the paddy field in Bangkhen

district, Bangkok suburb and broadcasted rice seeds into the field. Furthermore, the rice farmers has always been recognized by the Thai people as *"The Backbone of the Country"*.

The Thai economy very much relies on its exports. The export earning constituted about 60 % of the total GDP. Agricultural exports share about 20 % of the total export value. Major agricultural exports in terms of value are rubber, rice, shrimp, processed fish, sugar and cassava, respectively. Many agricultural commodity exports are ranked first or very high on the list in terms of world market share.

From the total land area of 320.7 million rais (51.3 mill. hectares), it can be categorized into 3 major groups as agricultural land which, in 2017 occupied about 23.9 million hectares or about 47 % of the total land area, the forest area covered about 17.2 million hectares or about 33 % and the rest are non – agricultural land which are used for housing, commercial and industrial purposes. For agricultural land, about 11.2 million hectares or about 47 % of agricultural land are classified as paddy fields (Fig. 1).

In this paper, the relative importance of Thai rice to the country's economy and to the world in terms of production and trade, Thai rice markets, characteristic of rice farmers and rice farming system will be presented. The government policies and activities implemented towards high value products will be also described.

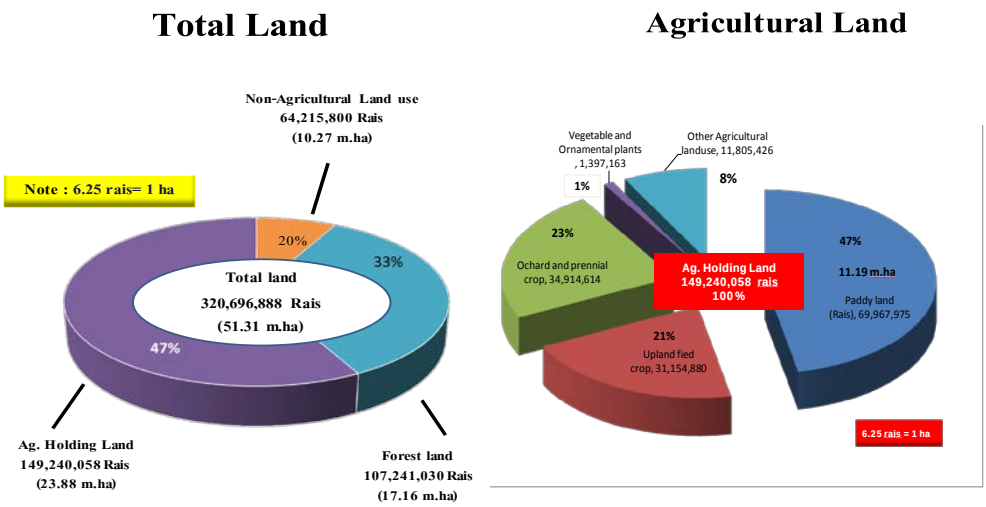

Fig. 1. Land Use of Thailand 2017

Source: Office of Agricultural Economics (OAE)

RICE INDUSTRY IN THAILAND

Importance of Thai rice

In Thailand, rice is the most important crop in many aspects. It is a staple food for the Thai people and a major source of foreign exchange earning as well as a major source of employment. Rice production contributes about 15 % of its agricultural GDP which is the first in ranking among agricultural products. It ranked second after rubber in terms of export earnings.

Thailand is currently ranked sixth in the world in rice production but constitutes only about 4 % of the world production. For export, Thailand is ranked second in rice export which have market share of about 24 % of the world rice trade. The world rice production and trade is shown in Table 1. However, for more than 30 years, Thailand used to consistently rank number one in rice export in the world until it lost its position to India and Vietnam in 2012. Over the last 50 years, the rice export from Thailand has increased from about 2 million tons to about 10 million tons with an average annual growth of about 4.4 %. During the same period, the world rice trade has increased from about 5 million tons to about 40 million tons with an average annual growth of about 3.6 %. However, the market share of Thai rice during this period has fluctuated from as low as 10 % to the highest point at more than 40 % (Fig. 2).

Table 1. World rice production, exports and imports, 2017

Country	Production		Country	Exports		Country	Imports	
	(Mill. Tons)	(%)		(Mill. Tons)	(%)		(Mill. Tons)	(%)
China	144.95	30	**India**	12.3	26	**China**	5.5	12
India	110.15	23	**Thailand**	11.614	24	**Nigeria**	2.5	5
Indonesia	36.86	8	**Vietnam**	6.488	14	**EU**	1.875	4
Bangladesh	34.58	7	**Pakistan**	3.6	8	**Iran**	1.6	3
Vietnam	27.4	6	**USA**	3.384	7	**Saudi Arabia**	1.4	3
Thailand	19.2	4	**Myanmar**	3.2	7	**Ivory Coast**	1.35	3
Myanmar	12.65	3	**Cambodia**	1.15	2	**Philippines**	1.1	2
Philippines	11.69	2	**Uruguay**	1	2	**Iraq**	1.07	2
Brazil	8.38	2	**Brazil**	0.594	1	**Malaysia**	1	2
USA	7.12	1	**Argentina**	0.392	1	**Indonesia**	0.3	1
Others	73.8	15	**Others**	3.827	8	**Others**	29.854	63
World	**486.78**	**100**	**World**	**47.549**	**100**	**World**	**47.549**	**100**

Source: World Markets & Trade, USDA, February 2018

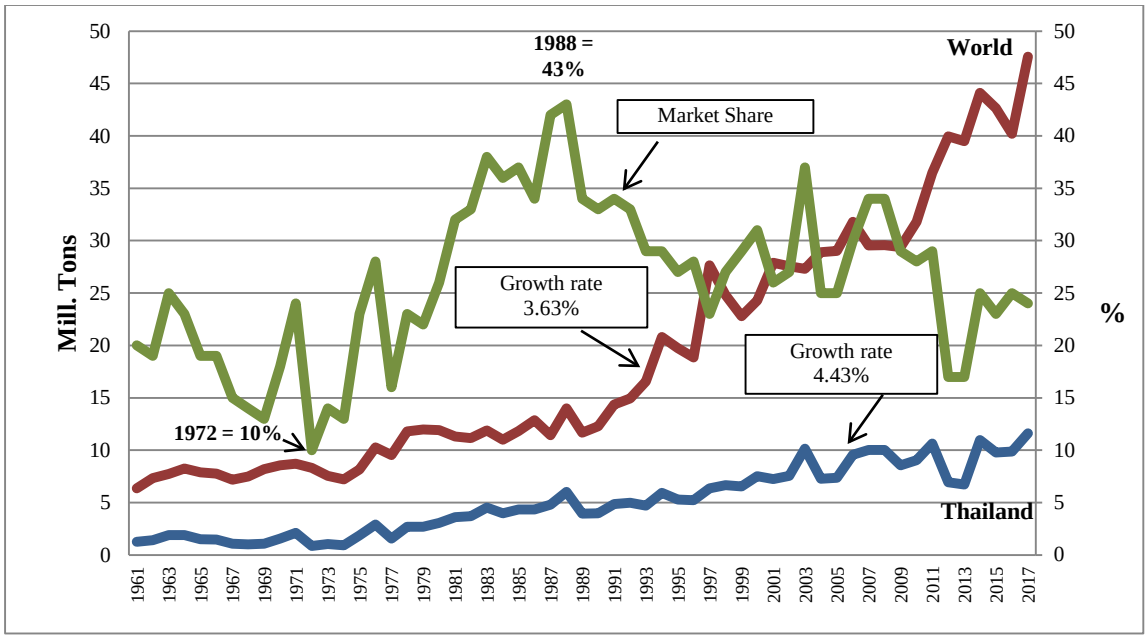

Fig. 2. Quantity of World Rice and Thai Rice Export and Market Share, 1961 – 2017

Source: IRRI and Thai Rice Exporters Association

Thai rice markets

In 2017, Benin is the biggest importer of Thai rice , followed by China and the United States, respectively (Table 2). Most of the Thai rice exports were white rice followed by Hommali Rice (Jasmine or fragrant rice) and parboiled rice, respectively (Table 2). The top ten customers of Thai rice by type of rice are shown in Table 3 Table 4 and Table 5.

In general, Thai rice is considered as a good quality rice which can be justified by the average FOB prices of major exporting countries such as India and Vietnam. The annual average of FOB prices for 5% white rice between 2012 and 2017 for Thailand, India and Vietnam is shown in Table 6. The FOB prices of Thailand are above the fob prices of both India and Vietnam while the FOB prices of India are higher than the FOB prices of Vietnam.

Table 2. Quantity and value of Thai rice exports by countries of destination and type of rice, 2017

Country of destination	Quantity		Value (Mill.	Type of rice	Quantity		Value	
	(Ton)	(%)			(Ton)	(%)	(Ton)	(%)
Benin	1,811,164	16	23,114	**White Rice**	5,050,047	42	62,766	32
China	1,199,737	10	19,352	**Hommali Rice**	2,299,262	19	51,237	26
USA	503,517	4	13,368	**Parboiled**	3,373,184	28	44,629	23
Republic of	775,175	7	10,502	**Glutinous**	514,740	4	8,956	5
Cameroon	744,508	6	9,121	**Pathumthani**	378,965	3	6,399	3
Bangladesh	550,119	5	7,081	**Others**	12,105	0	515	0
Ivory Coast	492,911	4	6,290	**Sub – Total**	11,628,303	97	174,502	90
Others	5,551,172	48	85,675	**Rice Products**	311,926	3	18,867	10
Total	**11,628,30**	**100**	**174,503**	**Total**	**11,940,232**	**100**	**193,370**	**100**
			(5,817 Mill. US$)					**(6,446 US$)**

Source: Office of Agricultural Economics

Table 3. Thai rice markets by countries of destination for white rice and parboiled rice, 2017

Country of destination	White rice		Country of destination	Parboiled rice	
	(Ton)	(Mill. Baht)		(Ton)	(Mill. Baht)
China	606,358	7,493	**Benin**	1,314,492	17,165
Benin	478,572	5,624	**Republic of South**	736,666	9,888
Mozambique	444,343	5,367	**Bangladesh**	537,209	6,914
Cameroon	450,989	5,167	**Cameroon**	251,988	3,347
Angola	389,656	5,109	**Yemen Republic**	146,210	1,928
Japan	335,812	4,167	**Soviet (Russian)**	39,079	536
Philippines	278,485	3,451	**Algeria**	36,178	474
Malaysia	254,834	3,221	**Niger**	30,331	405
Kenya	170,777	2,176	**United Arab**	27,831	389
Iran	143,123	1,881	**Spain**	21,747	353
Others	1,497,097	19,111	**Others**	231,454	3,229
Total	**5,050,047**	**62,766**	**Total**	**3,373,184**	**44,629**
		(5,817 Mill. US$)			**(1,488 Mill. US$)**

Source: Office of Agricultural Economics

Table 4. Thai rice markets by countries of destination for hommali rice (fragrant rice) and glutinous rice, 2017

Country of destination	Hommali rice (Fragrant rice)		Country of destination	Glutinous rice	
	(Ton)	(Mill. Baht)		(Ton)	(Mill. Baht)
USA	457,234	12,224	**China**	249,566	4,040
China	301,822	7,109	**Indonesia**	102,775	1,719
Hong Kong	180,532	4,796	**USA**	19,244	547
Ivory Coast	266,890	3,594	**Malaysia**	17,256	326
Iran	120,313	2,463	**Belgium**	20,955	317
Canada	80,350	2,161	**Vietnam**	11,664	229
Singapore	66,666	1,943	**Laos**	11,650	202
Senegal	151,175	1,906	**Japanese**	8,674	177
Ghana	82,665	1,675	**Philippines**	9,130	162
Australia	44,725	1,255	**Taiwan**	8,512	161
Others	546,890	12,112	**Others**	55,314	1,077
Total	**2,299,262**	**51,237**	**Total**	**514,740**	**8,956**
		(1,708 Mill. US$)			**(298 Mill. US$)**

Source: Office of Agricultural Economics

Table 5. Thai rice markets by countries of destination for Pathumthani rice (Fragrant rice) and Colored rice, 2017

Country of destination	Pathumthani rice		Country of destination	Colored rice	
	(Ton)	(Mill. Baht)		(Ton)	(Mill. Baht)
Ivory Coast	99,019	1,241	**USA**	2,309	116
China	41,372	678	**Hong Kong**	1,636	61
Singapore	25,716	593	**Singapore**	1,553	55
Hong Kong	25,059	502	**Italy**	1,386	54
Senegal	37,783	473	**China**	618	32
Ghana	21,589	412	**Australia**	496	29

USA	12,469	284	**Canada**	485	23
Israel	12,108	270	**Netherlands**	398	21
Netherlands	11,483	220	**Malaysia**	634	19
Taiwan	8,390	150	**France**	475	19
Others	83,978	1,576	**Others**	2,093	82
Total	**378,965**	**6,399**	**Total**	**12,082**	**510**
		(213 Mill. US$)			**(17 Mill. US$)**

Source: Office of Agricultural Economics

Table 6. FOB Prices of rice of major exporting countries for white rice (5%), 2012 – 2017

Year	Thailand	India	Margin	Vietnam	Margin
2012	575	434	141	432	143
2013	517	427	90	362	155
2014	423	420	3	415	8
2015	386	374	12	358	28
2016	397	368	29	359	38
2017	398	389	9	373	25

Source : Thai Rice Exporters Association

Thai rice farmers

Although rice farming in Thailand is a major occupation and occupied about 50 % of the agricultural land, most farmers are still considered as small scale farmers in terms of farm size. About 70 % of the rice farmers have rice planted area less than 20 rais or 3.2 hectares (Fig. 3).

Regarding the age of the head of rice farms, it revealed that about 33 % of rice farmers are above 60 years with an average age of 56 years (Fig. 4) Most of rice farm households have 4 family members with the average members of 4.5 persons per household (Fig. 5). As for the education level, about 80 % of the head of rice farms have finished their education up to primary school only.

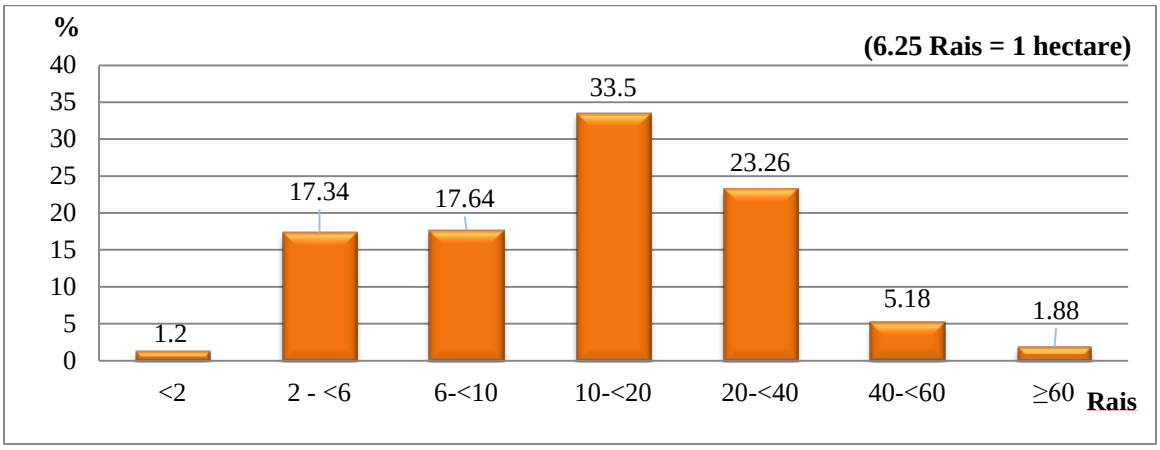

Fig. 3. Percentage of farms by size of rice planted area, 2014/15

Source : Office of Agricultural Economics

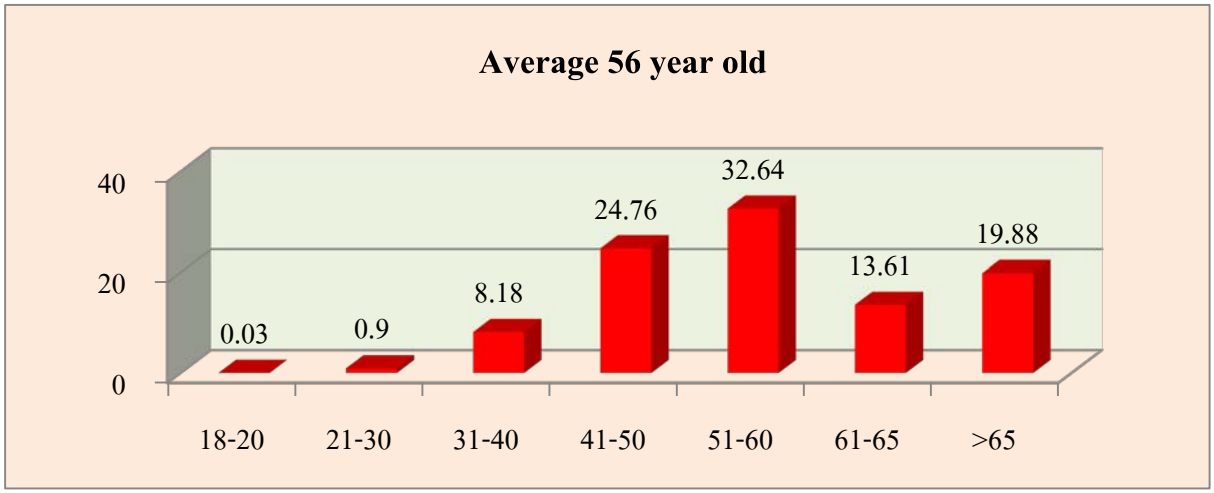

Fig. 4. Age Distribution of rice farm household head, 2011/12

Source : Socio-economic Survey of Rice Farmers, 2011/12, Agricultural Research Development Agency

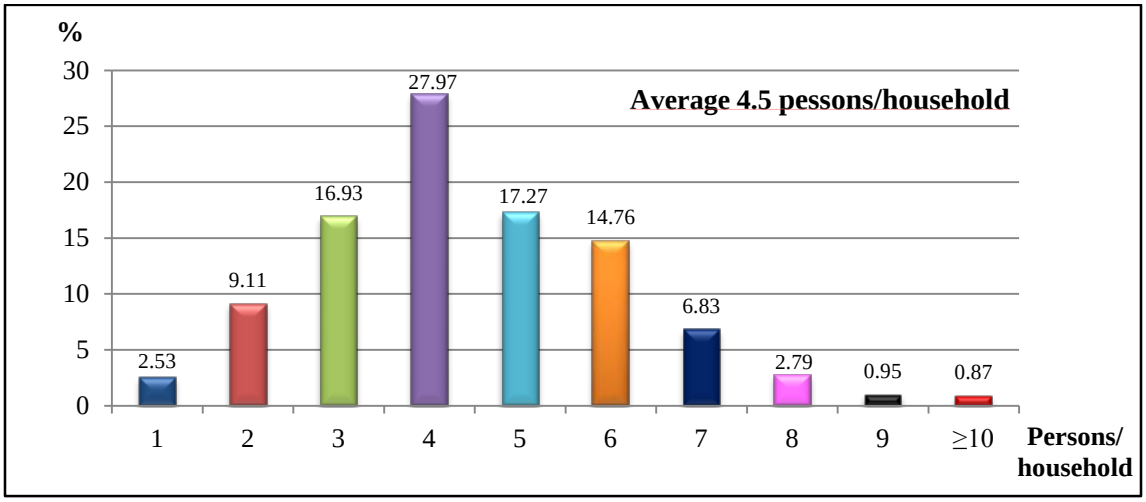

Fig. 5. Family members of rice farm households, 2011/12

Source : Socio-economic Survey of Rice Farmers, 2011/12, Agricultural Research Development Agency

Rice farming system in Thailand

There are four rice ecosystems in Thailand. The rainfed lowland is the largest area which constitutes about 72 % of the total paddy field and mainly located in the northeastern region. The second ecosystem is the irrigated lowland with a share about 20 % of the total paddy area and mostly located in the central plain. The other two ecosystems are deep water and upland rice with a share about 5 % and 3 %, respectively. The irrigated planted areas are varied from one region to the others with the average of about 25 % of the total rice planted area in the country. The highest percentage is in the central region, which have irrigated areas of about 70 %. The lowest irrigated area is in the northeastern region, the major rice producing region, which has an irrigated area of only about 10 % (Fig. 6). This is one of the reasons that make the national average of rice yield in Thailand to be very low. The other reason is that most of the varieties planted are

the native variety which generally have very low yield. However, these varieties are very good in quality such as Hommali, RD15 and RD6 (Glutinous rice) which are all fragrant rice.

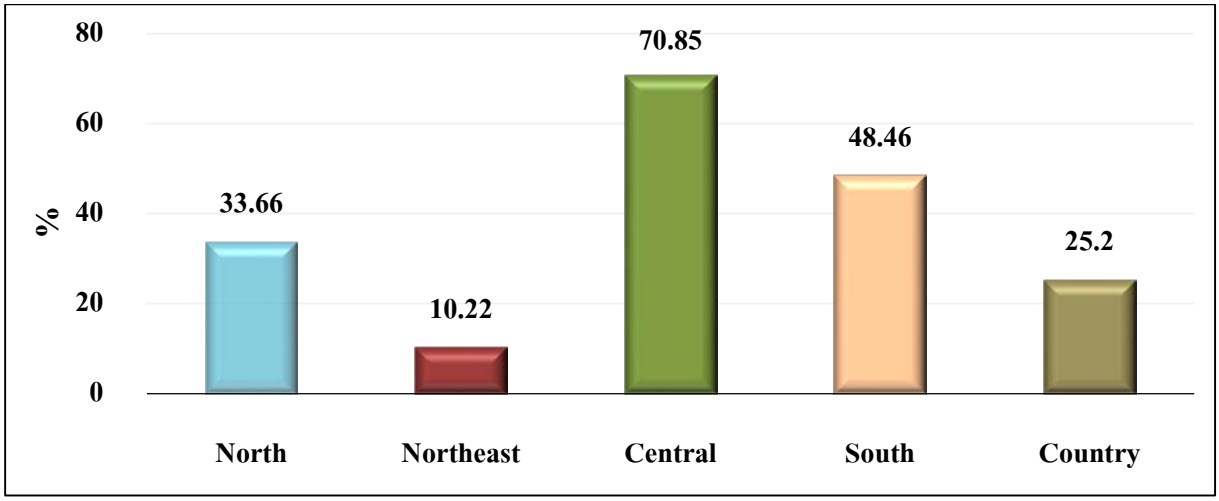

Fig. 6. Percentage of irrigated rice planted area by region, 2014/15
Source: Office of Agricultural Economics (OAE)

Typically, there are two main seasons for rice growing in the country, wet season rice and dry season rice. For the purpose of statistical data collection to avoid double counts, the definitions of wet and dry season rice as defined by OAE are given as follows:

Wet – season rice which is sometimes called major rice refers to the rice grown during the wet season which is May to October except in the eastern coast provinces of the southern region, namely, Nakhon Si Thammarat, Phatthalung, Songkhla, Pattani, Yala and Narathiwat where the wet – season rice is grown during 16 June to 28 February of the following year.

Dry – season rice which is sometimes called second rice refers to the rice grown duiring the dry season which is some time between November and April of the following year except in the above 6 provinces which the dry – season rice is grown during 1 March to 15 June. Most of the second rice areas are in the irrigated area in the central plain.

However, the actual rice season can be varied from year to year depending on the weather condition. In irrigated areas, there is no specific season and farmers may grow rice as many as 3 times a year or 5 times in 2 years.

Rice supply chain in Thailand

In general, rice trade in Thailand is a free market system with many buyers and sellers. However, during the 2011 – 2013 period the free market system has collapsed due to the change in government policy by adopting rice pledging scheme which offered very high mortgage prices compared to the market prices. Thus, most of the paddy produced are channeled to the government pledging scheme. The rice mills could not operate efficiently and many of them became storage of the rice stock of the government. The agricultural cooperatives could not collect the paddy from its numbers to carry out their business.

There are four major stages along the rice supply chain in Thailand which include input acquiring, production, paddy distribution and milled rice distribution. The important inputs used in rice production are seeds, fertilizers and chemicals (insecticides and herbicides). For seeds, most farmers obtained seeds from seed dealers in the local areas.

However, some farmers use their own seeds produced by themselves on farms. The use of their own seeds which is now very limited due to the change in harvesting method from manual to combine machine. Community Rice Centers (CRC) which produced seeds for farmers by farmers are also another seed providers in the community. For fertilizers and chemicals, most farmers buy from local dealers which sometimes also give some technical advice and credit to their customers.

Right after harvest, farmers may sell their paddies to the local assemblers or sometimes mobile (*ad hoc*) assemblers which usually come from other provinces during the peak of the harvesting period. Some farmers may sell it directly to the rice mills in the nearby areas. This is because most of the rice farmers have no drying facilities and no storage. However, some famers may keep some of their paddies for household consumption and for seeds in the next season. The paddies that the farmers kept for household consumption will be milled by small rice mills in the village when it is needed.

After the paddy is milled, most of the millers sell their milled rice to rice exporters through rice brokers. Generally, the big buyers such as exporters and wholesalers will ask the broker to collect milled rice which specify the quantity and the quality (grade) of rice for them. Besides collecting rice, the brokers will also provide credit to buyers by advancing some or all of the amount of money required to buy rice from the millers. In return, brokers will receive a commission about 0.6 – 0.75 % from buyers for their services. For some millers, which have full facilities such as color sorter and packaging machines, they may sell rice directly to buyers such as wholesalers, exporters and oversea importers.

For the domestic market, the milled rice is usually distributed via the wholesalers who bought rice from rice millers and sell it to the retailers around the country and to the modern trade stores or supermarkets as a small rice pack (mainly 5 kg/pack). Some of the milled rice are sold to the rice processing industries for further processing activities to make food and non-food products and sell it in both domestic and oversea markets. However, the secondary or sophisticated rice products are still produced in limited amount compared to the primary products such as regular milled rice. The current rice supply chain in Thailand is shown in Fig. 7.

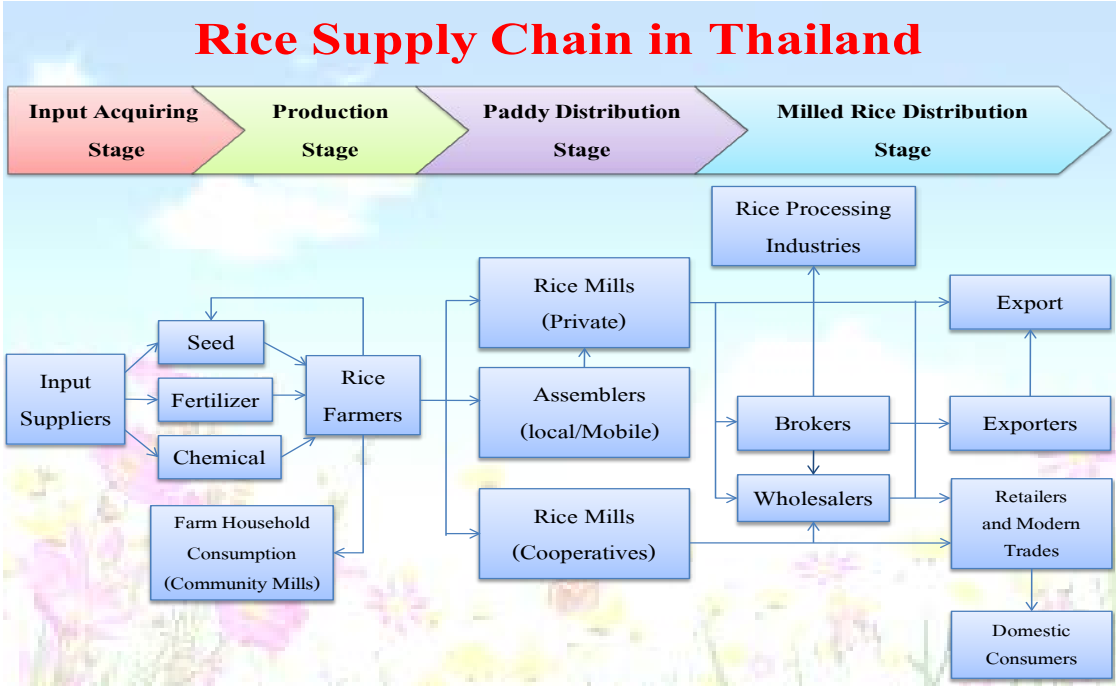

Fig. 7. Rice supply chain in Thailand

The market structure and flow of rice in Thailand is very dynamic because of the many changes in government policies such as change from income warrantee scheme to pledging scheme due to the change in political party which controlled the government administration. The paddy central markets are no longer in existence and the future market is not anymore active in the trading of rice.

CURRENT AGRICULTURAL POLICES OF MOAC

The current policies of the Ministry of Agricultural and Cooperatives (MOAC) that are related to the high value products development can be summarized as follows.

Production policies

1) Establish the restructuring plan in order to reduce the over production to match with the demand.

   For rice crop, the existing growing areas are classified into two major zones, suitable areas and unsuitable areas. For suitable areas, improvement of efficiency of production and quality of the products will be emphasized. Moreover, the second rice have to be reduced and changed to other cash crops or green manure crops or left idle during the dry season. For unsuitable area, mixed farming or change to other activities will be promoted by providing the farmers with some incentives.
2) Reduce cost of production and improve quality of products.
   The appropriate technologies will be transferred to the rice farmers extensively. The good agricultural practices (GAPs) for rice farming are encouraged and certified.
3) Promote value-added products.
   The training courses and equipment and other incentives will be provided. The government supports include packaging equipment and branding development.

Marketing policies

1) The market driven strategy will be emphasized.
   Production target will be set up to match with the demand before planting time.
2) Promote business matching and e – market platforms establishment.
   These activities include establishing farmers' markets in the rural communities, facilitating in price negotiation with the local millers as well as organizing the training courses on how to develop e-market platforms.
3) Promote niche market products.
   Rice for niche markets include organic rice, geographical indication (GI) rice, nutritious rice, colored rice, native varieties rice and rice for food processing industry.

Targets

1) All products have to be safety products in 2022.
2) 60 % of all products are organic products in 2027.

Approach

1) The area – based extension approach will be adopted to implement the above policies.
   The paddy fields of each small farmer in the neighborhood are consolidated to make it look similar to a large farm while the ownership remains unchanged. The objectives of the area-based extension system are to make the promoting target areas to achieve economy of scale in order to increase the bargaining power of farmers. Thus, the cost of production for each small farmer in the area will be reduced while the price received by the farmers will be

increased. In doing so, it is also very convenient for government officials to transfer site specific technology to the farmers in the areas and assist them in linking with the buyers. In addition, the area – based approach will facilitate the integration of work among different departments to further improve the efficiency and productivity of rice farming. The farmers' organization for farmers in the particular large farm will be set up, it's not yet existing, and the farm manager will be appointed to operate each big farm.

2) Local leaning center for each commodity will be established and strengthened.

The best practice farm in each district will be selected to be a local learning center for farmers in each commodity which include rice crop.

CONCLUSION AND RECOMMENDATION

Thai rice is very important nationally and globally. It is a major source of export earning for the country and a major source of rice supply to feed the world. However, Thai rice farmers are still very poor compared to other occupations in the agricultural sector. Most of them are small farmers and are very old. It is very clear that the government wanted to promote high value products for export instead of primary products such as milled rice as usual to avoid competition from other exporting countries. In practice, however, the action taken by the government to further development and enhancing the secondary products business is very limited especially for small farmers and startup business. More researches and investments by the government in the field of value – added product development are needed. Furthermore, the farmers' organizations and its network should also be established and strengthened especially in developing and operating high value products business. Agro – tourism should also be promoted for people as consumers to visit rice farms and observe rice cultural practices and value – added activities under the concept "Know producer, Know quality".

EVALUATION OF POLICY PERFORMANCE AND PROFIT EFFICIENCY OF RICE PRODUCTION AND MARKETING AREAS IN TAIWAN

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ABSTRACT

Under the requirements of the AMS reduction and competitiveness improvement in the rice sector, the government has been implementing the Rice Production and Marketing Areas (RPMA) program in Taiwan since 2005. It rewarded operation units with price that is higher than the guaranteed price of government through making contact with rice farmers, and to run a business model by integrated value chain. The purposes of this study are to evaluate the policy performance in terms of government expenditure and farmers' income, and estimate profit efficiency of operation unit in the RPMA program. It found that the program of the government's purchasing paddy reduction and expenditure savings has some effects. Farmers' income would be extra increased from participating in the program. Besides, profit efficiency of operation units which participated in the program is also higher compared to than non-RPMA. It revealed that the core strategy for the RPMA program is to enhance rice value-added.

Keywords: rice, price support, profit efficiency, metafrontier model

INTRODUCTION

Rice is the most important industry in the agricultural sector in Taiwan, and it is also an industry that invests the most resources and government expenditures. However, thr government purchases rice at a guaranteed price that distorts market mechanism, reduces efficiency of resource allocation, and causes a heavy financial burden on the government. At the same time, it also faces pressure from the WTO to reduce AMS. Therefore, the government started to implement the "Rice Production and Marketing Area"(RPMA) program in 2005, hoping to reduce the government's purchase expenditure and AMS through reward payment for grain merchants to encourage making production contract with rice farmers. The RPMA program is accompanied by the common production operations and marketing activities and it can ensure the quality of domestic rice and establish its own brand. It is expected to benefit to the rice industry in terms of upgrading quality standards and competiveness.

The purpose of this paper is to evaluate the RPMA program performance in terms of government expenditure, farmer' revenue and profit efficiency of grain merchants, so as to provide a reference basis for rice industry development and policy reforms in Taiwan. The rest of the paper is organized as follows. The next section briefly describes the features and current situation of RPMA. Section 3 evaluates RPMA by rice policy review and its influence on government's purchasing quantity and expenditures and farmers' revenue. Section 4, on the other hand, focuses on profit efficiency estimation and its determinations for grain merchants who participated in the RPMA program. Finally, the last section is the conclusion and outlook for the RPMA program.

I. Rice Production and Marketing Area (RPMA)

1.1 Features

In order to avoid the impact from importing rice in the domestic rice industry Taiwan has the joined World Trade Organization in 2002 and emphasized domestic rice production with its own brand that symbolizes good quality. The government has been trying to do rice industry adjustment since 2005. The promotion of the RPMA program is one of the adjustment strategies. Government encourages Farmers' Associations and grain merchants as operation unit to coordinate with local rice farmers, nursery operators and millers to establish a RPMA which at least 50 hectares. It is expected to have advantages in in terms of the RPMA's production integration and economic scale.

The most important thing is that operation units have to make contract with participating farmers at higher price compared to the guaranteed price of government purchases. It could raise farmers' income and reduce government purchasing rice and expenditure. On the other hand, operation units can get reward payment from the government to implement the RPMA program to support higher price under contract and related spending on production integration, farmers' education and product marketing.

Although there are multiple meanings for rice farmers, the government, grain merchants and even consumers, the final target of the RPMA program is to enhance competitiveness and value-added for rice industry in Taiwan.

1.2 Implementation

The RPMA program has been in operation since 2005. It started with 27 operation units which included Farmers' Associations and grain merchants with 4,908 hectares total, then increasing to 63 operation units with a total of 23,292 hectares as shown in Table 1. Because of affording payment at higher contract price to participating farmers, the number of operation units failed to increase as expected. It still less than 7% in terms of total rice plant hectares. Fortunately, the number of operation units and participating hectares had significantly increased in the past two years.

Table 1. Implementation of the RPMA program during 2005-2017

Year	Participated area	Participated farmers	Reward payment	Contract price	Guaranteed price	Production
Unit	Hectares	People	NTD 10 thousand	NTD/KG	NTD/KG	MT
2005	4,908	2,301	3,873	22.37	19.88	26,863
2006	8,023	2,915	5,626	23.14	19.88	40,490
2007	10,480	4,828	4,854	22.79	19.88	57,582
2008	9,897	6,731	4,513	23.72	19.88	56,994
2009	10,487	4,170	4,859	23.67	21.88	59,881
2010	13,978	4,911	6,653	23.83	21.88	80,299
2011	14,356	5,329	6,838	26.53	21.88	90,913

2012	14,556	4,281	8,676	25.26	24.91	93,698
2013	15,103	4,555	8,465	26.21	24.91	79,471
2014	15,721	4,304	11,335	26.64	24.91	92,797
2015	16,451	5,180	7,159	26.40	24.91	98,943
2016	19,503	7,668	8,601	26.73	24.91	95,547
2017	23,292	12,974	12,778	25.05	24.91	136,049

Source: Agriculture and Food Agency, Council of Agriculture.

Basically, the reward payment provided by the government is a key factor to attract Farmers' Associations and grain merchants to participate in the RPMA program. The correlation coefficient is 0.86 between reward payment and participated hectares. The government could have a balance consideration on the reward payment and purchasing expenditure saving to decide whether to increase reward payment for expansion and exclusion of the participated hectares.

The operation units could be Farmers' Association and grain merchant with different business culture and objectives. There were 21 Farmers' Associations and grain merchants and 42 grain merchants who participated in the RPMA program in 2017. Under the consideration of market size and capital stock, Farmers' Association and grain merchants sell milled rice mainly and partly from what it purchased paddy rice from the RPMA, respectively.

Table 2 indicates that average contract price of Farmers' Association is 27.13 NTD/Kg, which is higher than grain merchants, 25.28 NTD/Kg. It reveals that Farmers' Association has been supporting farmers' income instead of just searching for profit maximization. The average participated area for Farmers' Association is 289 hectares, which is smaller than grain merchants, 413 hectares. It would affect benefit of economic scale. The average scale for each participated farmers' of Farmers' Association is 1.62 hectares, which is lower than grain merchants, 1.86 hectares, as well.

Table 2. Current situation of the RPMA program in 2017

	Number	Participated area		Production		Participated farmers	Reward payment	Contract price	Participated area	Farmerspated a
	Unit	Hectares	%	MT	%	People	NTD thousand	NTD/KG	Unit	Hectares
Farmers' Association	21	6,070	26	36,055	27	3,739	29,010	27.13	289	1.62
Grain Merchant	42	17,337	74	100,660	74	9,342	99,350	25.28	413	1.86
Total	63	23,292	100	136,049	100	12,974	127,780	25.98	370	1.80
North	12	1,362	6	7,571	6	652	13,890	25.27	113	2.09
Central	22	6,299	27	40,397	30	5,576	51,260	23.08	286	1.13
South	8	2,100	9	14,718	11	1,209	7,690	24.46	263	1.74
East	21	13,531	58	73,363	54	5,537	54,940	25.49	644	2.44

Source: Agriculture and Food Agency, Council of Agriculture.

The RPMA program is a kind of contract farming which is based on mutual benefit for farmers and operation units participation. It has been in existence for many years as a means of organizing the commercial agricultural production of both large-scale and small-scale farmers. Eaton and Shephered (2001) pointed out contract farming is beneficial to farmers' price risk that is often reduced as many contracts specify prices in advance and can open up new markets which would otherwise be unavailable to small farmers. Operation units also gained more consistent quality and quantity which can be obtained than if purchases were made in the open market. There are more than 70% of operation units using brand that is endorsed by the RPMA program to increase rice price and competitiveness (Chen and Yang, 2007).

Since there are different production condition in Taiwan, there is only one crop season in the Northern part that is different from other parts with two crop seasons. Western farmers have been searching for quantity increase, unlike eastern farmers who emphasize quality improvement. Therefore, for regional distribution of participating in the RPMA program, the East part participate most, 58%, and contract price, 25.49 NT/Kg, which is also higher than other parts.

II. Policy evaluation

Rice industry and policy

Rice is staple food and the most important crop in Taiwan. Harvested area is 273,837 hectares, where first crop is 168,872 hectares and second crop is 104,965 hectares in 2017. Production quantity in terms of paddy rice is 1,587,776 MT.

For ensuring food security and raising farmers' income, government has been implementing policy of purchasing paddy rice at guaranteed price which is higher than market price. The purchasing system is made up of three layers: planned purchase, guidance purchase and surplus purchase with different guaranteed price and quantities. The weighted average guaranteed price is 24.91 NT/Kg, which is higher than farm gate price 23.91 NT/Kg, as shown in Table 3. Government purchased paddy rice for 312,033 MT, which accounted for nearly 20% of total production in 2017.

Theoretically, quantity purchased by government depends on guaranteed price and price difference between guaranteed price and farm gate price. In the past, government raised guaranteed price several times to raise farmers' income. It also stimulated rice plant area and production expansion which resulted in the problem of much purchasing quantity and excess inventory. In 2011, government raised guaranteed price by 3 NT/KG. It brought about significant jumps in purchasing quantity 406,223 MT and expenditure over 10 billion NTD in 2013.

Although there were many contributions on food security and farmers' income, there have also been many criticisms always on the policy of purchasing paddy rice at guaranteed price, including market mechanism distortion, government financial burden, resources allocation inefficiency and crops production imbalance, etc. However, due to political consideration, it is hard to terminate the policy. The reason for promoting the RPMA program is trying to partially substitute purchasing paddy rice at guaranteed price and solve some related problems.

Table 3. Government paddy purchase price and quantity

Year	Harvested area	Production	Quantity	Expenditure	Purchased price	Farm gate price
	Hectares	MT	MT	NTD thousand	NT/KG	NT/KG
2004	237,015	1,433,610	259,386	5,255,997	19.88	18.70
2005	269,023	1,467,138	207,230	4,232,397	19.88	19.49

2006	263,188	1,558,048	245,414	5,065,428	19.88	18.93
2007	260,116	1,363,458	215,246	4,390,569	19.88	18.38
2008	252,292	1,457,175	204,793	4,584,728	21.88	21.87
2009	254,590	1,578,169	182,452	4,171,559	21.88	22.12
2010	243,862	1,451,011	190,453	4,327,709	21.88	20.77
2011	254,255	1,666,273	345,400	8,678,807	24.91	21.60
2012	260,762	1,700,229	375,438	9,425,589	24.91	23.10
2013	270,165	1,589,564	406,223	10,192,801	24.91	22.17
2014	271,051	1,732,210	367,124	9,218,938	24.91	24.03
2015	251,861	1,581,732	294,686	7,403,341	24.91	23.08
2016	273,837	1,587,776	312,033	7,819,173	24.91	23.91

Source: Agriculture and Food Agency, Council of Agriculture (2017), Taiwan Food Statistics Book.

Policy evaluation on the RPMA program

Since emphasizing on quantity increase rather than quality improvement under oriented by the policy of purchasing paddy rice at guaranteed price in Taiwan, the government continually promotes a series of rice industry adjustments, which includes the RPMA program. Based on experiences of farmers who participated in the planned purchase and guidance purchase, the estimated reduction of the government's purchasing paddy rice was 46,584 MT with expenditure saving 1.1 billion in 2017 as shown in Table 4. Compared with reward payment 0.12 billion. The government benefitted from a net expenditure savings of about 1 billion NTD.

Besides, farmers' income would be extra increased from contract price, which is higher than government's guaranteed price, by at least 0.1billin total. For instance, farmers' income increased by 0.145 billion NTD total in 2017; in other words, each farmer's income increased by 11,178 NTD average, or each hectare increased by 6,227 NTD average.

Table 4. Policy benefit of the RPMA program

Year	Participated area	Equivalent of government purchase	Expenditure saving	Reward payment	Increase farmersasethe r		
					Total	Per hectare	Per farmer
	Hectare	MT	NTD thousand	NTD thousand	NTD thousand	NTD/Hectare	NTD/Farmer
2005	4,908	9,541	191,539	38,730	66,969	13,644	29,104
2006	8,023	15,597	313,105	56,260	132,040	16,457	45,297
2007	10,480	20,373	408,981	48,540	167,527	15,985	34,701
2008	9,897	19,239	424,695	45,130	219,006	22,129	32,537
2009	10,487	20,387	450,028	48,590	107,039	10,207	25,669
2010	13,978	27,172	599,816	66,530	156,411	11,190	31,849
2011	14,356	28,712	699,792	68,380	423,089	29,470	79,394
2012	14,556	29,112	709,520	86,760	33,027	2,269	7,715
2013	15,103	30,206	736,186	84,650	102,999	6,820	22,612
2014	15,721	31,442	766,324	113,350	160,823	10,230	37,366
2015	16,451	32,901	801,876	71,590	147,330	8,956	28,442
2016	19,503	39,005	950,651	86,010	174,300	8,937	22,731
2017	23,292	46,584	1,135,352	127,780	145,029	6,227	11,178

Note: Experience of participation rate of planned purchase and guidance purchase is 80% and 60%, respectively. Policy requirement on 1st crop and 2nd crop of planned purchase is 2,000 KG and 1,500 KG, respectively, and on 1st crop and 2nd crop of guidance purchase is 1,200 KG and 800 KG, respectively,

Source: the author's estimation.

OPERATION PERFORAMNCE EVALUATION

Considerations of operation units

Participants of the RPMA program are government, farmers, operation units (i.e. Farmers' Association and grain merchants). In the above analysis, the program is beneficial to government's expenditure saving and raising of farmers' income. However, the key factor is operation unit participation. If operation units would improve their efficiency and profit, it is expected that more operation units would participate in the RPMA program in the future.

Contrast to production efficiency estimation used inputs and out data, this paper emphasizes profit efficiency estimation used cost and revenue data, which is consistent with operation units consideration about profit objective.

O'Donnell, Battese and Rao (2008) suggested application of Metafrontier model to estimate profit efficiency of operation units with different scale, area and business culture.

Model specification

Assume the form of profit function of operation units is random translog. We can build a profit Metafrontier function as follow (Battese et al., 2004; O'Donnell et al., 2008):

$$\ln \pi^* = \beta_0 + \sum_{i=1}^{3} \beta_i (\ln w_i^*) + \frac{1}{2} \sum_{i=1}^{3} \sum_{j=1}^{3} \beta_{ij} (\ln w_i^*)(\ln w_j^*) + \beta_4 (t) + \beta_5 (t^2)$$

$$+ \sum_{i=1}^{3} \beta_{6i} (\ln w_i^*)(t) + v - u$$

where $\pi$is operation unit's standardized profit deflated by milled rice sale price, W_1 , W_2 and W_3 are standardized paddy rice purchase price, process cost and salary, respectively. $\beta$are parameters. Error term consists of random error ($v_{it(j)}$) and profit inefficiency ($u_{it(j)}$), the former assumed to be normal distribution and the latter is actual profit for the *i* operation unit in *t* year which might deviate from optimal profit in the group j; i.e, it means profit inefficiency. It is assumed that $v_{it(j)}$ is independent of $u_{it(j)}$.

We will estimate profit efficiency step by step. Firstly, application of Stochastic Frontier Analysis (SFA) and Maximum Likelihood Estimation (MLE) to estimate profit efficiency of the *i* operation unit in group j. Secondly, constitute random profit function of each group as follow:

$$\pi_{it(j)} = f(P^y_{it(j)}, w_{it(j)}, t; \beta_{(j)})\, e^{v_{it(j)} - u_{it(j)}}$$

Where i=1,2,… N_j, t=1,2,…T, and j=1,2, …K represent different operation unit, time and group, respectively.

The purposes of random profit function are to estimate profit efficiency of the RPMA or not and its profit efficiency ratio. Thirdly, we then judge estimated profit efficiency difference by Likelihood ratio. If reject null hypothesis, it means there is different profit efficiency in participation of the RPMA program or not. Finally, application of GAUSS software suggested by Battese et al. (2004) incorporate estimated parameters of each group into linear programming (LP) and quadratic programming (QP) to estimate optimal parameter of profit Metafrontier as follow:

$$\pi^*_{it} = f(P^y_{it}, w_{it}, t; \beta^*) \equiv e^{f(P^y_{it}, w_{it})}$$

Where π_{it} is profit on Metafrontier. It represents potential profit for operation unit with opitimal resource allocation and as a basis for Metaprofit efficiency and Metaprofit ratio calculation.

Empirical results

Profit efficiency

Estimated parameters of operation units in the PRAM, non-PRAM and total are shown in appendix table A1. There are 8-9 estimated parameters are 10% significant, and 1% significant by likelihood ratio testing on total operation units. It means that there is significant difference among operation units. Therefore, it is inappropriate estimation by random profit function and should apply profit meta-frontier model for profit efficiency analysis.

We used LP and QP to estimate parameters in the profit meta-frontier model. Since both results are similarity, hereafter, we will only show empirical results by LP estimation.

Because of operation units purchased paddy rice mostly/partially from contract production under the RPMA program, we can divide them into RPMA and non-RPMA with different production and marketing mode. It is assumed both modes have different profit performance and group profit efficiency frontier. Then, there is a frontier that is an envelope in both groups' profit efficiency frontiers. The Group Profit Efficiency (GPE) is ratio of operation unit's actual profit to optimal profit on their group profit frontier. Table 5 shows that the GPE of operation unit in RPMA and non-RPMA is 0.9100 and 0.7242, respectively. In other words, operation unit used non-RPMA mode with lower profit efficiency. It should do something in both increasing price and lowering cost to shorten the distance to optimal profit.

Table 5. Total and group profit efficiency estimation and testing

Group	GPE	MPE	Testing	MPE/GPE	Testing
RPMA	0.9100	0.8065	RPMA>non-RPMA***	0.8863	RPMA>non-RPMA***
Non-RPMA	0.7242	0.5760		0.7954	
Total	0.8148	0.6913		0.8484	

Note:*, **, *** represent 10%、5%、1% significance.

Source: the author's estimation.

Since belonging to different group frontier, both group's GPE cannot directly make comparison. We consider Meta Profit Efficiency (MPE) which is able to incorporate all operation units together. MPE is ratio of operation unit's actual profit to potential profit on profit meta-frontier. The MPE is 0.6913 which means there is 30.87% of profit inefficiency to be improved. On the other hand, the MPE of operation unit in RPMA and non-RPMA is 0.8065 and 0.5760, respectively. Based on non-parametric Mann-Whitney testing, MPE in RPMA is significantly higher than in non-RPMA. Although contract price and processing cost are higher in RPMA than in non-RPMA, sale price is much higher in RPMA than in non-RPMA. The key factor is how to increase rice value-added. It could be a core strategy for developing the RPMA program in the future.

The MPE/GPE ratio also estimated for operation unit in RPMA and non-RPMA is 0.8863 and 0.7954, respectively. It indicates that Farmers' Association and grain merchant both participating in the RPMA program could significantly improve their profit performance.

Determinants of profit efficiency

For exploring determinants of profit efficiency, it is supposed to be relevant to number of rice species, brands, channels, and channel types. We specified Tobit regression equation as follow:

$$y_{it} = \alpha_0 + \sum_{k=1}^{N} \alpha_k x_{it} + \varepsilon_{it}, \quad i = 1,2,...n$$

Where y_{it} is a vector of GPE, MPE and GPE/MPE of *i* operation unit in *t* year, x_{it} is vector of rice species, brands, channels, and channel types, respectively. α_k are coefficients of relevant variables. $\varepsilon_{it} \sim N(0, \sigma^2)$ is error disturbance.

Regression results are shown in Table 6. We learned that variety of rice species, brand concentration and home delivery would enhance GPE of operation unit in the RPMA and non-RPMA program. In addition, variety of rice species and less brands of operation unit would improve its MPE and MPE/GPE. Those channels located in department stores, organic stores, and home delivery has better performance in terms of profit efficiency. We can conclude that the RPMA program not only emphasize business model innovation, but also has to consider rice species, focus branding and choice of channel type in order to achieve the core objective, profit maximization, of operation unit.

Table 6. Results of Tobin regression: determinants of GPE and MPE

	GPE				MPE		MPE/GPE	
	RPMA		Non-RPMA					
Constant	0.8614	***	0.7972	***	0.5361	***	0.6950	***
	(0.1224)		(0.1910)		(0.1552)		(0.2401)	
Rice species	0.0243	**	-0.0024		0.0612	*	0.0295	*
	(0.0096)		(0.0393)		(0.0320)		(0.0160)	
Brands	-0.0163	*	-0.0234	*	-0.0136	*	0.0339	
	(0.0092)		(0.0140)		(0.0072)		(0.0256)	
Channels	0.0068		0.0253	*	0.0135		0.0256	*
	(0.0055)		(0.0134)		(0.0105)		(0.0145)	
E-commerce	0.0430		0.0488		0.1536		0.0531	
	(0.0337)		(0.0371)		(0.1053)		(0.0474)	
Home delivery	0.0156	*	0.1177		0.1183	**	-0.0100	
	(0.0085)		(0.1071)		(0.0497)		(0.0361)	
Department stores & organic stores	-0.0217		-		0.0909	*	0.0195	*
	(0.0301)		-		(0.0493)		(0.0113)	

Note: Number in parenthesis is standard error. Dummy variables for e-commerce, home delivery, department stores & organic stores, respectively. *, **, *** represent 10%、5%、1% significance.

Source: the author's estimation.

CONCLUSIONS AND OUTLOOK

Rice industry is the most important industry in Taiwan's agricultural sector. The government has been spending a lot by purchasing rice at guaranteed price, which causes financial burden, market mechanism distortion and resources misallocation. Under requirements of AMS reduction and competitiveness improvement, the government began implementing the Rice Production and Marketing Areas (RPMA) program in 2005. It rewarded operation units to make contact with rice farmers at a higher price than the government's guaranteed price, and to run a business model by integrated value chain. The purposes of this study are to evaluate policy performance in terms of government expenditure and farmers' income, and estimate profit efficiency of operation unit in the RPMA program.

The RPMA program has been in operations since 2005. It started with 27 operation units which included Farmers' Associations and grain merchants and 4,908 hectares total, then increasing to 63 operation units with a total of 23,292 hectares total. Basically, the reward payment provided by the government is a key factor to attract Farmers' Associations and grain merchants to participate in the RPMA program. The correlation coefficient is 0.86 between reward payment and participated hectares. Government could have a balance consideration on reward payment and purchasing expenditure saving to decide whether to increase the reward payment for participated hectares expansion or not.

Regarding the policy evaluation on the RPMA program, it has achieved the objectives of government's purchasing paddy rice reduction. For example, we estimated reduction of government purchasing paddy rice at 46,584 MT and expenditure saving 1.1 billion in 2017. Government benefitted from a net expenditure saving of about 1 billion compared to 0.12 billion from reward payment. Besides, farmers' income would be extra increased from contract price, which is higher than government guaranteed price by at least 0.1billin total. For instance, farmers' income increased by 0.145 billion NTD total in 2017; in other words, each farmer's income increased by 11,178 NTD average, or each hectare increased by 6,227 NTD average.

Participants of the RPMA program are government, farmers, operation units (i.e. Farmers' Association and grain merchants). As analysis above, the program is beneficial to government's expenditure saving and farmers' income raising. However, the key factor is operation unit participation. If operation units would improve their efficiency and profit, it is expected that more operation units would participate in the RPMA program in the future.

We applied the Metafrontier model to estimate profit efficiency of operation units. Empirical results showed that the GPE of operation unit in RPMA and non-RPMA is 0.9100 and 0.7242, respectively. In other words, operation unit used non-RPMA mode with lower profit efficiency. It should do something in both increasing price and lowering cost to shorten the distance to optimal profit.

In addition, we consider Meta Profit Efficiency (MPE) which is able to incorporate all operation units together. MPE is ratio of operation unit's actual profit to potential profit on profit meta-frontier. The MPE is 0.6913 which means there is 30.87% of profit inefficiency to be improved. On the other hand, the MPE of operation unit in RPMA and non-RPMA is 0.8065 and 0.5760, respectively. Based on non-parametric Mann-Whitney testing, MPE in RPMA is significantly higher than in non-RPMA. Although contract price and processing cost are higher in RPMA than in non-RPMA, sale price is much higher in RPMA than in non-RPMA. The key factor is how to increase rice value-added. It could be a core strategy for developing the RPMA program in the future.

This paper made regression on profit inefficiency, it showed that variety of rice species, brand concentration and home delivery would enhance GPE of operation unit in the RPMA and non-RPMA program. Those channels located in department stores, organic stores, and home delivery have better performance in terms of profit efficiency. We can conclude that the RPMA program not only emphasize business model innovation, but also has to consider rice species, focus branding and choice of channel type in order to achieve the core objective, profit maximization, of operation unit.

The RPMA program has been running for 14 years in Taiwan. Participation of grain merchants, farmers, and areas has constantly grown. However, participated area is only 8.5% of rice plant area. Since the program has effects of government purchasing paddy rice reduction, government expenditure saving and farmers' income raise, government should actively encourage more grain merchants to participate in the program. Grain merchants will also improve its profit efficiency, build its own brand and have a better business performance after participating the program. We can say the RPMA program is a win-win-win program which is beneficial to government, farmers and grain merchants. Furthermore, products under the RPMA should be required by Taiwan Good Aquaculture Practice (TGPA), which ensures rice quality and safety. Actually, the RPMA program is also good for consumers.

From this year, the Taiwan government started implementing rice direct payment program, which is an alternative to government purchasing paddy at guaranteed price for farmers. This is if more rice farmers decide to take direct payment instead of selling to government at guaranteed price. The influence of government purchasing paddy at guaranteed price on purchased quantity and expenditure will decrease. We can expect that rice industry would move towards high quality and value-added development.

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APPENDIX

Table A1. Estimation results of parameters and its standard error

Variables	Random Frontier Model						Joint Frontier Model			
	PRAM		Non-PRAM		Total		LP		QP	
Constant	6.0732	*	23.8684	***	18.2067	*	10.5827	*	15.0356	*
	(3.3944)		(8.2383)		(10.6602)		(5.1192)		(8.6672)	
$\ln w_1^*$	-3.9960	*	-15.5183	***	-12.6414	*	0.7391		-4.0193	*
	(2.0770)		(2.6341)		(7.1014)		(0.5113)		(2.2774)	
$\ln w_2^*$	2.3520	**	18.4683	***	7.8930	**	2.3288	**	5.9905	*
	(1.0878)		(7.1364)		(3.1025)		(1.1497)		(3.3943)	
$\ln w_3^*$	-2.5534		-1.2243		-3.2902		6.6035		2.6947	
	(6.0026)		(8.7925)		(6.9321)		(5.9991)		(4.8674)	
$(\ln w_1^*)^2$	-4.3156	*	-50.8708	***	4.5998	*	-1.3954	*	-3.9270	**
	(2.4914)		(8.8913)		(2.7149)		(0.8115)		(1.7541)	
$(\ln w_2^*)^2$	2.3968	**	6.3253	**	2.2823	**	0.4937	*	0.9724	
	(1.0691)		(2.7292)		(0.9654)		(0.2791)		(3.0326)	
$(\ln w_3^*)^2$	-2.6917	*	-11.3352	**	1.3868		-0.5122		2.4104	
	(1.4433)		(5.0395)		(3.4017)		(3.8863)		(2.6092)	
$(\ln w_1^*)(\ln w_2^*)$	2.2731	**	6.1642	**	3.6531	***	-0.3429		-0.7123	
	(1.0511)		(3.0637)		(1.1958)		(5.4944)		(4.0355)	
$(\ln w_1^*)(\ln w_3^*)$	-1.2161		0.8242		-2.4031	*	8.5485	**	7.6072	***
	(2.8282)		(8.5154)		(1.2807)		(4.1708)		(1.7314)	
$(\ln w_2^*)(\ln w_3^*)$	-0.5740		-1.0751	*	-1.5023		0.4579		0.7269	
	(1.8030)		(0.6041)		(2.0630)		(3.7980)		(4.5771)	
t	0.3143		-0.3377		0.3459		0.4358		0.5230	
	(1.7016)		(1.1756)		(1.5068)		(2.7876)		(5.1850)	
t^2	-0.1451		0.1405		-0.0732		0.0812		-0.1894	*
	(0.5848)		(0.3699)		(0.5046)		(0.5087)		(0.1117)	
$(\ln w_1^*)t$	-1.0316	*	-1.4313	**	-1.0605	**	-1.1528	**	-1.2450	**
	(0.5896)		(0.7006)		(0.4498)		(0.5549)		(0.4600)	

$(\ln w_2^*)t$	0.0910	*	0.4081	**	0.2063	*	0.4002	*	0.7604	**
	(0.0510)		(0.2057)		(0.1035)		(0.2417)		(0.3631)	
$(\ln w_3^*)t$	-0.2523		0.0933		-0.0397		0.0746		-0.1342	
	(0.6719)		(0.5558)		(0.5476)		(0.7831)		(1.1355)	
Likelihood ratio	-104.987		-82.337		-224.119					

Note: number in parenthesis is standard error, and *, **, *** represent 10%、5%、1% significance. Standard errors in LP and QP are estimated by Booth-strapping method.

Source: the author's estimation.

RICE FARMING IN THE JAPAN'S MATURED MARKET:

OVERCOMING THE SHRINKING DOMESTIC DEMAND BY VALUE-ADDING AND EXPORT-ENHANCING STRATEGIES

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ABSTRACT

Rice and its farming have been culturally the backbone of Japan's society so far. However, Japan's rice farming is facing an unprecedented turning point, in which this role will seemingly be doomed to being weakened due to the shrinking domestic demand. The purpose of this paper is to clarify the background of this turning point and consider possible strategies in order to recover the profitability of rice farming. One of the feasible strategies is to promote exporting more rice and its processed and high valued products, Sake. Exporting rice as grain form has also a possibility to enhance rice production, however, to reduce the cost and to strengthen the competitiveness is necessary because its price elasticity in exporting destinations is more than one. On the other hand, the price elasticity of Sake is lower. Both products' income elasticities for exporting are so higher that export increase will be expected along with economic growth in destination countries.

JEL classification: Q11, Q13, Q17, Q18

Key words: nutritional improvement, westernization, rice export promotion

INTRODUCTION

Japan's rice farming is in a severe condition, in which the domestic consumption is shrinking. Even its typical value-added product, *i.e.*, Sake (alcohol beverage made from rice), the consumption of which is also declining. Such consumption shrinkings in rice and Sake have already been observed as per capita consumption. Moreover, from now on, it is predicted that these declining phenomena will be accelerated further by the population decrease.

Cultural and social westernization exists as a background for these consumption shrinkings. This westernization has intentionally been introduced by the government policy. In order to understand the severe situation in the rice and Sake markets, a review of the history of westernization of food life style in Japan is indispensable. In the next section, we review the history, then in section 3, we analyze the present situation, and finally explore strategies for the survival of Japan's rice farming in the future.

HISTORICAL BACKGROUND

Two times' westernization of foods and eating habits

Japan experienced two times' westernization of foods and eating habits including the government's intentional promotion.

In the 1860s, Japan started to modernize the country not only economically but also socially and culturally. To fulfill such an objective, the government had several policy measures, ranging from establishing steel-production factories to building a museum of a collection of western oil paintings. One of the polices in the field of social modernization was to promote eating beef instead of rice.

The government had been eager to introduce and disseminate western cultures. Eating beef was a typical example of the targets of westernization. Major newspapers also had raised slogans or published articles, saying that "eating beef" was a key step for Japan to catch up with western-modernized countries such as the Great Britain, France and Germany. The Japanese were and are still now Buddhists, and at that time, the Japanese were so pious Buddhists that most of them had a strong feeling of evasion against eating meats.

Despite the government efforts to promote western foods and eating habits, specifically eating beef instead of rice, people's daily food life had not changed significantly. Rather, since people could not have eaten rice sufficiently until 1870s, they had a desire to eat more rice. Actually, they usually had eaton barley[1] instead of rice. Therefore, after the modernization, along with economic growth, the rice consumption had increased dramatically.

Ironically, under the government promotion of western style foods and eating habits, rice consumption had increased drastically. Replacement of barley to rice caused this rice consumption increase. In the 1890s, Japan changed its position in the rice international trade from an exporting to an importing country.

The second opportunity to westernize Japanese foods and eating habits was during the 1950s, after Word War Ⅱ. At this time, the Japanese had an inferiority complex to Americans who boosted the campaign of westernization of foods and eating habits. In the last 1940s, the average life span of Japanese was 48, whereas Americans' was over 70. The average height of Japanese men adults was 157 cm., compared to the higher Americans, 178 cm[2].

The government campaign of westernization of foods and eating habits included the bi-partisan statement in the Parliament that Japanese should change traditional foods and eating habits with heavy dependence on rice to more westernized mode of eating by introducing milk and beef as replacements to rice and bread. Moreover, the so-called "kitchen cars" subsidized by the government visited around the country’s in rural areas to educate housewives to introduce western style dishes. Persons who educated the people recommended the eating of bread instead of rice. This government campaign of westernization on eating habits brought about a huge success.

Effects of westernization on eating habits in the long run

Specifically, one of the most effective ways to westernize eating habits was the school lunch westernization. Six times a week, every lunch, only bread had been provided as staple food, where rice had completely been excluded. This "no rice" school lunch continued from 1953 to 1975. This rule was clearly stipulated in the law, the School Lunch Act, enacted in 1954. This policy ended up reducing rice consumption dramatically, especially in the long run. The generation who did not eat rice at lunch soon had their families and raised children. In those homes, a limited number of rice dishes have been served.

Fig. 1 shows the trends of the consumption of bread compared to rice in households, not in school lunches. Even after the six days bread lunch system was introduced, its influence had not been explicit for almost 20 years. However,

[1] Barley can be raised both on upland fields and paddy, in which it is grown by double-cropping as a winter crop combined with rice in summer. Historically, such convenience made poor peasants' economy in rural life heavily depending upon barley.

[2] At present, the average life span of Japanese is far beyond that of Americans. That of Japanese men is 81 and women 87. The height of Japanese also improved to 172 cm as for men adults.

after that, when those generation was educated to eat bread in their daily lives and had their own families, the effect of such education was revealed gradually. Nowadays, expenditure to bread surpasses that to rice.

Of course, some elements of those westernization movement on eating habits should be appraised positively, especially intaking more amount of foods that contain rich protein, such as milk, eggs and meat. It must surely have contributed to longer Japanese average heights physically and prolong their life span with healthier life.

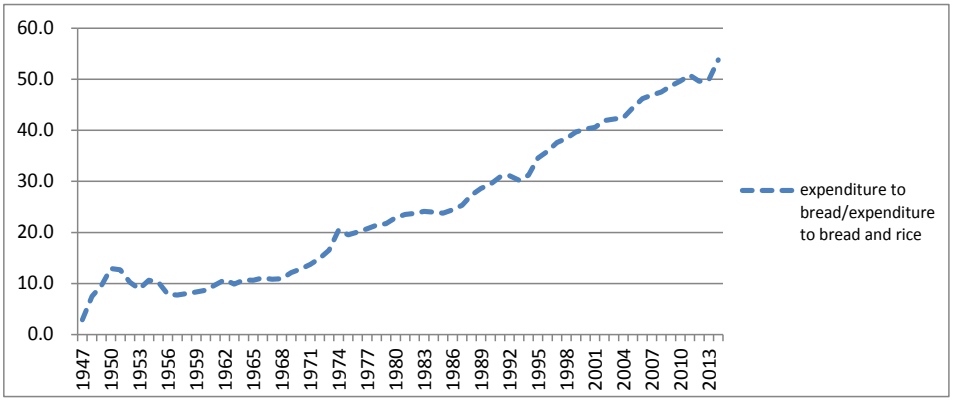

Fig. 1. Expenditure ratio of bread to rice + bread (%)

Source: The statistics for households consumption; The Statistics Bureau of Japan.

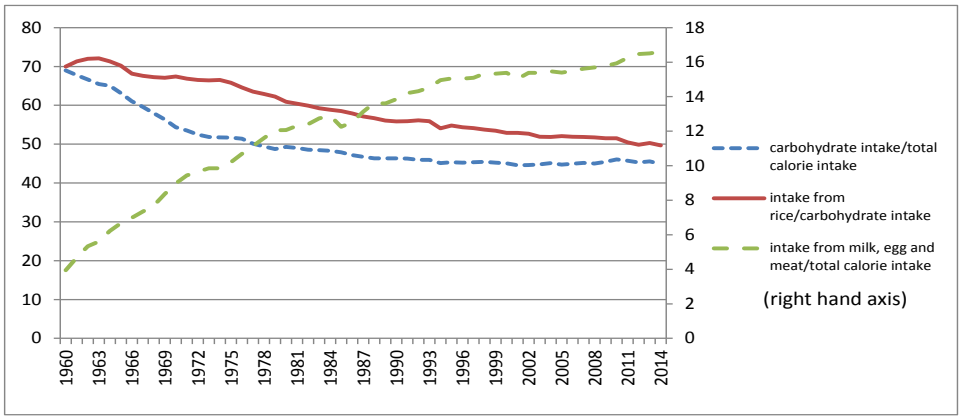

Fig. 2. Calorie intake ratio (%)

Source: Food demand and supply statistics tables; The Ministry of Agriculture of Japan.

Fig. 2 shows the tendency of calorie intake over the past 60 years. Within total calorie intake, the ratio of carbohydrate has been decreasing, while the ratio of calorie originated from meat, milk and eggs has been increasing. These changes have brought about positive effects to the poor protein food life in the rural areas in 1950s from a nutritional viewpoint[3].

[3] Recently, some experts say that this change went so excessively that the balance of foods intake is rather toward being unhealthier by too much meat eggs and milk.

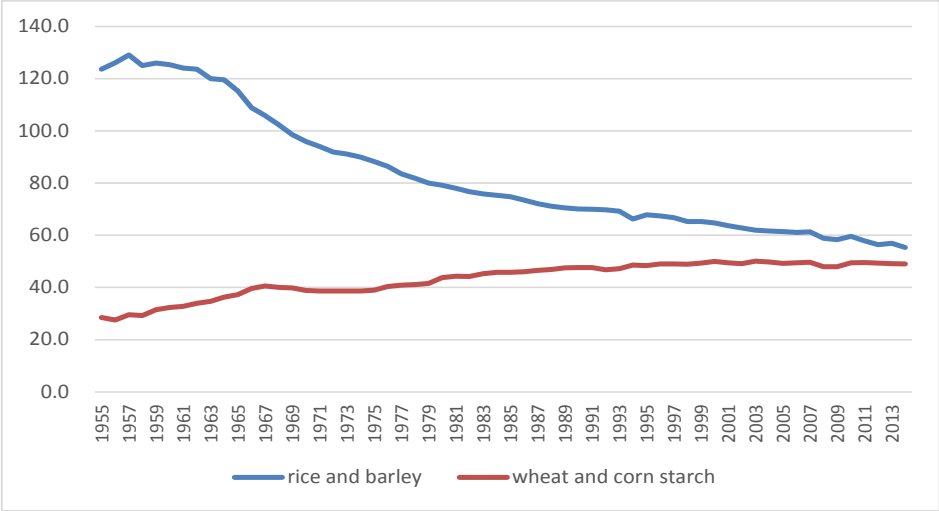

Fig. 3. carbohydrate consumption (kg/capita/year)

Source: The statistics for households consumption; The Statitics Bureau of Japan.

Fig. 3 also shows the effects of such westernization of foods and eating habits, specifically indicating the decline of rice consumption. The decreasing line shows the consumption of steamed rice and barley (recently 99% is rice) and the increasing line shows the consumption of wheat and other cereals consumed as powder form. It clearly shows that rice consumption became almost half during the past 60 years.

Rice policies faced with decreasing rice consumption

Due to shrinking consumption, Japan's rice policy over the past 50 years has principally been focusing on how to deal with overproduction problems. The acreage reduction has been established as the center of such a policy mix. Many developed countries were annoyed with overproduction issues in various crops and milk. Main causes of this problem were in the supply sides. By contrast, in the case of Japan, the main cause was demand side, that is, drastic and continuous rice consumption reduction.

Table 1. The history of rice policy

Period	Policy mix
1955-1969	two-tier price system alone *1965-1969: over production
1970-1994	two-tier price system with acreage control (mandate) *1980-1994: budget cutback and two prices became almost equal (approximately price support system)
1995-2000	acreage control plus subsidies
2000-2006	acreage control plus counter cyclical payments
2007-2009	acreage control plus counter cyclical payments and direct payments (limited to large farms)
2010-present	acreage control (voluntary) plus its compensation payment

Table 1 shows past policy measures that the government has adopted when it tackled this serious issue. In the 1960s, overproduction of rice was revealed and in 1970, the acreage reduction was introduced.

Present situation and key factors affecting the rice consumption decrease

Still, there are two negative factors that affect rice consumption's decline. One is the continually progressing of foods and eating habits westernization. The other is that the increase of fat intake may push out rice consumption within the limited calorie intake.

Continually progressing food culture's westernization

As mentioned before, the government policy to westernize Japan's foods and eating habits has succeeded. Ironically, however, it has succeeded in excess. Surely, the increase of protein-rich foods such as milk, eggs and meat are evaluated positively from the viewpoint of nutrition. However, the replacement of rice to bread has yielded a neutral effect on people's health. A serious side-effect is to culturally lose cuisines with Japanese tradition and to make farmers abandon their paddy fields.

In the 1960s, when the cultivated area for rice peaked 3.2 million hectares, rice consumption also reached the highest, 118 kg per capita. At present (2016), the cultivated area for rice is only 1.5 million hectares and the rice consumption is 55 kg per capita.

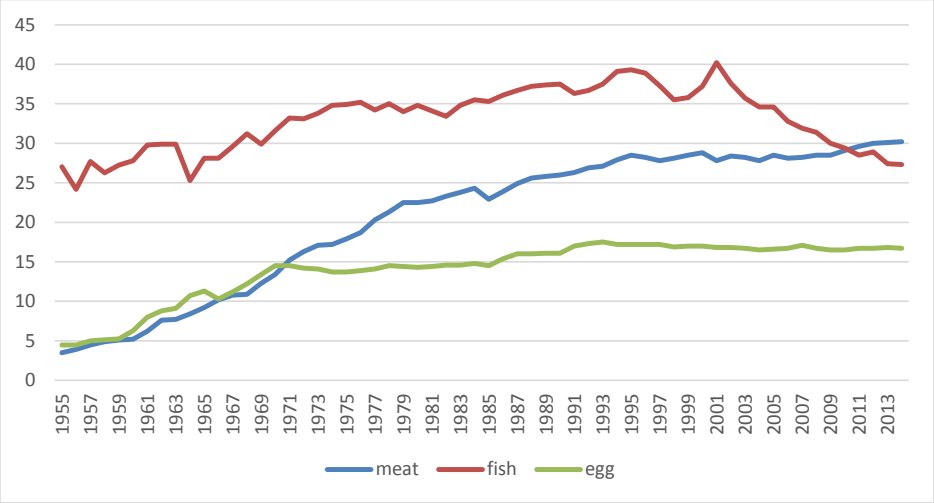

Fig. 4. Trends of fishes, meat and egg consumption (kg/capita/year)

Source: The statistics for households' consumption; The Statistics Bureau of Japan.

Fig. 4 suggests a pessimistic future for rice consumption. Rice is consumed with other foods which are harmonized with each other. For example, raw fishes are specifically harmonized with rice, not with bread. Beef steak can choose either one as a combination staple food. However, drinking milk as liquid is not necessarily fitting with eating steamed rice. From this viewpoint, recent dramatic reduction of fish consumption may provide a fairly pessimistic view for rice consumption in the future.

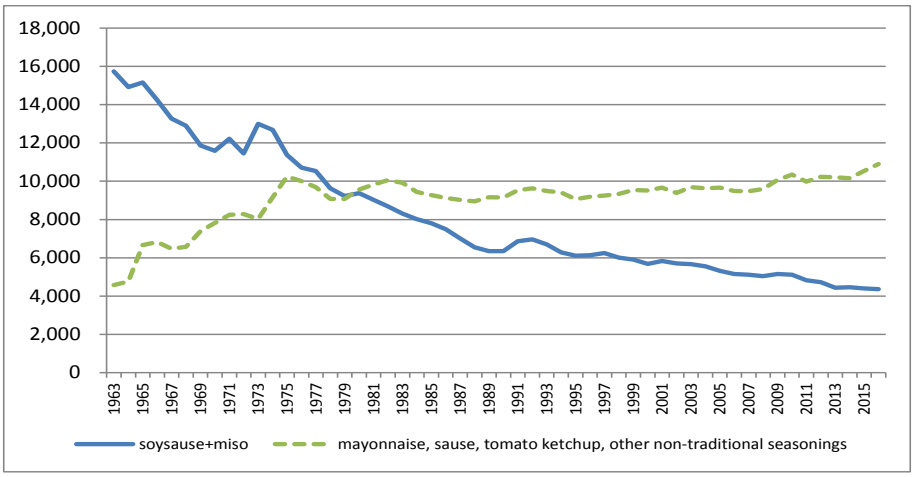

Fig. 5. Trends of seasonings consumption (yen/household/year)

Source: The statistics for households' consumption; The Statistics Bureau of Japan.

As considering the tendency of seasonings consumption, we must view the rice consumption in the future as not optimistic but pessimistic. This is depicted in Figure 5. Traditional Japanese seasonings such as *"shouyu"*, soy sauce, and *"miso"*, soy past, can well match with rice cuisines. Although younger generations have no hesitation to eat rice with mayonnaise, mayonnaise harmonizes with both rice and bread. Considering these combinations and the tendency shown in Figure 5, further shrinking of the rice consumption would be predicted.

Within limited amount of calorie intake, is rice pushed out by other foods?

Another negative factor that affects the rice consumption decrease is the increase of fat intake. This movement may push rice consumption to be more decreasing within limited calorie intake. In Japan, the obesity problem has still not become serious issue, however, people are aware of this issue. Currently, the obesity issue in other advanced countries, specifically in the U.S. is raising high concerns. The Japanese's total calorie intake has already been saturated. As shown in Figure 6, from 1970s to 1990s, fat intake has increased dramatically. As a result, there is no more room remaining to increaserice consumption, though sugar consumption is decreasing considerably. Rather too much westernization may bring about more fat intake. This may make rice consumption move backwards further more.

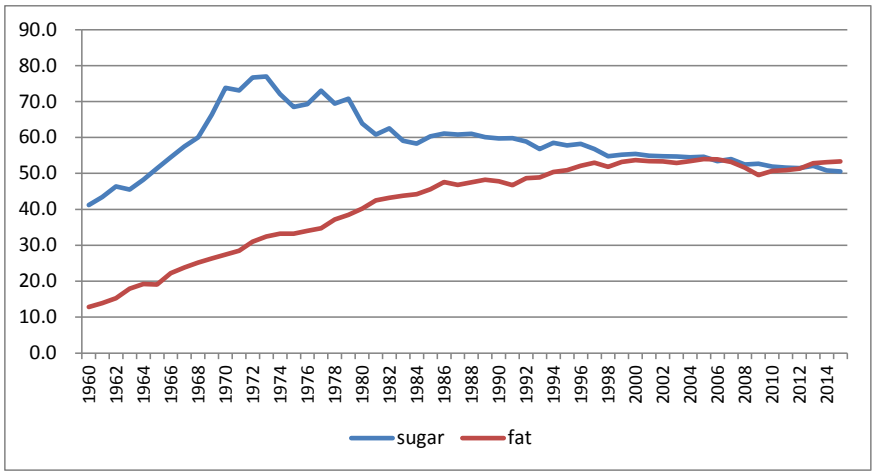

Fig. 6. Sugar and fat consumption (kg/capita/year)

Source: Food demand and supply statistics tables; The Ministry of Agriculture of Japan.

Still, Japanese food consumption and calorie intake may not become equal to those in western countries. Figure 7 shows that, in advanced countries, Japan's calorie intake has a unique position compared to other countries. When the economy develops, protein intake would increase and carbohydrate intake would decrease. However, there still exists uniqueness in every country's cultural tradition in food consumption. For example, Italy intakes higher calorie from carbohydrates. It is maybe due to its pasta tradition. On the other hand, the U.S. consumes more sugar and less other carbohydrate foods.

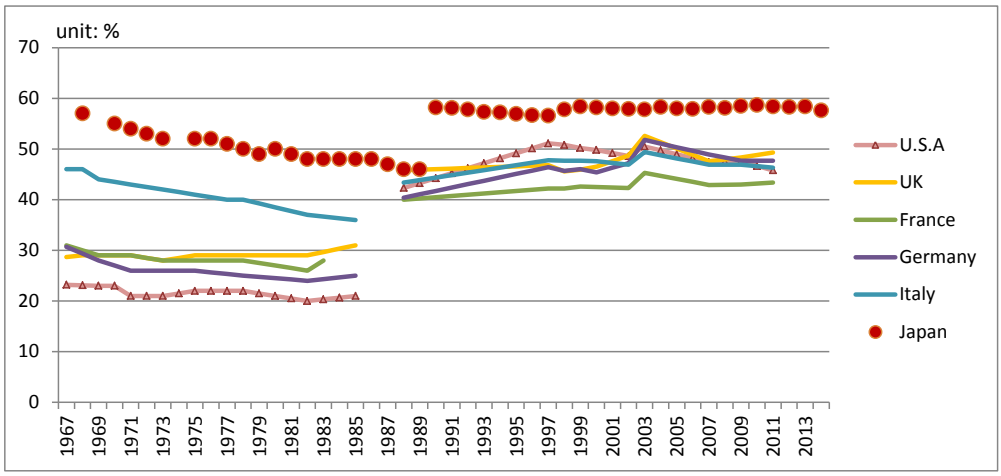

Fig. 7. International comparison of calorie intake among advanced countries[4]

Source: Food demand and supply statistics tables; The Ministry of Agriculture of Japan.

Nevertheless, even we admit such food cultural uniqueness in each countries' calorie intake, in Japan there should be no room to intake more calorie from rice.

[4] The lines do not continue smoothly due to data restriction. Until mid-1980s, the data had been the calorie intake from carbohydrate except for sugar. From 1990s to present, it includes sugar.

Is it possible to maintain and recover Japan' rice production?

Under the declining consumption, Japan's rice industry is now facing a critical point, at which we consider strategies that can maintain the present production level, further being able to recover. There are two aspects, i.e., the one related to domestic consumption and the other for exports.

Maintaining domestic production by supplying rice for non-traditional usage

The tendency of gradually declining rice consumption in the Japan's domestic market cannot be reversed. The problem is not to change the direction but to alleviate the speed of declining.

Within the limited amount of Japan's domestic consumption, the supply side should keep up with its continuing westernization in food life styles. People are increasingly preferring pilaf, paella and Chinese-style fried rice rather than the traditional Japanese rice cuisines, in which rice is simply cooked by steaming. With regard to the criteria of quality, sticky rice is highly evaluated in traditional rice dishes. On the other hand, when rice is used in Chinese-style fried rice dishes and other newly introduced cuisines, sticky rice can not necessarily be evaluated higher.

The point is that sticky rice is evaluated with high-price, while less-sticky rice is transacted as low-priced. Farmers are reluctant to raise less-sticky rice even though varieties of less-sticky rice are expected to achieve high yield. In Japan, at present, the consumption of less-sticky rice is increasing. Nevertheless, producing rice for these usage does not mean producing value-added rice but producing rice with lower prices.

This contradiction cause serious problems. These various usage with lower priced rice are rather suitable to imported rice. Farmers' hesitated attitude to the production of less-sticky rice for non-traditional usage may bring about the replacement of domestically produced rice to imported rice. As things stand, Japan's rice market for domestically produced rice may shrink further more.

Exporting rice and its processed products, Sake: A promising strategy

Before arguing the exporting strategy for rice and its processed products, it is informative to review the present situation of the worldwide food market. Traditionally, foods are viewed as products less differentiated. Of course there exist quality differences in some foods, however, in other bulk foods, differences are not so distinctive and the degree of price range reflected such quality differences is not so large compared to other products such as clothing, automobiles and electric appliances. Usually, these product differentiations bring about "Intra-Industry Trade," in which some countries exports a certain goods even if it imports a large amount of the same goods.

Yet, recently, even foods with such features intrinsically, Intra-Industry Trade have prevailed. Fig. 8 shows this tendency. Seven foods except for beef[5] have indicated consistent progresses of Intra-Industry Trade.

[5] The international trade of beef has severely been affected by the BSE epidemic disease. This should be considered as an exceptional case.

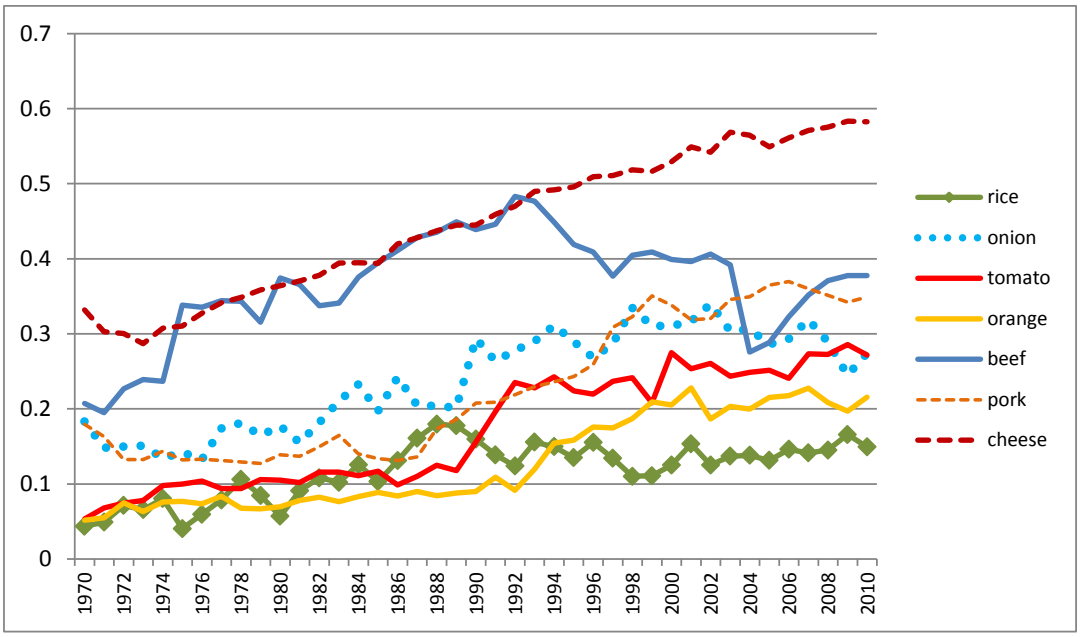

Fig. 8. Intra-Industry Trade on selected agricultural products (G.L.index)

Source: FAO-Stat; FAO.

In this context, it is not unusual phenomenon that, Japan, the typical rice importing country, in which the price competitiveness is inferior to other countries, would export rice and Sake.

With regard to sake, it should be emphasized that the domestic consumption of Sake is also shrinking and its producing firms are under severe financial situation, as same as rice farmers. Figure 9 shows these trends. The consumption of shouchu, which is made from sweet potatoes, and wine have increased consistently, while that of Sake has declined continuously.

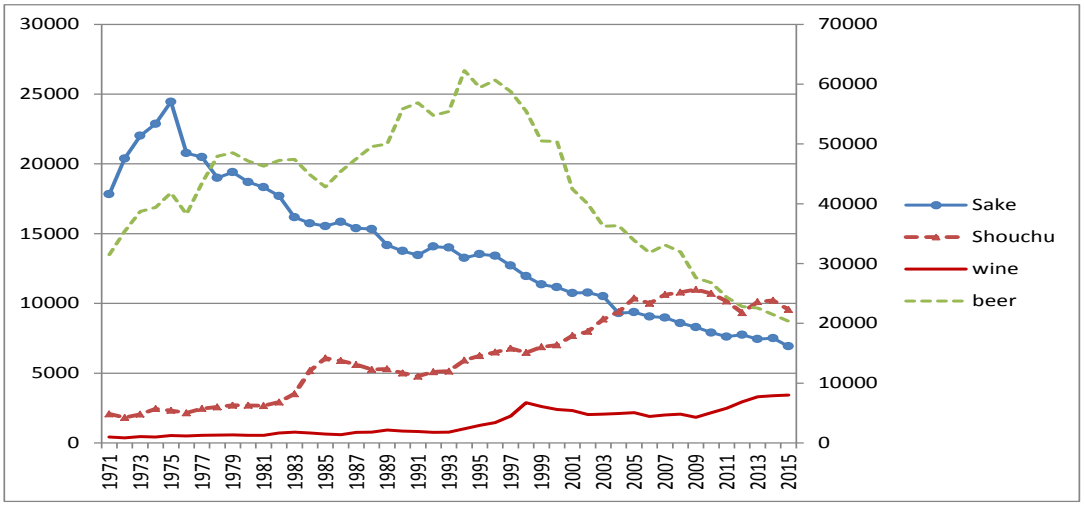

Fig. 9. Alcohol beverages consumption

Source: The statistics for households' consumption; The Statistics Bureau of Japan.

Fig. 10 shows recent rapid increase of rice and Sake exporting from Japan to the world. Considering the shrinking domestic consumption and pessimistic future prediction of consumption, it is appropriate to adopt the strategy of exporting rice and Sake.

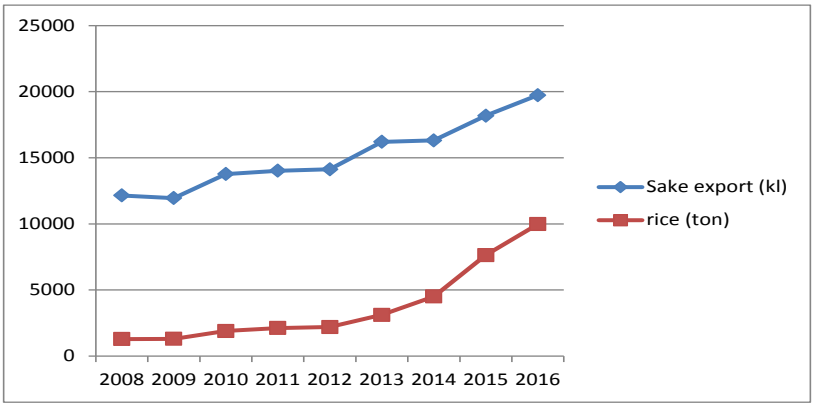

Fig. 10. Recent trends of exports of rice and Sake

Source: Statistics for Trade; The Ministry of Finance, Japan.

In order to establish a feasible strategy, it is needed to examine further the market conditions. Table 2 is the result of econometric estimation for rice export as grain form. Since its price elasticity in exporting countries is more than one, it is essential to enhance price competitiveness. In main exporting destinations, Asian high income countries such as Hong Kong, Taiwan and Singapore, a high price elasticity is estimated. Considering this fact, cost reduction is much more necessary.

With regard to income elasticity, generally high figures were estimated, specifically higher in western countries such as the U.S. and UK. This indicates promising expectation of the increase with the economic growths in those countries, however, on the other hand, it means that rice exporting is vulnerable when the economy in these countries fall into stagnation.

Table 2. Econometric analysis of Rice export (2008-2013)

	price elasticity	income elasticity	adjusted-R-squared
World (26)	−1.476***	2.814	0.9307
Asian high income countries (3)	−3.435***	1.471	0.8762
Western countries (10)	−1.458***	4.473*	0.8489

Source: Statistics for Trade; The Ministry of Finance, Japan.

Table 3 shows the result of econometric estimation of Sake exportation. It shows lower price elasticity compared with rice as grain form. This may mean that Sake's exporting is far beyond the price competition, thanks to its high quality evaluation. On the other hand, income elasticities for exporting are also high. An export increase will be expected along with economic growth, while it is needed to pay attention to sensitivity to economic conditions in exporting destination countries.

Table. 3. Econometric analysis of Sake export (2009-2016)

	price elasticity	income elasticity	adjusted-R-squared
World (26)	−0.6952***	3.4417***	0.9524
Asian high income countries (3)	−0.8920***	6.1650***	0.9465
Western countries (10)	−0.3022*	1.8913*	0.9719

Source: Statistics for Trade; The Ministry of Finance, Japan.

CONCLUSION

Major findings of this paper are as follows:

First, Japan has tried to westernize its traditional eating habits throughout the government policies two times in the past. The second one achieved a huge success, however, ironically, this success caused dramatically the reduction of rice consumption.

Second, this policy effects has been fundamental in the long run through children's education and is still on going. From the viewpoint of westernization in foods and eating habits, rice consumption is hard to recover. Furthermore, from the nutritional point of view, appropriate calorie intake has been maturated so there is no more room to eat more rice.

Third, considering the above mentioned situation, promising strategies are limited. The most prospecting one is to promote exporting more rice and its processed and high valued products, Sake. With regard to exporting rice, to reduce the cost and to strengthen its competitiveness, it is indispensable because its price elasticity in exporting countries is more than one. On the other hand, the price elasticity of Sake is lower. Both products' income elasticities for exporting are so high that increasing exports will be expected along with economic growth in destination countries.

THE VALUE CHAIN AND RICE PRICE POLICY IN INDONESIA

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ABSTRACT

Rice is one of the strategic commodities in Indonesia. Government intervention plays a significant role in Indonesian rice economy. A large input subsidy was delivered to rice farmers. Price policies were introduced annually. However, in Indonesia, rice is currently produced at the highest cost compared to the costs spent by some peers in Asia. From the farm gate to the market, rice is transported through a long supply chain. Uncompetitive markets are dominant along the chain. This study employed field and time-series data of regional rice markets to investigate the marketing efficiency, from both technical and price perspectives. The results show that in general, the value chain still needs many improvements regarding unbalanced marketing margin received by the actors. Price analysis shows the asymmetric condition among the producer and retail markets. The current rice price policy worsens the market situation, thus the Government of Indonesia is suggested to improve the rice price policy.

Keywords: rice competitiveness, supply chain, price transmission

INTRODUCTION

The better fulfillment of food and nutrition for the community has become a global commitment (SDG). The utilization of resources for the achievement of these objectives should be carefully thought out in order to achieve sustainable results, not just for the achievement of temporary goals. This principle should also be implemented along the supply chain, including rice, starting from farmers to products available at the consumers' tables. The whole process should provide a balanced economic value so that trade fairness can be obtained.

In Indonesia, the rice economy is one of the issues that have continuously been discussed by many for a long time. One important issue is the rice price in the consumer market in Indonesia which is higher than that in many other producer countries. The rice price in the domestic market reaches US $ 1 per kg, one and a half to twice the price in other countries. The causes are long rice supply chain, lack of policy control, and rice farmers' production which has no comparative advantage. Based on the IRRI publication (2006), from six rice producing countries in Asia, it turns out that the farmers in Indonesia have to spend the highest cost to produce 1 kg of harvest dry rice. Overall, the cost incurred by Indonesian farmers is two and a half times the cost paid by the farmers in Vietnam, or nearly twice as many as the cost spent by the farmers in Thailand and India. The largest cost components paid by farmers are for paying labor and land rent (calculated). The expenditure on inputs, such as urea fertilizer which is suspected to be far beyond the recommended limit, is in fact lower, due to large subsidy resulting in a relatively cheap price (second only to India). The competition with other agricultural commodities of higher value, or the increasing land demand from non-agricultural sectors, has also led to the difficulty to lower the high land cost for growing rice paddies.

Another problem is the low land tenure; for example in the three largest rice producing regions in Java, the average land tenure amounts to 2,000 m^2 and the average total land is about 0.4 hectares. With the small amount of land tenure,

it is often discovered that the bargaining position of farmers is weak against merchants/collectors. In Indonesia, there is Law No. 19 of 2013 which regulates the government's obligation to guarantee the prices of the products benefitting the farmers, one of which is through a balanced market structure. This condition can be interpreted as an ideal trade system arrangement for agricultural products, which happens when a trading condition of healthy, efficient and fair competition for producers, traders and consumers is created. The government's desire for producers to get a decent price, and for consumers to pay a reasonable price, especially for strategic food products such as rice, is certainly very understandable. In developed countries such as the USA (marketing mission), it is the responsibility of the government to conduct an agricultural product marketing policy intervention, i.e. how to decrease the price gap between producer and consumer levels; whether through direct marketing or chain shortening for the necessary conditions (not all the time).

Historically, the monthly rice price movement in Indonesia each year has a similar pattern. The rice price tends to rise from January to February and then gradually decline until June. Starting in July, rice price is on the rise again until the end of the year. The pattern is caused by the harvest time of the rice itself.

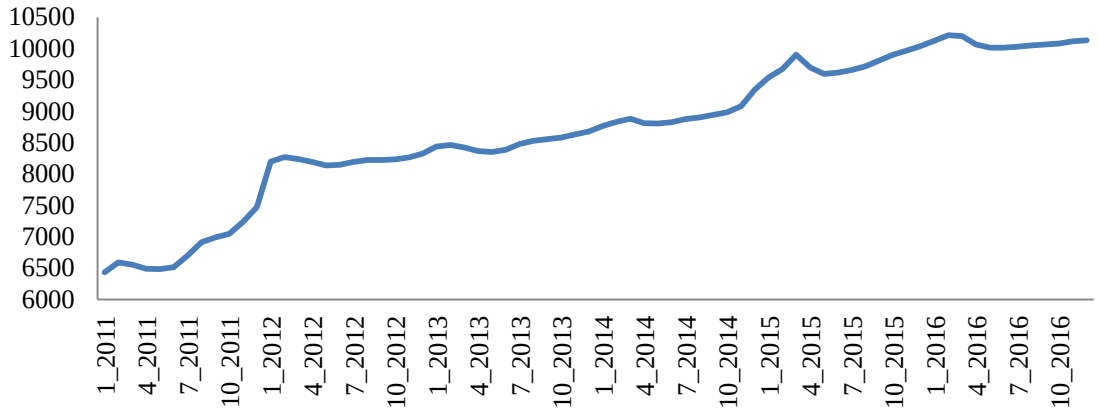

Fig. 1. The Monthly Rice Price Development of Indonesia, 2011-2016
Source: BPS, 2016

Fig. 1 shows that the national rice price tends to increase from year to year. From 2011 to 2016 it is recorded that the rice price has risen by 57 % or the equivalent of Rp3,650/kg. The highest price was recorded in the February 2016 period which amounted to Rp10,214/kg. Meanwhile, the highest price increase occurred in the March 2015 period due to harvest delay and declining production in 2014. Hence, the supply was interrupted.

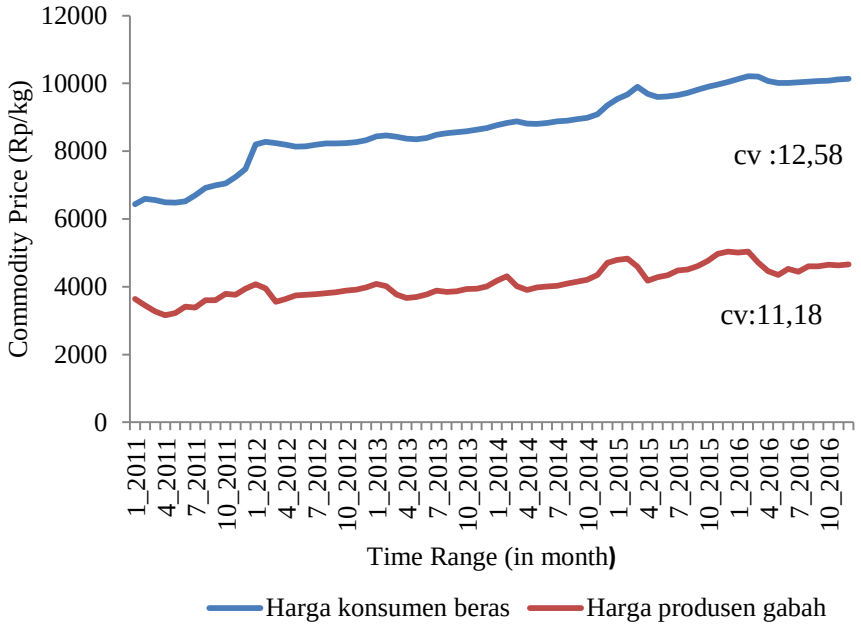

Fig. 2. The Producer and Consumer Rice Price Development of Indonesia, 2011-2016
Source: BPS, 2016

It can be seen in Fig. 2 that rice as a staple commodity tends to have a fluctuative price movement with an increasing trend on the consumer side. On the other hand, the highest producer price occurred in the early period of 2016. Price fluctuations are more volatile on the consumer side than on the producer side. It is proved by the higher value of coefficient of variation (cv) of the consumer price at 12.58, while the cv value of the producer price is only 11.18.

At the provincial level, rice price tends to be more fluctuative than the price at the national level. This is because the supply and distribution of rice of each province vary. This condition raises the price disparity between provinces.

Extreme price disparity between regions may indicate that the rice market is inefficient and the price integration between regions has not been well developed. In fact, the Law No. 7 of 2014 on Trades explains that inter-island trading activities aim to integrate the domestic market. It is suspected that the occurring problems of rice price are due to the asymmetric price transmission. This study aimed to analyze the extent on which the rice value chain has been working in Indonesia. In addition, is the increase of rice price in the consumer market really transmitted well to the producers?

METHODOLOGY

This study implemented two methods. First, to analyze the condition of rice value chain working in Indonesia, descriptive analysis was used. Second, the econometric model was applied to analyze the price transmission from consumers to producers. Both methods were used in two analyses separately.

Asymmetric vertical price transmission

Asymmetric price transmission is the different price responses between positive price shock (price increase) and negative price shock (price decrease). Asymmetric price transmission can be classified into three criteria (Meyer & Von Cramon-Taubadel 2004). The first criterion of asymmetric price transmission can occur vertically or spatially. Vertical price transmission occurs between the marketing levels in one chain, while spatial price transmission occurs between markets that differ geographically. The second criterion is based on the speed of time and the amount of price adjustment.

Vertical price transmission in an asymmetric marketing chain, either positive or negative, occurs not only from upstream to downstream, but also from upstream to downstream. In order to avoid misinterpretation, a positive asymmetric price transmission is a faster and or more perfect price transmission condition occurring when there is a reduction in margin compared to when there is an addition in margin. Margin reduction occurs when there is a price increase upstream or a price decrease downstream, whereas margin addition occurs when there is a price decrease upstream or a price increase downstream.

Von Cramon-Taubadel and Loy Model

The error correction model of Von Cramon-Taubadel and Loy in the price transmission analysis has been declared valid by Hassouneh *et al.* (2012). Hassouneh *et al.* (2012) compared several econometric models in a price transmission analysis, taking into account the presence or absence of unit roots and cointegration in two price series data. They concluded that ECM (error correction model) is a valid model to test the price transmission pattern on non-stationary but cointegrated data condition.

ECM concept is used to analyse the asymmetric price transmission introduced by Von Cramon-Taubadel and Fahlbusch (1994) by observing the significance of the deviation (error) of its long-term equilibrium model. In the cointegration concept, if there is a price movement deviation, it will be included as a form of error correction (error correction term/ECT) (Vavra and Goodwin 2005). Pre-cointegration technique for asymmetric price transmission analysis can produce spurious regression because it uses non-stationary data series.

The analysis steps in this study are:

1. Data Stationarity Test;
2. Optimal (Order) Determination;
3. Cointegration Test;
4. Causality Test; and
5. ECM Implementation on Price Asymmetry Model

The ECM model of price asymmetry

This study examined whether there is a rice price asymmetry at producer and consumer levels by using real values obtained from the nominal price divided by the inflation from each province in 32 provinces of Indonesia. The ECM model was implemented through two stages, namely:

When PP affects PC

$$\Delta PC_t = \alpha_0 + \sum_{i=1}^{n} \beta_{PC}^{-} \Delta PC_{t-1}^{-} + \sum_{i=0}^{n} \beta_{PP}^{-} \Delta PP_{t-1}^{-} + \pi_1 Z_{t-1}^{-} + \sum_{i=1}^{n} \beta_{PC}^{+} \Delta PC_{t-1}^{+} + \sum_{i=0}^{n} \beta_{PP}^{+} \Delta PP_{t-1}^{+} + ect^{+} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.5)$$

When PC affects PP

$$\Delta PP_t = \alpha_0 + \sum_{i=1}^{n} \beta_{PP}^{-} \Delta PP_{t-1}^{-} + \sum_{i=0}^{n} \beta_{PC}^{-} \Delta PC_{t-1}^{-} + \pi_1 Z_{t-1}^{-} + \sum_{i=1}^{n} \beta_{PP}^{+} \Delta PP_{t-1}^{+} + \sum_{i=0}^{n} \beta_{PC}^{+} \Delta PC_{t-1}^{+} + ect^{+} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.6)$$

Where:

PP_t = The rice price at producer level of the tth period in province *x* (Rp/Kg)

PC_t = The rice price at consumer level of the tth period in province *x* (Rp/Kg)

PP_{t-1} = The rice price at producer level of the previous period in province *x* (Rp/Kg)

PC_{t-1} = The commodity price at consumer lever of the previous period in province *x* (Rp/Kg)

α_0 = Intercept

P = Lag length

ect =Error correction term

The data used in this research were quantitative secondary data. Monthly data of rice consumer and producer prices from each province were taken from BPS (Statistics Indonesia). The consumer prices used were the monthly consumer prices of premium rice of 33 provinces in Indonesia in the period of 2011-2016. The rice producer prices used were the prices of GKP (Harvest Dry Rice) in the four rice production centre provinces in the same period. CPI and PPI data of agriculture sector were also taken from BPS.

VALUE CHAIN ANALYIS

The rice trade system in Indonesia today is not much different from the trade system in the past few decades, namely implementing a controlled agricultural policy. Both at the present and in the past, farmers still sell grains to collecting merchants or through *tebasan* system (the produce sold before harvesting). After reaching the collectors, the grains are handed over to the rice mills, which then distribute the products to big merchants and central/city markets. Consumers can buy rice through retailers who buy rice either from big merchants or traders in the central markets. Another trade system channel is farmers selling grains to village cooperatives which are then purchased by Bulog (Indonesian Bureau of Logistics). The existence of village cooperatives in the rice distribution is very strategic for farmers in order to get the prices which are in accordance with government regulations, especially during the great harvest. Rice that has been collected is stored in Bulog warehouses, which is then distributed to the markets through big merchants or central markets, where it is purchased by retailers who sell it to the consumers.

In general, the market structure of grains and rice is not competitive, but rather included within the market structure of oligopsony, oligopoly and monopolistic. The number of farmers is higher than the number of collectors or rice mill entrepreneurs and the number of collectors is higher than the number of rice mill entrepreneurs. Meanwhile, the quantity comparison between hullers and big merchants is almost balanced. The market structure at the consumer level is close to monopolistic because the number of retailers and consumers is relatively high and the rice product is relatively not homogeneous.

This type of market structure allows farmers and consumers in a weak position and mills and rice merchants in a dominant position. The rice mill entrepreneurs and big merchants generally know each other and trust each other. Their position is reinforced by the existence of natural barrier to entry, such as capital and technology control, and also by the grain purchasing policy issued by Bulog as well as the distribution of capital assistance funds to the rice mill entrepreneurs. The domination of hullers and big merchants in the rice trade causes them to become the party

that determines the prices (price maker). Therefore, grain price is mostly determined by rice mill entrepreneurs and rice price is determined by big merchants.

Based on further analysis of conduct and performance, there are several factors that are suspected to cause a wider price disparity between the harvest dry rice at farmer level and rice at retailer level, namely:

1. The change of floor price to farm-gate reference price since 2003 followed by the policy reform stipulating that Bulog no longer acts as the price stabilizer. This policy has led to an increasingly oligopoly/oligopsony market structure, where strong investors take the opportunity to take over Bulog's position. These big entrepreneurs move primarily in the inter-region large scale rice milling and trading businesses. This indicates that the policy prevailing before the reform is more effective in improving farmers' welfare and is effective in reducing price increase at the consumer level;
2. The policy in the fund distribution of Rural Economic Enterprises (LUEP), which are pro-rice mills, and Bulog's partnership in the procurement of rice/grain strengthen the dominant position of marketing institutions, namely rice mill entrepreneurs and big merchants, in the markets; and
3. The rice trade has not run efficiently and business competition is not healthy, which are indicated by the analysis results of marketing margin, market integration, and behaviour. In marketing margin analysis, the profit margin is greater than the cost margin and there is an uneven distribution of profit margin among the marketing actors. In addition, market integration analysis shows that GKP and rice prices at retailer level are not integrated, whereas the rice prices at wholesale and retailer levels are integrated.

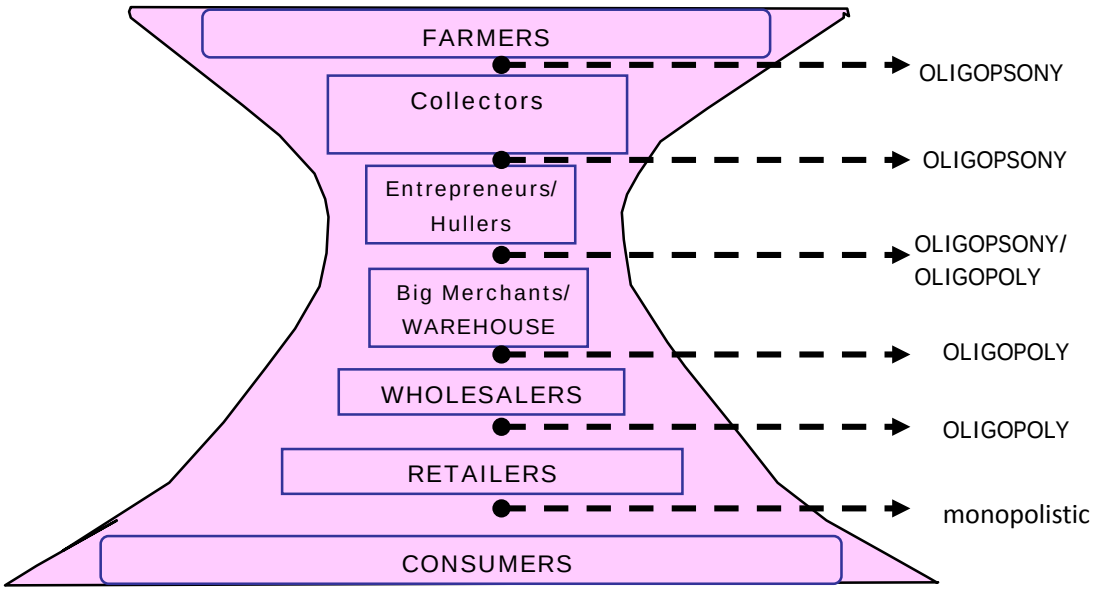

Fig. 3. Grain and Rice Market Structure at Various Market Levels

Source: Firdaus, et al. (2012)

PRICE TRANSMISSION ANALYSIS

Many studies suggested that the market structure of rice is highly asymmetric. The merchants who sometimes double as the rice mill owners are very skilled in managing rice reserves in warehouses. Often rice merchants use information such as the arrival of imported rice to suppress farmer price through collectors. The asymmetric condition above can also be indicated by the price movement responses ranging from farmer level to consumer level. There is the fact that when price increases at the retailer level or at the wholesale level, then the price at the farmer level will also increase but with a lower percentage, compared to if the retailer or wholesale price is down. To put it simply, price increase at

the retail level or wholesale level is less likely to affect farmers, but when price decline occurs, farmers will feel the immediate impact. In terms of market competition, this means that the bargaining position of farmers is not equivalent to wholesalers or retailers. To demonstrate this hypothesis, an econometric model is used to show the analysis results as follows.

Data stationarity test

The results of data stationarity test with ADF statistics show that the rice producer price in the production centre provinces tends not to be stationary at the level, but stationary at the first difference. In all provinces the producers are stationary at the first difference. At the consumer level, rice consumer price in 33 provinces tends not to be stationary at the level, but stationary at the first difference. In all provinces consumers are stationary at the first difference.

Cointegration test

The analysis of the integration between the consumer price and the price of the four producing provinces (West Java, Central Java, East Java and Lampung) with the Eangle-Granger procedure indicates that all consumer provinces are cointegrated with producer provinces with a five percent significance level. The highest average value of the degree of integration belongs to the production centre province of East Java. This shows that the consumer price and producer price of East Java move in tandem. From the four production centre provinces, the producer price of West Java has the lowest average value of the degree of integration.

Causality test

The Granger Causality Test in this study was conducted to ensure the direction of price transmission. The direction in question is whether consumer price affects producer price or vice versa. It can also test whether there is a two-way relationship or not. In this study, not all provinces passing the cointegration test stage passed this causality test. Further analysis with ECM was performed for regions passing this causality test.

Rice price asymmetry model analysis

The modelling was conducted after passing through several stages. The price asymmetry analysis was used to see whether the price transmission occurs perfectly between producer price and consumer price. Due to the relatively large number of provinces, several provinces were selected for comparison. The model used in this study was the ECM EG model. This model separates between the short term and the long term price transmissions. For rice, 9 models were modelled to explain the occurring price transmissions (see Table appendix 1).

The analysis results of price asymmetry models show that generally, price asymmetry occurs in the short term and only one finding indicates that price asymmetry occurs in the long run. This is in accordance with the study conducted by Baquedano and Liefert (2014) which stated that in the long-term transmission process, price elasticity is generally small and also the majority of transmission process is incomplete. What determines the asymmetric price transmission is sometimes unclear and difficult to determine. In the study by Aguiar and Santana (2002), both the product shelf life and market concentration variables similarly do not determine whether prices will be asymmetric or not. Even non-durable commodities in the competitive markets show a higher price transmission when price increase occurs.

CONCLUSIONS

This study derives some conclusions as follows:

1. The rice supply chain in Indonesia is performed with the important role of middlemen who link farmers to end users. In most cases, the supply chain is relatively long because it has to go through several middlemen, such as village traders, district traders and wholesalers outside the districts, before it gets to end users.
2. The rice price movement at the provincial and national levels indicates the trend that tends to be more fluctuative on the consumer side than the producer side. The Eastern Regions of Indonesia, which have a deficit in the production balance, have a more volatile price movement with averagely higher consumer price than other regions.
3. In the price asymmetry analysis, there is a case where the producer price determines the price or the consumer price determines the price. Generally, if the consumer price acts as a price determinant, then the model is symmetrical in both the long and short terms. But when producer price acts as a price determinant, then the model is asymmetrical in the short term.

IMPLICATION FOR FURTHER AGENDA

The competitiveness of Indonesian rice is due to the problems of productivity and long chain of trade system. Technology dissemination effort with the help of machines and equipment by the government, if carried out optimally, will definitely be able to reduce the cost of labor. The keywords to increase the rice competitveness in Indonesia are **increasing productivity**, not increase the number of rice produced. Disseminating technology to farmers should be the focus of the Ministry of Agriculture, such as the provision of seeds from certified superior varieties, irrigation and pest control. Based on the report by the Directorate General of Food Crops in 2016, only 43.5% of paddy farmers have adopted these types of seeds (the number decreased from the condition of 2015) although a lot of research budget has been spent to construct and test these new seeds. This is indicated by the fact that the average cost incurred by the rice farmers in Indonesia for seeds is very low, far below the cost spent by the farmers in other producer countries. IRRI study report states that there are only about 60 % of farmers using certified inbred rice seeds in West Java; the rest use their own seeds. In contrast, 100 %of the farmers in China use hybrid seeds, and more than 90 %of farmers in India have adopted certified inbred rice seeds.

In addition, the access of farmers to information technology and institution strengthening are equally important. Currently, farmers of various strategic commodities in the production centres can directly access the prices in the markets of various cities, by utilizing Android technology. For example, from the author's own survey results, the applications Informasi Pangan Jakarta (Jakarta Food Information) and SiHATi from Bank Indonesia that always update the prices of food every day are perceived as very beneficial to the farmers in Temanggung when negotiating with the collectors in their villages.

Furthermore, in the issue of rice trade system, some improvements absolutely have to be done. Even in a developed country like the USA, the trade system of agricultural products derived from plants (food, fruit and vegetables) still faces many quality standard problems; in contrast to the products from animals which have better quality classification (grading). In addition, there is still a gap in farmer's share between regions in the USA; from the worst condition, namely the farmers only receive about 17% of the consumer price, to the ideal condition (food hubs), where farmers can earn up to 75%.

Government intervention in the rice industry is not only in the form of input subsidies (fertilizers, seeds) as well as facility and infrastructure assistance, which is very large in number; but also in the form of price policies, namely the government's purchase price (farm-gate reference price) and the highest retail price (ceiling price). This intervention is also commonly practiced in other rice producing nations. Both pricing policies are primarily intended

as a reference for Bulog as the national food support agency to make purchases to farmers or operations in the consumer market. Though, various obstacles limiting the authority of Bulog have caused assorted problems in the field.

Some discussions have been made well in advance about the effectiveness of farmgate reference price of grains. The farmgate reference price set by the government is thought to be ineffective, and one of the reasons is that the selling price of grains by farmers is always far above the farmgate reference price. Over the past three years, prices have always been well above Rp 4,000. This actually implies that the current farmgate reference price may be lower than the supposed condition. Especially when referring to the results of some researches, which have included components such as land rent and all labour that must be taken into account. This includes the price of urea fertilizer paid by farmers that is always calculated equal to the government's subsidized price at effective condition; but the reality in the field is not like that. Some research results have shown that only about 10 % of farmers bring grains to the mills (Gapoktan – the association of farmers groups) and then sell them in the form of rice; the rest sell grains to the collectors. This means that the farmgate reference price is important to ensure the welfare of farmers, certainly with the assumption that marketable surplus is still high.

For the ceiling price, it is obvious that at Rp 9,500, let alone Rp 9,000, it is ineffective. BPS publication on rice prices in Indonesian cities or Bank Indonesia publication that can be easily accessed via smartphone show that the prices of IR rice (64) in the retail markets of Jakarta are reported, for grade 1, 2 or 3, to range from almost Rp 12,000 to Rp 9,700. If it is assumed that the rice market share outside this modern retail still dominates the market, it means that the implementation of ceiling price does not occur in the field. In some countries, when this condition occurs, the consumers can report to the local authority, so there will be a follow-up from the government. How about in Indonesia? In addition, the government in their regulations calculate the rice ceiling price (farmers) in the mills at Rp 7,300. If the ceiling price is consumed only at Rp 9,500, it means the the share received by farmers is more than 75%. This has overcome the best condition of the share received by the farmers in the USA. Thus, this ceiling price number seriously needs to be reviewed.

The government has a lot of homework to do. In addition to the serious efforts to improve the productivity of rice farmers, subsidy mechanism, namely inputs such as fertilizers and also prices, and assistance to farmers need to be evaluated. The production data accuracy to the success of food diversification efforts will also greatly determine the goal achievement of food security (food sovereignty). Closer collaborations with Agriculture Higher Education Institutions, independent research institutions, NGOs and the business world, which are implemented in the neighbouring countries and many developed countries, are highly anticipated.

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Appendix 1. Estimation of Asymmetric Price Model of Rice in Indonesia

Var	KDKI-PJTG	PJTG-KDKI	KPAB-PJTG	PJTM-KDKI	KDKI-PJTM	KDKI-PLMP	KDKI-PJBR	PJBR-KDKI	KPAB-PJBR
C	17,11[a]	15,03	74,11	16,15	31,61	121,87	53,17	12,65	82,74
	(0,71)[b]	(0,66)	(0,18)	(0,65)	(0,45)	(0,10)	(0,27)	(0,72)	(0,12)
$dP(_{t-2})^{+}$	-0,29	**0,6**	0,05	0,13	0,2	0,11	-0,29	**0,6**	0,02
	(0,24)	**(0,004)**	(0,83)	(0,52)	(0,34)	(0,56)	(0,26)	**(0,004)**	(0,93)
$dP(_{t-2})^{-}$	0,12	**-0,27**	0,07	-0,19	0,13	**-0,35**	0,06	**-0,28**	0,02
	(0,35)	**(0,009)**	(0,51)	(0,18)	(0,38)	**(0,03)**	(0,64)	**(0,009)**	(0,82)
$dK(_{t-2})^{+}$	-0,06	-0,11	0,15	-0,1	-0,14	-0,06	-0,04	-0,11	0,19
	(0,74)	(0,44)	(0,35)	(0,50)	(0,39)	(0,83)	(0,83)	(0,45)	(0,26)
$dK(_{t-2})^{-}$	-0,08	0,14	0,22	-0,002	0,008	-0,03	-0,07	0,14	0,26
	(0,73)	(0,47)	(0,22)	(0,99)	(0,97)	(0,93)	(0,77)	(0,45)	(0,17)
$dP(_{t-1})^{+}$	**0,51**	**0,54**	**0,55**	0,31	0,21	0,08	**0,54**	**0,54)**	**0,65**
	(0,04)	**(0,01)**	**(0,02)**	(0,14)	(0,33)	(0,67)	**(0,03)**	**(0,01)**	**(0,007)**
$dP(_{t-1})^{-}$	0,34	-0,1	**0,28**	0,02	**0,3**	-0,22	**0,31**	-0,11	**0,28**
	(0,007)	(0,35)	**(0,01)**	(0,90)	**(0,08)**	(0,15)	**(0,02)**	(0,34)	**(0,02)**
$dK(_{t-1})^{+}$	0,3	-0,09	0,13	-0,08	-0,12	-0,03	0,36	-0,09	0,06
	(0,21)	(0,51)	(0,27)	(0,59)	(0,56)	(0,94)	(0,15)	(0,53)	(0,59)
$dK(_{t-1})^{-}$	-0,31	0,28	-0,11	0,18	-0,22	-0,15	-0,34	0,29	0,06
	(0,24)	(0,15)	(0,65)	(0,37)	(0,35)	(0,73)	(0,20)	(0,15)	(0,79)
$dP(_{t})_{+}$		0,1		0,19				0,1	
		(0,59)		(0,34)				(0,61)	
$dP(_{t})_{-}$		-0,04		**-0,4**				-0,04	
		(0,68)		**(0,03)**				(0,67)	
$dK(_{t})^{+}$	0,27		0,07		-0,001	0,24	**0,33**		0,009
	(0,17)		(0,53)		(0,99)	(0,44)	**(0,09)**		(0,94)
$dK(_{t})^{-}$	0,34		-0,28		-0,05	-0,29	-0,04		-0,13
	(0,16)		(0,31)		(0,81)	(0,50)	(0,83)		(0,62)
ECT^{+}	0,27	**0,2**	0,1	**0,21**	0,22	0,06	0,04	**0,19**	-0,01
	(0,21)	**(0,09)**	(0,68)	**(0,09)**	(0,25)	(0,80)	(0,83)	**(0,09)**	(0,95)
ECT^{-}	0,34	0,21	**0,67**	0,24	**0,43**	**0,81**	**0,38**	0,18	**0,56**
	(0,16)	(0,17)	**(0,02)**	(0,14)	**(0,04)**	**(0,003)**	**(0,08)**	(0,24)	**(0,02)**
R^2	0,47	0,36	0,58	0,28	0,31	0,31	0,45	0,34	0,55
R^2ADJ	0,36	0,22	0,49	0,13	0,17	0,16	0,33	0,2	0,45
FSTAT	4,22	2,58	6,48	1,86	2,13	2,11	3,82	2,46	4,9
	(0,0001)	(0,008)	(0,00000)	(0,06)	(0,03)	0,03)	(0,0003)	(0,01)	(0,00003)

Note: [a] Estimation parameter [b] p-value, letter (K) at the beginning of the province name describes the consumer price, letter (P) at the beginning of the province name describes the producer price. DKI (DKI Jakarta), JTG (Central Java), PAB (West Papua).JBR (West Java), LMP (Lampung), JTM (East Java)

ROLES OF AGRICULTURAL COOPERATIVES IN JOINT PRODUCTION-CONSUMPTION LINKAGE MODEL RELATED TO LARGE SCALE RICE FIELDS IN MEKONG DELTA

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ABSTRACT

Agricultural cooperatives (ACs) have an important role in supporting the linkage between their members and trading enterprises. This paper presents a study result of roles of ACs in joint production –consumption linkage model related to large-scale rice field (LSRF) in Mekong Delta of Vietnam. Based on survey of 80 agricultural cooperatives (ACs) in 4 provinces in 2016, the study shows i) ACs participate in some kind of linkage models; ii) ACs have some roles in linkage models and in LSRF; iii) linkage brings interest to cooperatives and rice producers. The linkage with trading partners brings to rice producer a net profit from 9.2 to 12% higher than non-linkage; iv) Cooperatives have still several difficulties for the linkage and in rice production in LSRF; v) Supporting policy is not effective.

Keywords: rice, linkage, production, large-scale rice field, Mekong delta

INTRODUCTION

Agricultural production in Vietnam is characterized by small family households. Seventy percent of family households have annual cropland less than 0.5ha (GSO 2011) and divided into several small plots and dispersed. That causes the difficulties for the mechanization, the application of same production process in order to have big production with homogenous quality. The enterprises do not want to have business with small family households because of the heterogeneous product quality and high transaction cost (ILO 2011).

In order to improve the competitiveness of agricultural products and the income of small family households, in 2013, the Vietnamese government issued the policy promoting the model of production-consumption linkage toward crop products, including rice, related to the application of rice production in large scale rice field (LSRF) (Prime Minister 2013). In this linkage model, the agricultural cooperatives (ACs) play an important role. The ACs help to resolve the existing problem of agricultural production system with small family households and facilitate the linkage between the enterprises and small farmers (ILO 2011). The ACs also help to increase their power in the negotiation with the enterprises (ILO 2011, Grega 2003, Tosun *et al.* 2013) and access to market information. In the value chain, the ACs can implement several activities such as providing input and production services to their members, collecting, transporting, preserving the products, preliminary treatment of products, providing information and internal loan to members, etc. (Stockbridge *et al.* 2003, Grega 2003). These activities improve importance of ACs to members, assure stable market for the products and increase the income of their members.

This paper presents the role of ACs in the joint production – consumption linkage model related to LSRF in the Mekong delta in Vietnam. Concretely, the paper reviews supporting policy aiming to promote the linkage among stakeholders in rice value chains as it relates to LSRF, introduce the linkage models with the participation of ACs, analyze the role of ACs in production -consumption linkage model, identify the interest of linkage for cooperatives and their members.

METHODOLOGY

The result presented in this paper comes from a survey of 80 agricultural cooperatives implemented in 2016 in four provinces of Mekong Delta of Vietnam as Soc Trang, Bac Lieu, An Giang, Ca Mau. Only agricultural cooperatives of rice producers are chosen for the survey.

Total number of agricultural cooperatives in the survey are 80, that is unequally distributed among four provinces due to the different number of rice producer cooperatives in the provinces. The number of crop cooperatives are very few in the provinces of Ca Mau, and Bac Lieu, so only 10 agricultural cooperatives in each of these provinces are surveyed (this is almost all crop cooperatives in two provinces). Provinces of Soc Trang and An Giang have more rice producer cooperatives, so in each of these provinces, 30 ACs are surveyed.

The ACs are randomly selected on the list of agricultural cooperatives provided by provincial competent authority, but the cooperatives that have the linkage to enterprises or organize the rice production for their members in LSRF model are selected according to priority. The direct interview of members of AC management Board with semi-open questionnaire is applied to collect the data of the cooperatives and opinion of the AC members.

In addition, the information is also collected from meetings, discussion with public agencies at levels of provinces, districts, and communes and from rice trade enterprises (including the enterprises with and without linkages to rice producers).

An AC is considered as having the linkage to enterprise if AC and enterprise sign a contract with agreed conditions in which the enterprise engages to buy the paddy according to contracted conditions. A rice field is called LSRF if its area is not less than 50 ha and composites of adjoining rice plots with same rice variety and same production process. De factor, the area of a LSRF is largely different among provinces, but with an interval of 50-300 ha.

REVIEW OF SUPPORTING POLICY FOR LINKAGE AND LSRF

The government has preferential and supporting policy to enterprises, cooperatives and rice producers when implementing the linkage in joint production – consumption related to LSRF model. This policy consists of:

i) Exempting or reducing land use tax or land rent when being assigned or rented by State for building processing factory, storehouses, worker's houses, working houses for LSRF projects;
ii) Prioritizing in the participation into government programs in rice export and stockage;
iii) Supporting partly the cost for planning, improving rice field, improving roads, interior field irrigation system and electric system;
iv) Support the cost of technical training courses and guidance for rice producers. The enterprise can receive 50% of this cost while the AC can receive 100%.
v) Support until 50% of training cost for AC managers;
vi) Support the cooperative in providing plant protection service. The support can be until 30% for first year and 20% for second year for the costs of pesticide, hired labor and hired machine.
vii) Support rice producers until 30% of cost to buying certificated rice seed;
viii) Support 100% cost for the stockage of paddy in enterprise's storehouse in a period of 3 months;
ix) Support the application of good agricultural practices in rice (VietGAP), including the cost for the certification.

x) Possible access to preferential credit as low interest rate, and no mortgage. The commercial banks are allowed to provide the loan without mortgage to enterprises and agricultural cooperatives. The loan can achieve until 80% of total budget of LSRF-linkage project.

The potential beneficiaries of this policy are presented in the table below:

Table 1. Promoting policy for stakeholders involved in joint rice production – consumption linkage model related to LSRF

Kind of support	Enterprise	Cooperative	Producer
Exemption or reduction of land use tax or land rent	Yes	Yes	No
Priority in rice export in G2G export contract or stockage program	Yes	Yes	No
Supporting partly cost to improve field infrastructure (road, irrigation, electric systems)	Yes	No	No
Supporting cost of training for rice producers	Yes	Yes	No
Supporting cost for training of cooperative managers	No	Yes	No
Supporting cost of pesticides, hired laborers and machines	No	Yes	No
Supporting cost of certified rice seeds	No	No	Yes
Stocking paddy in silo	No	No	Yes
Support the application of VietGAP	No	Yes	Yes
Possible access to preferential credit	Yes	Yes	No

Source: synthesis from Decision 62/2013 (Government, 2013); Decision No. 1050/QĐ-NHNN (State Bank, 2014); Decree No. 55/2015/NĐ-CP (Government, 2015).

To receive the public support, the LSRF- linkage project has to meet all of following conditions:

- Rice is produced in LSRF and has joint production – consumption linkage;
- Having the signed contract between buyers and rice producers in buying the paddy and the enterprise has to provide input to rice producers (they can have themselves or signed contract with other enterprises to provide input to rice producers);
- Trade enterprise must have the infrastructure for stockage, drying the paddy and has rice production area ensuring at least 50% of their rice need;
- LSRF project is placed in planned rice production zone and approved by competent authority; and
- Linkage project has at least the implementation duration of 5 years

The satisfaction of all above-mentioned conditions is very difficult. None of the enterprises meets all of these conditions. In fact, in surveyed provinces, none of LSRF-linkage project is approved. Consequently, some provinces give the support to cooperatives, and rice producers for rice production only in LSRF, but not linkage with enterprises.

PARTICIPATION OF AGRICULTURAL COOPERATIVES IN LSRF AND JOINT PRODUCTION-CONSUMPTION LINKAGE MODEL

The study shows that 30.3% of surveyed cooperatives applied rice production in LSRF and had joint production – consumption linkage with enterprises; 13.2% of the cooperatives produced the rice in LSRF, but not linkage to enterprises; 26.3% of cooperatives have the linkage to enterprises but not apply LSRF; 30.3% cooperatives do neither LSRF nor linkage to enterprises. In summary, 41.8% cooperatives applied LSRF and 54.4% cooperatives link to enterprises in rice production and consumption.

58.2% cooperatives do not apply LSRF model by several reasons such as: i) rice parcel of cooperative's members are alternated with rice field of non-members (55.6% cooperatives), do it does not meet the criteria of LSRF; ii) Cooperative members do not find out the enterprises that want to engage in a contracted linkage (37.8%); iii) Cooperative members do not want to LSRF because the production process in LSRF is so complicated (31.1%); iv) rice producers do not receive the support from public agencies (20.0%); v) Cooperatives do not know how to apply the LSRF model (15.6%); vi) Members do not acknowledge the interest of LSRF model.

Table 2. Reasons for non-participation of agricultural cooperatives into LSRF model

Unit: % cooperatives

Reason	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Members do not want to apply LSRF because of complicated production process	31.1	40.0	16.7	25.0	36.4
Member's rice field is alternated with ones of non-members	55.6	80.0	33.3	66.7	50.0
Do not know how to do LSRF	15.6	40.0	66.7	8.3	0.0
Do not have enterprise signing contract to buy paddy	37.8	40.0	33.3	33.3	40.9
Do not receive public support	20.0	60.0	50.0	8.3	9.1
Do not acknowledge the interest of LSRF	11.1	0.0	0.0	0.0	22.7
Other	15.6	60.0	16.7	0.0	13.6

Note: percentage is calculated only on the number of cooperatives that do not applied LSRF.

Why are cooperatives not engaging in linkages with enterprises? The survey results that 77.4% cooperatives that do not have contracted linkage to enterprises revealed the reason for non-linkage as they do not find out the partners for signing rice buying contract. 25.8% of cooperatives mentioned that the enterprises do not buy the paddies with higher price, so rice producers do not want to link in order to have the flexibility in selling their paddies. Some additional reasons explained include the non-linkage of cooperatives with enterprises such as enterprise's requirement is so complicated, difficult (16.1% cooperatives), the rice quality does not meet the requirement of partners (12.9%), the area of LSRF is small so enterprises do not want to sign the contract (12.9%).

The most important reason for non-participation of cooperatives in the linkage model with enterprise is that the enterprises do not want to link. Some reasons explain the non-interest of trading enterprise in the linkage. First, to have a sustainable linkage, the enterprises have to invest in advance to farmers, so they need an important capital; Second, the enterprises have to invest in the infrastructure as storehouse, factories, renting land, vehicles and machines (Transport means, drying machine, etc.). That needs also a big capital. Third, the enterprises have to recruit additional staff for supporting and supervising the linkage, so they have to bear additional operation cost. Fourth, the enterprises have to buy the paddies with higher price than market price. Fifth, to recompense additional cost related to the linkage, the enterprises have to ask the cooperatives in producing high quality rice, but it is easy to find out the market for high quality rice. In summary, to do linkages, the enterprises need a very big capital, pay additional cost but the enterprises are so difficult to benefit supporting policy of government. The procedure to benefit public support is so complicated and local government themselves do not have enough resources to support the enterprises involved in the linkage.

Table 3. Reasons explaining the non-linkage of cooperatives with enterprises

Unit: % cooperatives

Reason	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Cannot find out buying partner to sign contract	77.4	60.0	85.7	72.7	87.5
Small LSRF area, so company does not sign the contract	12.9	40.0	0.0	9.1	12.5
Enterprises do not buy paddy at price higher than market price	25.8	0.0	14.3	18.2	62.5
Rice quality is not meet requirement of enterprises	12.9	60.0	0.0	9.1	0.0
Do not have means to transport paddy to storehouse of enterprise	9.7	0.0	0.0	18.2	12.5
Requirement of enterprise is difficult and complicated	16.1	20.0	14.3	9.1	25.0
Other	12.9	20.0	28.6	9.1	0.0

Note: percentage is calculated only on the number of cooperatives that do not have the linkage with enterprises.

COOPERATIVE'S ROLES IN LSRF AND LINKAGE MODELS

Models of linkage and LSRF with the participation of cooperatives

Linkage model between rice trading company and cooperative

In this model, the company signs the linkage contract with agricultural cooperative (AC) of rice producers. The list of rice producers with their signatures is annexed in the contract. The linkage mechanism and the responsibilities of each of both parties are:

i) the company invests to the rice producer throughout the cooperative. The advanced investments can be in cash or in kind (rice seeds, fertilizers, plant protection chemicals). In case of in cash, advanced amount equals about 50% of the total cost of rice seeds, fertilizers, plant protection chemicals. The advance is delivered to AC, then the later redistribute to their members;
ii) the company decides used rice variety and grade of rice seed (usually certificated rice seeds);
iii) The company gives the guideline of production process and supervises the application of technical practices. The AC is also responsible to supervise technical practices applied by their members in conformity to determined production process; and
iv) The company buys the paddy at field or at silo at agreed price by both parties. Normally, agreed price is equal to or higher than market price by a prime and determined before some days of the harvesting.

In this linkage model, the LSRF can be applied or not yet. It depends on company need of rice quality and the capacity of organizing LSRF of AC. The AC plays an important role in the linkage, but its limited capacity is an obstacle.

Linkage model between input agent and cooperative

Agricultural input agent, based in villages or communes, signs the contract with cooperative for an input – output trade. The agent buys the paddy of AC members and sells the input to the cooperative. The agent's only interests is in rice variety and not in the technical process. Therefore, they decided which variety is sowed for every cropping and let the farmers freely in applying the techniques. The agent can buy the paddy at field or at storehouse at agreed price between AC and agent. The price can be fixed at sowing or at buying time. The agent resale purchased paddy to rice trading company.

Doing this linkage, the agent achieves double objectives: i) preventing other agent in providing input to farmers and make profit from selling the input; ii) Making profit from trading paddy. However, in some cases, the agent can suffer financial losses from marketing paddy because the fixed price at sowing is lower than the price at paddy buying time.

In this linkage model, LSRF is applied to assure homogenous rice quality, facilitating the agent in resale. The AC is responsible to distribute the input to their members, supervise technical application of members and assures the member to sell the paddy to input agent.

Cooperative organizes LSRF and do marketing paddy itself

In this model, the AC does not sign the contract with any paddy buyer before sowing. The AC organizes the rice production in LSRF. There are two cases in the model:

- AC organizes the LSRF from the rice field of their members, AC buys the paddy of members, then resells the paddy to other trading partners. The AC only guides and supervises the technical practices of their members.
- AC organizes the LSRF from their collective land. Collective land can be hired from their members or non-members.

The marketing of paddy is not difficult because of high rice quality. However, very few ACs can be capable to apply this model because of their limited capacity on capital, asset, management skill and low performance.

Cooperative's role in rice production in LSRF model

To apply LSRF model in rice production, the cooperative must build collective rice production process with agreement of their members and do this so that their members apply and respect this process. To do that, the cooperatives have to lobby, communicate, guide and supervise their members in whole cropping. The survey indicates that the cooperatives did their w roles well as presented in table 4.

Table 4. Applying collective rice production process by cooperatives

Unit: % cooperative

Item	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Used same rice variety	79.4	60.0	75.0	88.2	75.0
Applied same rice production process	85.3	100.0	100.0	76.5	87.5
Sowing same period as planned	91.2	80.0	100.0	94.1	87.5
Harvesting rice as planned	94.1	80.0	100.0	94.1	100.0
Rules on using fertilizers, pesticides	29.4	20.0	25.0	29.4	37.5

The agricultural cooperatives provide some services to support their members in the application of LSRF model such as sowing, irrigation and drainage, fertilizing, spraying pesticides and herbicides, harvesting, transportation, providing input, land preparation, etc. The production service that the cooperatives provide the most is irrigation and drainage is provided by 48.5% of the cooperatives (Table 5). Very few cooperatives can provide input (rice seeds, fertilizers, pesticides) and post-harvest services (transport, drying, stockage) to members because of their limited capacity on human resources, capital, and asset. There is a reduction of the power of cooperatives in negotiating with partners and put the burden to companies in linkage activities.

Table 5. Service of cooperative to member for application of LSRF

#	Service	% cooperative provides service
1	Sowing	9.1
2	Irrigation, drainage	48.5
3	Fertilizing	9.1
4	Spraying pesticide	12.1
5	Spraying herbicide	15.2
6	Harvesting	24.2
7	Transporting	9.1

Cooperative's roles in joint production –consumption linkage model

Nearly 60.8% of ACs have the linkage with an enterprise for sale of the paddy of their members. In the linkage, the ACs play an intermediate role between enterprises and household members. The ACs perform a number of roles including negotiating and signing the contracts with partners; receiving investments from buying rice partners and redistribute them to members; Guide and supervise the household members implementing farming processes (technique process, seasonal calendar) (Table 6).

Because of majority of cooperatives do not have transportation vehicle, the enterprises have to buy wet paddy at rice field and transport it to their storehouse. In cases where cooperatives have vehicles and transport paddy of their members to storehouses, the enterprise pays the cooperative the transportation cost.

Table 6. Roles of cooperatives in supporting linkage between household and enterprises

Role	% of cooperatives
Signing of contract with partners	29.0
Receiving the investment from partners and redistributing them to members	16.0
Looking for relevant input to provide to members	8.0
Announcing, guiding members about production process	17.0
Supervising members in respecting the agreed production process	20.0
Identifying the harvesting calendar	24.0
Transporting paddy from rice field to storehouse of partner	3.0

Role of enterprises in the rice production-consumption linkage model

In the joint production-consumption linkage production with the cooperatives, the enterprises play the following roles:

- Buying paddy as indicated in the signed contract. The enterprises usually buy wet paddy at rice field just after harvesting, then transport it to their storehouse and dry it. Normally, the enterprises pledge to buy paddy at market price or higher than market price.
- Advanced investment for the farmers. The enterprise can invest rice seeds, fertilizers, pesticides or money for the farmers so they can buy themselves the input. In order to have homogenous and high quality rice, the enterprise normally invests certificated rice seeds. Therefore, 73% of cooperatives in linkage models receive rice seeds from enterprises. In case of advance in cash, the amount is about until 50% of input cost (seeds, fertilizers, and pesticides). The advanced investment of the enterprises will be deducted when enterprises receive paddy from farmers at the end of rice cropping.
- Support to cooperatives in the form of a small amount to recompense to the responsibility of cooperatives in assuring the implementation of the linkage. Cooperative managers have to mobilize their members, supervise the application of agreed rice production process and assure their members to sell paddy to enterprises. Supporting level is different from one to other firms, but in interval of VND 10-200/paddy kg and depend on requirement level in supervising the application of rice production process. For example, in case of applying GlobalGAP, the enterprise has to support higher amount.
- Send technicians to guide production technique and supervise the farmer in the application of agreed rice production process. This support only happens in case that the enterprise need the rice of high quality or in application of high standard as GlobalGAP, organic.

Table 7. Investments of enterprises to cooperatives in linkage model

Form of investments	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Cash advance	10.0	0.0	0.0	0.0	20.0
Supply of rice seed	73.3	100.0	100.0	81.8	60.0
Supply fertilizers	43.3	100.0	50.0	54.5	26.7
Supply pesticide	43.3	100.0	100.0	36.4	33.3
Paying fee for AC for supporting the linkage	26.7	50.0	100.0	18.2	20.0

Received support of cooperatives

When participating in rice production in LSRF and linkage model, the cooperatives receive not only the investment from enterprises, but also from public agencies (Table 8). The cooperatives and farmers receive four kinds of public supports as:

i) Support of input (seeds, fertilizers, pesticides). However, the percentage of cooperatives receiving input support is very low (less than 15%);
ii) Technical training of promoted rice production process as one must five reduction[6], three reduction three increase[7], VietGAP). Guidance of application of production process in practices and Guide measure to prevent and treat pestilent insect and diseases. The most public support is focus on these issues as about 50% of cooperatives received these supports.
iii) Support for post harvesting activities, but it is also very limited.
iv) Support in case of happened objective risk as flood, drought, diseases,..

Table 8. Percentage of cooperatives receiving public support for their participation in LSRF and linkage model.

Kind of support	% AC
Rice seeds	14.0
Fertilizers	5.3
Pesticides	1.8
Training on technique practices	52.6
Applying sustainable rice production process (1must 5 reduction, 3 reduction 3 increase,VietGAP,…)	47.4
Guide measure to prevent and treat pestilent insects and diseases	49.1
Transport paddy from field to storehouse	1.8
Keep paddy in storehouse	1.8
Support in case of happened objective risks (natural disasters, diseases)	15.8
Others	3.5

[6] 3 reduction 3 increase: 3 reductions include reduction of used volume of rice seeds, fertilizers and pesticides. 3 increases include increase in rice yield, rice quality and economic effectiveness.
[7] 1 must 5 reduction: one must is must use certificated rice seed, 5 reductions include the reduction of used volume of rice seed, fertilizer, pesticide, water and reduction of post harvesting loss.

INTEREST OF LINKAGE TO MEMBERS AND COOPERATIVES

Interest to cooperative's members

The linkage between AC and rice trading enterprise brings several interests to cooperative members such as paddy is stably traded; producers are trained and guided in rice production; rice price and production profit is higher; producers receive advanced investments from enterprise and good quality of input (Table 8).

Table 9. Interest of cooperative's members in linkage with enterprises

Kind of interest	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Sustained sale of paddy	81.3	60.0	100.0	88.9	77.3
Rice price is higher than without linkage	33.3	60.0	66.7	33.3	22.7
Higher profit	35.4	80.0	100.0	22.2	27.3
Receiving support of fertilizers, seeds, plant protection chemicals	14.6	20.0	0.0	22.2	9.1
To be guided	45.8	60.0	100.0	55.6	27.3
To be advanced the cash without interest rate	35.4	20.0	33.3	55.6	22.7
To be provided input with ensured quality	39.6	40.0	66.7	55.6	22.7

33.3% of surveyed cooperatives mentioned that rice price is higher than non-linkage. Even the average level of higher is only about VND121/kg of paddy (higher about 2.2%), it is motivated for rice producers and compensate their additional work for respecting agreed rice production process. In several cases, rice producers break the contract by not selling their paddy to enterprises because the later do not invest in advance to producers and do not buy paddy with higher price.

The training, guidance to rice producers help increase rice productivity and reduce production cost, plus higher paddy price brings higher profit to cooperative members in the linkage with enterprises. The survey indicates higher profit of 9.4% in comparison to non-linkage cases.

Table 10: Higher level of paddy price and profit in linkage model in comparison to no linkage

Province	Higher amount of price (VND/kg)	Higher percentage of profit
Ca Mau	150.0	9.3
Bac Lieu	100.0	17.5
Soc Trang	175.0	7.3
An Giang	83.3	7.0
Total	121.4	9.4

Interest to cooperatives

The linkage with enterprise in rice production-buying model brings also several interests to cooperatives. The cooperatives have additional income from commissions paid by rice trading enterprise and input agent. The linkages help improve the cooperatives' role to their members, and improve the capacity of cooperative managers. The linkages require the cooperatives in guiding, supervising the production practices of their members. The cooperative managers are responsible in negotiating with partners or have to look for ways to mobilize the capital or enlarge the cooperative's services to members. All of these support the cooperative managers improve their capacity throughout "learning by doing" method.

Table 11. Interest of cooperative in linkage with enterprises

Kind of interest	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Have income paid by rice trading enterprises for cooperative responsibility in the linkage	47.9	60.0	66.7	27.8	59.1
Have commission paid by input agents	27.1	40.0	66.7	11.1	31.8
Enlarging activities of AC	8.3	20.0	0.0	5.6	9.1
Improved role of AC to their members	68.8	80.0	100.0	88.9	45.5
Capacity of AC managers is improved	54.2	80.0	100.0	50.0	45.5

DIFFICULTIES OF COOPEARTIVES IN LINKAGE MODEL

The ACs also encountered some difficulties in the linkage with rice trading enterprises. The reason is mainly mentioned is that the enterprises do not buy the paddy with higher price than the market price. The next reason is that the farmers do not comply with the contract. The survey results showed that more than 10% of members did not respect their commitment to contracted enterprises. They sell their paddy to non-contracted enterprises and several HHs do not repay for the investment enterprises in advanced production inputs. Twenty-five percent of cooperatives mentioned their difficulty, as they did not receive public support. The complexity of technical process is the difficulty of 8.3% of those surveyed cooperatives. Examples of difficulties mentioned include cases of applying the GlobalGAP or that rice producers are required not to use some pesticides that normally the producers use before the participation of linkage model.

Table 12. Difficulties of cooperatives in the linkage with enterprises

Unit: % cooperatives

Type of difficulty	Total	Ca Mau	Bac Lieu	Soc Trang	An Giang
Technique process is complicated	8.3	0.0	0.0	11.1	9.1
Members do not respect signed contract (sell their paddy to non-contracted buyers)	20.8	20.0	0.0	16.7	27.3

Enterprise does not buy paddy at price higher than market price	33.3	0.0	0.0	27.8	50.0
Not be supported	25.0	40.0	66.7	16.7	22.7
Other	8.3	20.0	33.3	5.6	4.5

Note: percentage is calculated only on the number of cooperatives that do not have the linkage with enterprises.

CONCLUSION

The model of rice production-consumption linkage related to LSRF promoted by Vietnamese government aims to improve the competitiveness of Vietnamese rice in the world market throughout higher quality, stabilize rice supply and ensure the income of rice producers. The result of survey of 80 agricultural cooperatives in the Mekong delta region shows that:

- Forty-two percent of cooperatives applied LSRF and 54.4% cooperatives have linkages to enterprises in rice production and consumption. However, only 30.3% of cooperatives applied both rice production in LSRF and joint production – consumption linkage with enterprises.
- Fifty-eight percent of cooperatives do not apply LSRF model. There are several reasons, but two main reasons are that i) rice parcel of cooperative's members are alternated with rice field of non-members (55.6% cooperatives); and ii) Cooperatives do not find out the enterprises that want to engage in a contracted linkage (37.8%).
- Seventy-seven percent of cooperatives that do not have contracted linkage to enterprises said the reason for non-linkage is they do not find out the partners for signing rice-buying contract.
- The rice trading enterprises play a determined role for the participation of agricultural cooperatives in rice production in LSRF and joint production-consumption model. However, several reasons for very limited involvement of trading enterprise in linkage model are that they need a big capital, additional cost to buy paddy, difficulty in finding the market for linked rice while it's very difficult for them to benefit supporting policy of government.
- Sixty-five percent of ACs that they have linkages received investments from these enterprises. The enterprises often advance money or seed rice, fertilizers, pesticides for farmers through ACs. Enterprises would decide the seeds sowed, besides, enterprises have to pay more for Acs a commission from 20VND – 200VND/kg of rice in order to Acs implement the linkage in production under collective rice production process.
- Acs implementing the linkages received support from the State, mainly in the form of training course on applying sustainable farming techniques. However, the rate of Acs received seed rice, fertilizers and pesticides was very low.
- Cooperatives most find it difficult in terms of linkage model with enterprises are as the enterprises do not buy paddy with higher price and cooperative's members do not sell their paddy to contracted enterprises.
- In the linkage with enterprises, the farmers receive several interests as provided ensured and high quality of rice seeds, fertilizers, pesticides; be trained about technical process and guided in practices and stable market for their paddy.
- Implementing production under LSRF associated with the linkage brought higher average profit of about 9% compared to without linkage because of the application of sustainable farming processes that helped reduce manufacturing costs and increase selling prices. In addition to higher profits, 90% of ACs appreciated stabilizing of rice for their members.
- The agricultural cooperatives also have interest in the linkage with enterprises. The cooperatives have more income, improve their role to members, enlarge cooperative's activities, and improve the capacity of cooperative's managers.

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PERFORMANCE OF RICE INDUSTRY IN INDIA: POTENTIAL OPPORTUNITIES AND CHALLENGES

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ABSTRACT

Rice is an important component of the agri-value chain, and a life-line for the livelihood of billion rural Indians. India's rice sector has been transformed significantly with the increase of rice production by 250% and yield by 230% between 1971 and 2015. There is a wide variation in the growth of the rice sector across ecosystems as well as states. India became a leading rice exporter in the world with the worth of US $ 9 Billion-an increase in export of basmati rice by four times and non-basmati rice by 3 folds in 2015 over 2005.

About 80 to 85% of rice farmers are small and marginal. Nearly 75% of India's rice production is marketable surplus-largely generated by irrigated rice farmers in the north and south Indian states as well as large farmers in other parts of the country. The marketing system for rice has huge network that purchase paddy from farmers. Nearly 85-90% of the total rice production is domestically consumed in the form of cooked and steamed rice. Thus, rice value chain is largely confined to drying at farmers' level, and milling and bagging at millers and traders' level. Total value of rice value chain in India is estimated at only US $ 71 Billion, which is only 7.4% of the gross agri-value chain. In case of basmati rice, value chain has been developed considerably during the past decade. However, there is a huge potential to promote rice based products through modern value chain in view of rising demand for processed and packaged foods, driven by rapid urbanization, feminization, diet diversification and increase in incomes of middle class consumers in urban areas. Thus, promotion of rice value addition on large scale will generate huge employment opportunities for youth besides increasing farmers' income.

Key words: *Rice, India, value chain, marketing*

INTRODUCTION

Rice is a life-line for food and nutritional security of a majority of 1.30 billion Indians. It is also a vital source of livelihood, directly or indirectly, for a majority of the 0.86 billion rural Indians. In particular, rice is the principal crop and the staple grain in the eastern, north-eastern and the southern states of India, and it is an important commercial crop in the north-western states of Punjab and Haryana where wheat is the staple grain. Rice farming is still considered as subsistence activity in about 60% of India's rice area, dominated by rainfed ecosystem (eastern, north-eastern, and central regions). About half of the small and marginal farmers of eastern and north-eastern states produce rice mainly for their household consumption with little marketable surplus. However at national level, nearly 75% of rice production is considered marketable surplus, largely generated in the north and southern regions as well as by large farmers in other parts of the country (Government of India, 2016). Increasing productivity and profitability of the whole rice value chain is always a priority in India's development policy in order to improve rural livelihood, ensure an adequate supply of rice at affordable prices, and earn foreign currencies from rice exports.

India's paddy rice production increased from 63 to 158 million tons between 1970 and 2015–an increase of over 150%. Yield improvement contributed 84% to this increase while area expansion contributed only 16% (Janaiah and Faming, 2010). The rice production and productivity increased tremendously since the early 1970s, after the introduction of genetically improved high yielding varieties (HYV) during the mid-1960s. The widespread adoption of high-yielding varieties (HYVs) as well as crop and farm management practices; policy support to improve irrigation facilities, market infrastructure, and the supply of chemical fertilizers and agricultural credit; subsidies on farm inputs; and farmers' enthusiasm to adopt HYVs were the major drivers of the impressive growth in production and

productivity of rice in India (Janaiah *et al*. 2005; 2006). Within rice, the biggest success has been in the improvement of total factor productivity, the development and adoption of climate-smart varieties, vertical integration of value chain actors, and transformation of the *basmati* rice industry. As a result, India became one of the leading rice exporters in the world market today.

Although the Indian agriculture sector achieved astounding success over the past four decades, agri-value chain and agribusiness in India is yet to be transformed from primary stage to a modern industry level. Agri-processing and value addition is expanding recently in high-value food items such as fruits, vegetables, fish, etc. India's rice sector has a huge potential to generate high value products through modern value chain in view of its large size in terms of area and production. Further rapid urbanization, industrialization, feminization, and diet diversification towards high value processed foods due to increase in income levels are creating substantial consumer demand for value-added rice products.

In this context, this paper attempts to discuss with empirical evidences in four parts, (a) an overview of performance of rice sector, (b)brief description on nature rice farming, (c) marketing channels and value chain, and (d) conclusion.

RICE SECTOR PERFORANCE

Rice accounts for 35% of the total cropped area and 42% of the total production of foodgrains in India (Table 1). Between 1971-73 and 2013-15, rice's share in the total foodgrains slightly increased in area but remained virtually same in production. The national aggregate values, however, disguise a large variation in production environments across Indian states and regions. The data show that the contribution of rice to total foodgrains production varies enormously across regions and states (provinces) of the country depending on the agroecological conditions. In the humid tropics of the northeast (e.g., Assam and West Bengal) and the coastal regions of the south (e.g., Kerala), rice accounts for over 90% of the total area and production of foodgrains. Rice is also the principal crop in the humid subtropics of southern Bihar, Odisha and eastern Madhya Pradesh (MP), and in the sub-humid subtropics of northern Bihar and eastern Uttar Pradesh (UP). In these regions, farmers have little choice but to grow rice during the hot and humid monsoon season. The top three rice producing states are West Bengal, UP and AP (including Telangana), which together contribute 40% to India's rice production (Table 1).

Table 1. The relative importance of rice in total foodgrains area and production, by state, India, 1971-73 and 2013-15.

		Rice's share in total foodgrains				
		1971-73			2013-15	
		Area	Prod.		Area	Prod.
Zone/State		(%)	(%)		(%)	(%)
East zone						
	Assam	92	94		92	96
	Bihar	52	53		51	52
	Odisha	77	83		81	92
	W. Bengal	82	84		87	89
North zone						
	M. Pradesh	27	32		29	28
	Maharastra	11	25		14	26
	U. Pradesh	23	21		30	30
West zone						
	Gujarat	9	11		21	23
	Haryana	7	12		29	25
	Punjab	12	13		44	40

South zone						
	A. Pradesh	35	65		56	66
	Karnataka	16	35		17	30
	Kerala	95	98		99	99
	Tamilnadu	53	77		51	62
All zones						
	Others	8	17		10	14
	India	31	41		35	41

Source: Data from Ministry of Agriculture, GOI (2017 and previous years).
Notes:

- Foodgrains include milled rice, wheat, maize, coarse grains, and pulses.
- Andhra Pradesh includes Telangana; Bihar includes Jharkhand; Madhya Pradesh includes Chattisgarh; and Uttar Pradesh includes Uttarakhand.

Paddy rice production at the national level increased from 63 to 160 million tons between 1971-73 and 2013-15—an increase of 2.3% per year (Fig. 1), which is higher than the growth rate of population during the same period. Yield improvement was the major contributor to this production growth. The yield growth contributed 84%, while the area growth contributed only 16% to this production growth (Fig. 2). The paddy rice yield increased from 1.7 to 3.6 t/ha over the last four decades. The higher growth rate of rice production than population led to substantial increase in per capita rice production. Per capita paddy rice production increased from 108 kg to 126 kg from the early 1970s to the late 1990s, despite 70% increase in the country's population in the same period. It decreased in the early 2000s, but again stared rising since the late 2000s reaching 128 kg in 2013-15. The substantial increase in per capita rice production resulted in an adequate supply of rice at affordable prices, which was instrumental to improve national food security, reduce poverty, and uplift rural livelihoods.

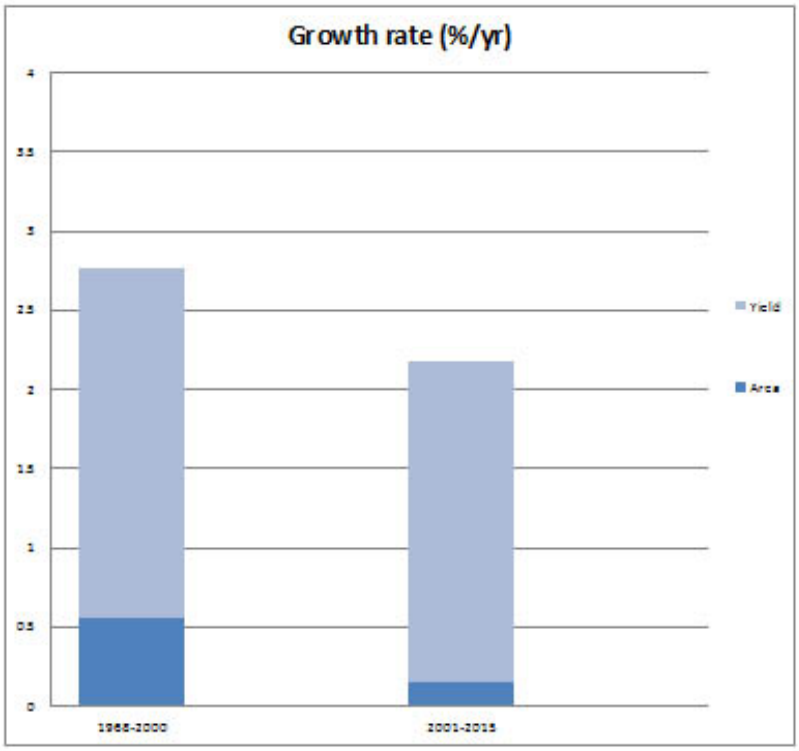

Fig. 1. Growth aate in area, production and yield during early and late green revolution periods in India

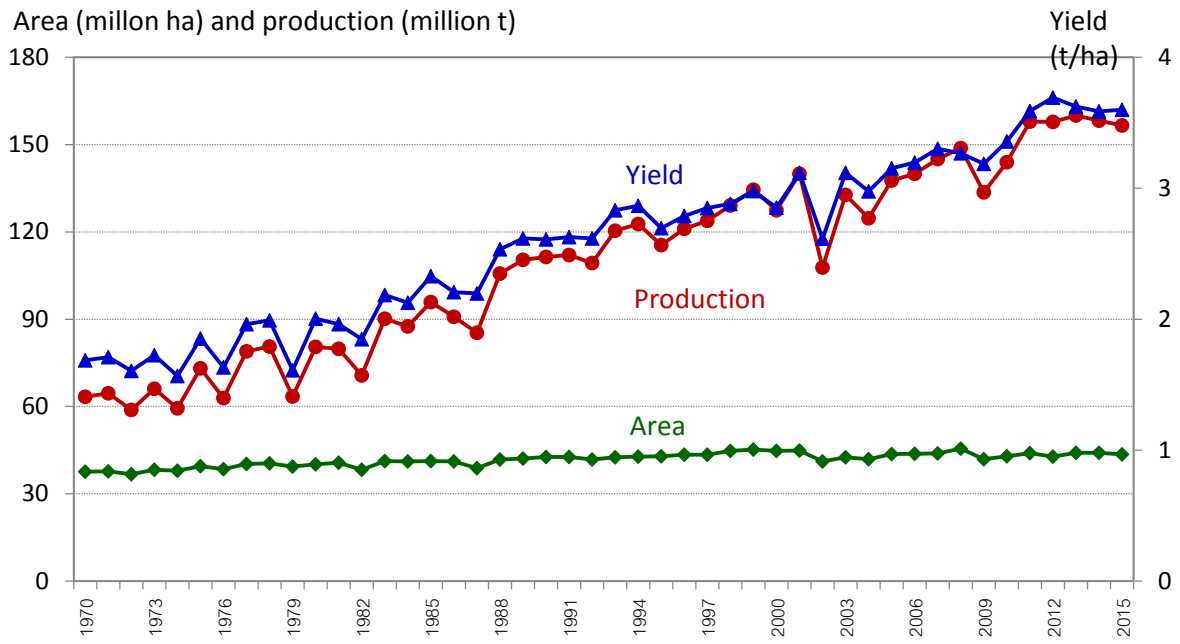

Fig. 2. Trends in rice (paddy) area, production, and yield in India, 1970-2015.

Source: Data from Ministry of Agriculture, GOI (2017 and previous years).

The national level aggregate values mask a large heterogeneity in rice area, yield, and production across the Indian states. Rice yield has increased significantly in all states over the past four decades, although the magnitudes of increase vary considerably. In the early 1970s, Paddy rice yield across states ranged from 1.1 to 3.2 t/ha (Fig. 2) during the early 1970s. The northern states of Punjab and Haryana and southern states of Andhra Pradesh (AP), Karnataka, Kerala and Tamil Nadu had relatively better irrigation infrastructure and quickly started adopting the green revolution technologies (Table 2). As a result, these states achieved a substantially high yield (over 2.0 t/ha) even in the early 1970s. After four decades in 2013-15, paddy rice yield across states ranged from 2.2 to 5.9 t/ha. Paddy yield is about 4.0 t/ha or above in West Bengal, Punjab, Haryana, and all major rice growing southern states. But the yield is still considerably lower in many other states, especially the eastern Indian states (Fig. 3).

Table 2. Input use intensification in rice farming, by state, India, 1970-2013.

	Rice irrigated area (%)			Rice area under high yielding varieties (%)			Fertilizers use per hectare of gross cropped area (NPK, Kg/ha)	
Zone/State	1985-87	2012-14		1970-72	2008-10		1975-76	2013-14
East zone								
Assam	23	11		10	65		2	65
Bihar	36	46		8	66		13	165
Odisha	33	33		6	79		7	98
W. Bengal	24	47		13	94		17	131
North zone								
M. Pradesh	20	34		9	45		5	84

Maharastra	30	26		17	94		14	127
U. Pradesh	37	85		19	79		21	149
West zone								
Gujarat	53	65		14	87		15	120
Haryana	99	100		23	50		19	179
Punjab	98	100		63	99		52	217
South zone								
A. Pradesh	95	97		26	98		31	227
Karnataka	59	74		16	87		20	136
Kerala	43	76		31	91		22	121
Tamil Nadu	90	93		77	87		39	154
All zones								
Others	45	55		21	54		9	85
India	44	60		19	79		17	131

Source: Data from Ministry of Agriculture, GOI (2017 and previous years).
Notes:

- Andhra Pradesh includes Telangana, Bihar includes Jharkhand, M. Pradesh includes Chattisgarh, and U. Pradesh includes Uttarakhand.

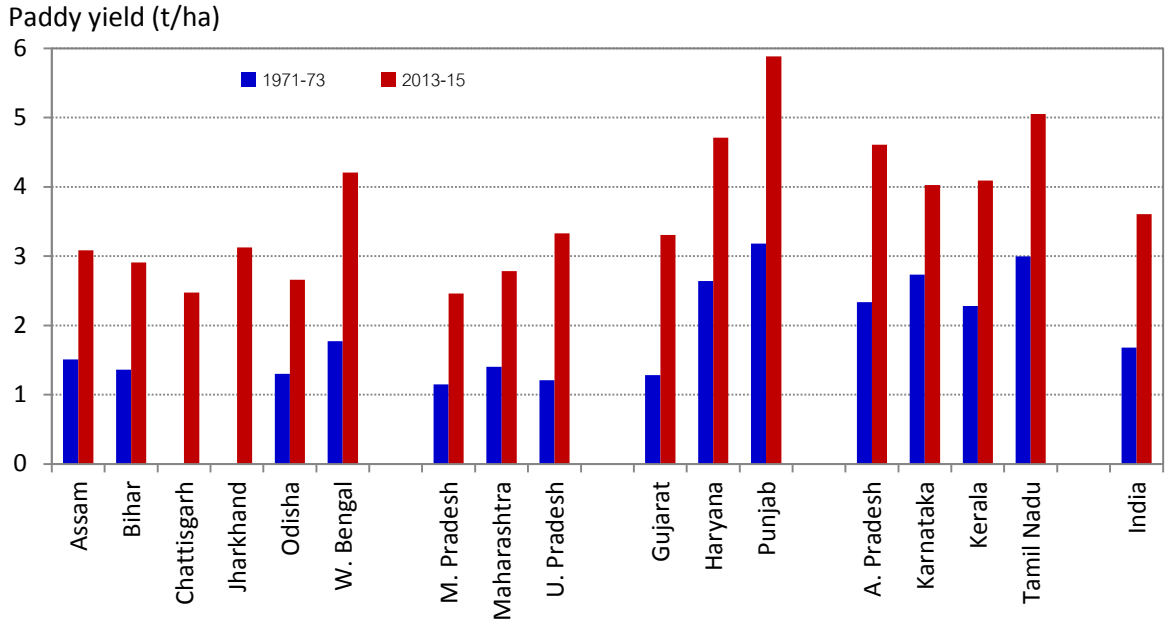

Fig. 3. Trends in paddy rice yield in major rice growing states, India, 1971-73 and 2013-15.

Source: Data from Ministry of Agriculture, GOI (2017 and previous years) (2015).

During the first decade of GR (i.e. 1960s), rice production growth was limited to regions with already developed irrigation infrastructure, such as AP, Haryana, Karnataka, Kerala, Punjab, and Tamil Nadu, where farmers quickly adopted HYV suitable for the irrigated ecosystem (Janaiah *et al.*, 2006). In the early 1970s, rice yield had been already high, exceeding 2.3 t/ha in these states (Fig. 3). In Punjab and Haryana, both rice area and yield increased spectacularly that led to a production increase of 250% in Punjab and 180% in Haryana from the early 1960s to the early 1970s. In

the traditional rice bowls of eastern India, the diffusion of new technologies started only in the 1980s with (a) the expansion of small-scale groundwater irrigation that allowed farmers to grow HYVs during the dry season (*boro* rice) and manage monsoon failures during the wet season with supplementary irrigation, (b) the availability of intermediate height HYVs that are suitable for the shallow and medium flooded, poorly drained land that constitute an important sub-ecosystem in these states. As HYVs started spreading in eastern India, the regional aggregate rice yield growth rate jumped from virtually 0 to 4.1% per year and rice production growth rate jumped from 0.1 to 4.7% per year from the 1970s to the 1980s. Across states in eastern India, the rice yield growth rate was negative in all states except West Bengal in the 1970s, but rice yield picked up and maintained in the order of 0.6 to 5.5% per year in the 1980s (Table 3).

Table 3. The decadal growth rate of area, yield, and production of rice, by state, India, 1970-2015 (% per year).

	1970-79				1980-89				1990-99				2000-15		
Zone/State	A	Y	P		A	Y	P		A	Y	P		A	Y	P
East zone															
Assam	1.5	-0.9	0.6		0.5	0.6	1.1		0.1	1.0	1.1		-0.1	2.7	2.6
Bihar	0.5	-0.2	0.3		0.3	3.8	4.1		0.1	4.3	4.4		4.1	6.6	10.7
Odisha	-0.9	-0.5	-1.4		0.4	3.5	3.9		0.2	-1.5	-1.3		-0.7	2.9	2.2
W. Bengal	-0.1	0.8	0.8		1.1	5.5	6.6		0.5	1.9	2.5		-0.6	1.1	0.5
North zone															
M. Pradesh	0.9	-4.0	-3.1		0.4	1.7	2.0		0.7	-0.9	-0.1		0.4	5.0	5.4
Maharastra	1.7	5.0	6.7		-0.1	-0.6	-0.7		-0.7	2.1	1.4		0.1	1.9	2.0
U. Pradesh	1.3	0.3	1.6		0.0	5.5	5.5		0.9	2.2	3.1		0.1	1.2	1.3
West zone															
Gujarat	0.3	3.8	4.1		0.4	-0.6	-0.2		2.0	1.7	3.7		2.1	4.3	6.4
Haryana	6.4	4.3	10.7		2.4	-0.1	2.2		5.9	-1.7	4.3		2.1	1.1	3.2
Punjab	11.7	5.2	17.0		5.3	1.3	6.5		2.5	0.0	2.5		1.0	0.7	1.7
South zone															
A. Pradesh	1.9	2.2	4.1		0.5	1.9	2.5		0.5	1.1	1.7		0.7	0.6	1.3
Karnataka	-0.1	1.5	1.4		0.4	-0.1	0.2		1.7	1.9	3.6		-0.2	0.8	0.6
Kerala	-1.1	0.6	-0.5		-4.2	1.2	-3.0		-5.7	0.7	-5.1		-4.0	1.9	-2.1
Tamil Nadu	0.2	0.2	0.5		-2.0	5.8	3.8		1.1	0.6	1.7		-0.1	1.2	1.1
All zones															
Others	2.0	1.5	3.5		-0.1	0.8	0.7		0.5	0.7	1.2		0.7	1.6	2.3
India	0.9	1.0	1.9		0.4	3.1	3.6		0.7	1.3	2.0		0.0	1.8	1.8

Source: Data from Ministry of Agriculture, GOI (2017 and previous years).

Notes:

- Abbreviations: A-area, Y-yield, and P-production.
- Andhra PradeshBihar includes Jharkhand, M. Pradesh includes Chattisgarh, and U. Pradesh includes Uttarakhand.

The additional rice production over the past four decades came mostly from the non-traditional rice growing states and the irrigated ecosystem in the traditional belt. During 1970–2013, India's paddy area increased by 6.1 million ha and paddy yield increased by 2.0 t/ha, which together lead to a production increase of 95.4 million tons (Table 4). The share of different states to the national rice production changed considerably during that period. It decreased from 40 to 35% in the eastern zone, increased from 20 to 26% in the northern zone, increased from 4 to 16% in the western zone, and decreased from 33 to 21% in the southern zone. Of the incremental rice production over the past four decades, the eastern states contributed 31%, the northern states contributed 30%, the western states contributed 23%, and the southern states contributed 14%. Punjab's share in the national rice production was only 2% in the early 1970s, but this increased to 10% in the early 2010s. Punjab contributed 16% to the incremental rice production over the past four decades (Table 4). Punjab benefitted the most from the green revolution in rice farming as it had developed reliable irrigation infrastructure and enterprising farmers with a relatively large size of farm holdings (Table 2).

Table 4. The relative importance of rice area and production, by state, India, 1971-73 and 2011-13.

	Rice area and production						Share of states to all India				
	1971-73			2013-15			1971-73			2013-15	
	A	P		A	P		A	P		A	P
Zone/State	(Mha)	(Mt)		(Mha)	(Mt)		(%)	(%)		(%)	(%)
East zone											
Assam	2.0	3.1		2.5	7.6		5	5		6	5
Bihar	5.1	6.9		4.7	13.9		14	11		11	9
Odisha	4.6	6.0		4.1	10.9		12	10		9	7
W. Bengal	5.1	9.0		5.5	23.0		14	14		12	15
North zone											
M. Pradesh	4.5	5.2		5.8	14.4		12	8		13	9
Maharastra	1.3	1.9		1.6	4.3		4	3		4	3
U. Pradesh	4.5	5.5		6.2	31.1		12	9		14	20
West zone											
Gujarat	0.4	0.6		0.8	2.6		1	1		2	2
Haryana	0.3	0.8		1.3	6.1		1	1		3	4
Punjab	0.5	1.5		2.9	17.1		1	2		7	11
South zone											
A. Pradesh	3.1	7.3		3.8	17.5		8	12		9	11
Karnataka	1.1	3.0		1.3	5.1		3	5		3	3
Kerala	0.9	2.0		0.2	0.8		2	3		0	1
Tamil Nadu	2.7	8.2		1.8	9.3		7	13		4	6
All zones											
Others	1.3	2.3		1.6	5.2		3	4		4	3
India	37.6	63.2		43.9	158.3		100	100		100	100

Source: Data from Ministry of Agriculture, GOI (2017 and previous years).

Notes:

- Rice production value refers to rice quantity measured in paddy form.
- Abbreviations: A—area, P—production, Mha—million hectares, and Mt—million tons.
- A. Pradesh includes Telangana, Bihar includes Jharkhand, M. Pradesh includes Chattisgarh, and U. Pradesh includes Uttarakhand.

Rice exports

India is a traditional exporter of a special quality rice, *basmati* to the Middle East, Europe and USA. However with the substantial increases in production of rice-both *basmati* and non-*basmati* rice- after mid-1990s, India became a leading rice exporter in the world during the recent past. At present, rice accounts for about 20% of total India's agriculture exports in terms of value. India is mainly exporting rice into two categories such as *basmati* rice and n*on-basmati* rice. Sella Rice, Steamed Rice, and Pusa Rice are the different types of rice that are exported under *basmati* rice category. While Parboiled Rice, Broken Rice, Sella Rice, Swarna Rice and Sona Masoori Rice are the types that are exported under non-*basmati* Rice category. The export of *basmati* rice has significantly increased from about one million tonnes to about 4 million tonnes during the past ten years (Table 5). Similar quantum jump was registered in the export of non-*basmati* rice by 2.5 to 3 times increase during the same period. Total rice export from India during 2014-15 was all-time record, i.e. about 12 million metric tons, which is about 30% of global rice exports. The total value of rice exports during 2014-15 was approximately US 9 Billion, of which the share of *basmati* rice was about 56%. In 2015-16 and 2016-17, *basmati* rice exports have increased by about 10% over previous years, but non-*basmati*

rice exports have declined after 2014-15 (Table 5). The Indian *basmati* rice and non-*basmati* rices have fetched price of US $ 1010 and 413 per metric tons respectively in the world rice market during 2016-17.

Table 5. Rice exports from India during 2004 - 05 to 2014 -15

(Quantity in million metric tonnes)

Year	Basmati	Non-Basmati	Total
2004-2005	1.163	3.615	4.778
2005-2006	1.167	2.922	4.089
2006-2007	1.046	3.702	4.748
2007-2008	1.183	5.286	6.469
2008-2009	1.556	0.932	2.488
2009-2010	1.217	0.140	1.357
2010-2011	2.371	0.101	2.472
2011-2012	3.178	3.998	7.176
2012-2013	3.460	6.688	10.148
2013-2014	3.757	7.019	10.776
2014-2015	3.702	8.274	11.976
2015-2016	4.047	6.373	10.420
2016-2017	4.104	6.815	10.915

Source: Government of India (2010, 2018)

Up until the early 1990s, Pakistan dominated the world *basmati* rice market, but significant increases in production due to improved technologies and farm management practices, upgrading of postharvest systems (drying, storage, milling, and processing), improved value addition (packaging and branding), and wider marketing brought success to the Indian *basmati* industry and has made India the leader in the world *basmati* rice market today. Favorable trade policy and licensing procedures for agricultural exports, private-sector efforts to promote rice exports, and the zeal of basmati rice exporters to establish themselves as reliable suppliers contributed to the success of the Indian *basmati* industry. Like-wise, surplus production of high-quality non-*basmati* rice varieties such as Samba Masuri and Jyothi made India to increase overall rice exports during the past one decade. However, there has been a wide fluctuations in the export quantity of non-*basmati* rice over the period (Table 5) due to fluctuations in domestic supply, and uncertain government trade policy on foodgrains exports.

NATURE OF RICE FARMING

Rice is widely grown by nearly 120 million farmers in total cropped area of 43 million hectares. About 80-85% of rice farmers are small and marginal whose average farm size is less than one hectare. Rice farming for these small and marginal farmers is subsistence in nature in rainfed areas who produce rice mainly for domestic consumption with little marketable surplus. However rice is emerged as a commercial crop under irrigated areas of north and south Indian where farmers produce paddy mainly for market. In India, about 85 to 90% of total rice production is consumed domestically.

Rice is cultivated under diverse production environments i.e. irrigated ecosystem, rainfed ecosystem and deep-water condition , which accounts for 56%, 38% and 6% of rice land area in India. Rice is mainly grown in wet season (June to Nov) accounting for about 70% of rice area while dry season (Dec -April) occupies remaining 30% where

assured irrigation is available. . Farmers harvest about 5 to 5.5 tons/ha of paddy yields during wet season under irrigated ecosystem. In dry season under irrigated condition, paddy yield is about 20-25% higher than in wet season. Under rainfed and deep-water conditions, farmers get average paddy yield of only 3 to 4.5 tons/ha.

Farmers follow transplantation method of crop establishment mainly under irrigated ecosystem, where farmers use 20-25 days old seedlings from paddy nursery for transplantation. In general, farmers follow zig-zag method of transplantation (not line row method). Broadcasting of three to four days old sprouted paddy seeds is a common method under rainfed upland areas where paddy yields are low. Farmers use 100 to 120 kg of nitrogen, 40-60 kg of phosperous and 40 to 50 kg of potassium per hectare in three to four splits in different form. The use of organic manures and fertilizers has declined over the period due to substantial reduction in livestock population in rural India. Nearly 85 to 90% of India's rice is now covered with high yielding varieties (HYVs). Hybrid rice coverage in the farmers' fields is very meagre, i.e. less than 3% of total rice area. In India, total of about 1200 HYVs and hybrids were developed and released by various R&D institutions over the past five decades. However, the 30 most popular HYVs covered in 75% of rice area in India (Janaiah and Hossain, 2005). On an average, farmers replace paddy seeds with newly purchased certified seeds once in three to four years; i.e. seed replacement rate is about 25 to 33% in India (Janaiah and Debdutta, 2016). Paddy farmers adopt integrated pest and disease management practices against major insect pests such as stem borer, brown plant hopper, leaf folder, gall midge, etc and major diseases such as blast, bacterial leaf blight, sheath blight, tungro, etc. Rice farming in India including under rainfed areas is largely mechanized as farmers use modern machinery for ploughing and puddling (tractors, power tillers), irrigation (pump-sets), transplantation (transplanters only in some areas), and harvesting, threshing and winnowing (mini and combine harvesters and threshers). In many rice areas, farmers follow chemical weeding. Increasing labour shortage for farming and decreasing livestock in rural India are two key reasons for increased mechanisation and chemicalization of rice farming in India. At present, cost of producing one metric tonne of paddy rice under irrigated input intensive areas is about US $ 200 to 250, while it is about 150 to 180 in rainfed regions.

MARKETING CHANNELS AND VALUE CHAIN

An efficient marketing with value chain is crucial for transforming the rice sector into an industry mode. Rice farming is a subsistence activity for half of the small and small farmers under rainfed rice areas whose marketable surplus is small portion of their rice production. Large quantity of marketable surplus of rice is generated in the southern and north Indian states. At national level, 75% of paddy production is marketable surplus, largely generated in the irrigated regions of south and north Indian states as well as by large farmers in other parts of the country (Government of India, 2016). Most of the marketable paddy surplus is sold out by farmers in the form of paddy after drying and bagging. Small and marginal farmers sell their produce after retaining required quantity for their home consumption to local village traders at relatively lower price right at the threshing yard. Large and medium sized farmers whose marketable surplus is substantially more sell paddy to rice millers or supply formal public agencies at higher price. In either case including *basmati* rice farmers (except contract farmers of few big companies), paddy farmers sell only paddy after very little value addition except drying and bagging. About 90% of paddy marketable surplus is marketed through the various channels. There is a huge public sector managing and marketing network in India with many agencies and institutions, which were set up in the 1960s and 70s. There are four forms of marketing channels through which paddy farmers sell their surplus paddy in India.

Public sector marketing agencies

The State Civil Supplies Corporation (SCSC) at state level and Food Corporation of India-FCI at the national level are two major public sector agencies that procure paddy rice through direct purchase centres mainly in surplus regions of the north-west and southern states. These agencies also procure rice (milled) through rice millers to maintain central buffer stocks. An important issue is that most of these agencies are old and not modernized in lines with demand. Nearly 25 to 30% of total marketable surplus of paddy rice is procured through these agencies. Farmers get paid government's fixed minimum support price (MSP) for their produce from agencies. However the operation of these agencies is very limited or even absent in the eastern, north-eastern and some central Indian states.

Regulated Markets (Agril. Market Committees):

There are about 8000 regulated markets and 32,000 rural and wholesale markets with government-controlled committees are functioning in the country. These markets are managed by farmers' representatives and financially self-sustained because; these markets collects 1% of farm produce values as a cess from purchasers, and use this income for market development. All transactions between farmers and licensed traders in these markets are monitored and regulated by respective State Department Officials in order to avoid malpractices and to facilitate fair trade through open auction method. All types of farmers especially medium and large farmers who were out of reach of FCI and SCSCs purchase centres bring their paddy to these markets for selling. Farmers may get competitive price in these markets as open auction method is followed by licensed traders to buy paddy from farmers. This price may less or more than MSP depends upon supply-demand situation on day to day basis. These markets purchase 30 to 35% of total marketable surplus of paddy in the country.

Women elf-elp roups

There are 12 million Women Self-Help Groups (WSHGs) in India, formed by village women themselves with the support of government and rural financial institutions over the past two decades. They are functioning as gross root level institutions especially for empowerment of rural women. Recently, these WSHGs are permitted in southern states to buy paddy directly from the farmers on behalf of State Civil Supplies Corporation, and millers for which Rs 1 per bag of 70 kg will be paid to WSHGs as a commission. About 3 to 4 million tons of paddy procured by WSHGs mainly in south Indian states.

Open Market (Village traders)

In addition to above channels, a large numbers of traders are buying farm produce from farmers and sell it to the millers. Most of these traders are village level business people, money lenders, etc who often lend loans to the small and marginal farmers with a condition that farmers sell their produce to these traders. Most of small farmers usually sell their produce to the village traders, which accounts for 30 to 35% of total marketed surplus. Generally, farmers get paid relatively lower price by the local traders.

Value addition

The value addition in rice sector is largely confined to drying and bagging of paddy at the farmers' level, milling, cleaning and separation at millers' point, and bagging with different sizes of quantity at wholesale point. In case of exportable *basmati* rice, some registered companies have contracts with farmers and provide required technical advises and quality seeds to farmers to produce quality basmati rice. These companies involved in grading, cleaning, packing and branding in order to meet requirements of global rice markets. There are about 100 different registered companies engage in rice trading of in India-both for export and domestic markets. These companies also started grading, packing and branding of quality non-basmati rice for providing to the high income consumers through different super markets and big retailers. Unlike earlier, rice in small packages of various sizes, varying from one to 25 kg are now available with brand names in some big retailing malls in urban areas. But the share of packaged and branded rice in the total rice sales to consumers is meagre, i.e. less than 10%. However demand for branded and packaged rice is increasing in urban India. Historically, the Indian consumers eat rice in the form of cooked and steamed rice. Rice-based processing industry is very small in India, and confined to only few rice based products for occasional consumption.

At present, only 5 to 6% of total farm output is passing through modern value chain and processing in India. Thus, the gross value of agri-value chain (both inputs and outputs is estimated at only US$ 960 Billion, although the value of raw farm output is about US$ 400 Billion. Rice is an important component of agri-value chain in India. The value of paddy rice accounts for about 8% of total value of raw agriculture output in India. Nearly 85-90% of rice production is consumed domestically, largely in the form of cooked/steamed rice. Therefore the share of rice-based products in the dietary system is negligible, however it is increasing in recent years. Thus, the gross value of rice value chain is only about US$ 71 Billion, of which share of value addition is only 28% (wholesale and retail traders' share), and -54% is for farmers' share (farm-gate price) and by-product value is 18%. The share of rice value chain in the India's agri-value chain is only 7.4%.

The opportunities for promotion of modern value chain rice are plenty in view of growing consumer demand for processed and value added rice products. Some key challenges that confront the expansion of the rice value chain are (a) small farm size of rice farmers, (b) inadequate institutional and infrastructure, (c) lack of modern milling and processing methods, (d) low yields, (e) weak quality regulation, and (f) traditional food habits of rice consumers-preferences.

CONCLUSION

Rice is a life line for India's food and nutritional security, and source of the rural livelihood for half billion people. With the introduction of green revolution led high yielding varieties coupled with input uses and government's policy support, rice production has increased by 250% and yield by 230% between 1971 and 2015. The irrigated regions of north and south Indian performed better in rice sector during the 1970 and 80s while the rainfed areas in eastern, north-eastern and central Indian states have picked up to increase rice yields after mid 1980s. As a result, about 10 to 12 million tonnes of exportable surplus-both *basmati* (4 million tons) and non-*basmati* (8 million tons) rice- was generated after meeting domestic consumption requirements. India became leading rice exporter in the world today worth of US $ 9 Billion-an increase in export of *basmati* rice by four time and non-*basmati* rice by 3 folds in 2015 over 2005.

Rice is grown by about 120 million farmers under diverse ecosystems across India, of which 80 to 85% are small and marginal. Farmers follow different methods of crop establishment with improved seeds of HYVs and other inputs, varying from one ecosystem to other. Nearly 75% of India's rice production is marketable surplus-largely generated by irrigated rice farmers in north and south Indian states as well as large farmers in other parts of the country. The marketing system for rice has huge network-both under public and private sector-that purchase paddy from farmers. Nearly 85-90% of total rice production is domestically consumed in the form of cooked and steamed rice. Thus, rice value chain is largely confined to drying at farmers' level, and milling and bagging at millers and traders' level. Total value of rice value chain in India is estimated at only US $ 71 Billion (58% of it is raw paddy value), which is only 7.4% of gross agri-value chain. In case of *basmati* rice, registered companies provide considerable services to contracted farmers for maintain quality of produce through various value addition activities. However, there is a huge potential to promote rice based products through modern value chain in view of rising demand for processed and packaged foods, driven by rapid urbanisation, feminisation, diet diversification and increase in incomes of middle class consumers in urban areas. Rice farmers' income cannot be increased in future without promotion of value addition and rice based processing. At present, farmers' get market price of only US $ 200 to 250 per ton of raw paddy without any value addition. If C-3 category cost of production is considered (includes all operational costs, imputed value of own family labour and rental value of land, interest on fixed capital and depreciation on farm equipments), farm-gate price of paddy is nearly same as C3 costs (Government of India, 2017). Further, promotion of rice value addition on large scale will generate huge employment opportunities for youth besides increasing farmers' income. The key challenges constraining rice value chain are traditional food habits, lack of modern infrastructure, presence of large number of small and marginal farmers in rice sector, etc.

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CASE STUDY OF BANK FOR AGRICULTUREAL COOPERATIVES (BAAC) RICE VALUE CHAIN IMPLEMENTATION

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ABSTRACT

This paper focuses on BAAC's participation in the public private and farmer sectors and their assistance in farming and marketing for farmers' produce through cooperatives society. It will also discuss the "Fair Care Share" idea that was recently implemented to provide assistance throughout value chain (upstream to downstream). The Agriculture Marketing Cooperative (AMC) plays a very important role in working together with the rice farmers, collective buying and marketing of rice and its byproducts.

Key words: rice, marketing cooperatives, Fair Care Share, agricultural banks

INTRODUCTION

Bank for Agriculture and Agricultural Cooperatives (BAAC) in Brief

Historical background

Bank for Agriculture and Agricultural Cooperatives (BAAC) was founded to replace the former Bank for Cooperatives under the enabling act of 1966 as a government-owned financial institution to enhance agricultural production through the provision of financial services to the farmers. It has steadily developed as a major agricultural financial institution in the rural area with the support of the government and international donor agencies. Now it is recognized as one of the few successful examples of the Specialized Financial Institutions (SFIs) in Thailand as well as agricultural development bank in Asia and the developing world.

BAAC like other Specialized Financial Institutions (SFIs) was established by acts of Parliament and owned by the Thai Government. It was originally established to achieve certain government policy objectives, such as promoting loans to farmers. However, its activities have been expanded to cover commercial banking services as taking deposit from the general public, which made up the biggest source of BAAC operating fund. According to the enabling act, BAAC's mission is to provide financial assistance to farmers, farmer associations and agricultural cooperatives. In addition to the new law amendment, BAAC can expand its service to individuals, groups, entrepreneurs, village funds and communities, organizations established with objectives to support farmers or communities and all kinds of cooperatives for the following purposes:

1. To undertake farm, farm related and non-farmed activities;
2. To undertake other activities to increase income;
3. To develop agricultural knowledge to increase income or to improve quality of living of farmers or their families; and

4. To invest in ventures intended to promote or support agricultural activities to increase income or improve quality of living.

The success of BAAC is based on the achievement of the dual objectives of maximizing outreach to millions of farm households as its target client and at the same time maintaining its financial viability and the sustainability of its operations and services. As of 2018, BAAC had an extensive rural network of 75 provincial offices and 962 branches throughout the country which provide services not only financial services but also of uplifting the quality of life of people in the rural areas. BAAC has shown its achievement on maximizing outreach to millions of farm households as its target clientele and at the same time maintaining its financial viability and sustainability

Vision

"To be a secured rural development bank with modern managerial technology focusing on the upliftment of small-scale farmer's quality of life"

Mission

To become a full-fledged rural development bank, BAAC has adopted a major four-fold mission as follows:

- To render credit services while providing fair opportunity and make sure that clients are able to attain production efficiency;
- To focus on development and service provision so as to enhance clients' improved quality of life;
- To locate funding sources with reasonable cost that would be sufficient to fund all of the bank's obligations and make sure that funds are administered with security; and
- To originate and develop new services in line with clients' needs and increase the number of easily accessible service points without unnecessarily putting more financial burden on clients.

Farm products marketing

Since BAAC started its operations in 1966, the credit operation was restricted to cash only. The loans extended to farmers were sufficient for seasonal production expenses, carried low interest, and fair terms and conditions compared to local private moneylenders. The loans provided by BAAC were used mainly to acquire farm supplies from local merchants. Under this method, some farmers were cheated because some merchants supplied inferior quality farm supplies at high prices.

In general, most Thai farmers practice agriculture at the whim or climatic elements. As a result, crop yields can rarely be estimated in advance, and are invariably low. In addition, agricultural products rarely attract high prices, and also prices fluctuate depending on the season or quantity.

In 1972, BAAC initiated a loan product pilot program to prevent forced selling of paddy by farmers at time of depressed market conditions. Under the program, shortly after harvesting season, farmer clients were given loans secured by the pledge of paddy, thus, enabling them to hold up their paddy for a better market. There was no client shall be given a loan exceeding 80 % of the market value of the product pledged with the bank.

In 1974, BAAC, in order to cope with fertilizer crisis, had provided financial assistance to agricultural cooperatives so as to cooperate with the Ministry of Agriculture and Cooperatives (MOAC) in acquiring and distributing scarce fertilizers for their members at reasonable prices. Moreover, the bank provided a constantly expanding credit services to both agricultural cooperatives and farmer associations for acquisition of sufficient farm supplies for their members.

Furthermore, the bank cooperated with related government agencies in formulating agricultural development projects of which long-term credit were not indispensable, included storage facilities and marketing of farm products of agricultural cooperatives project.

In 1980, BAAC introduced the credit-in-kind system by acting as intermediary in providing farm supplies to its farmer clients. Most of the farm supplies were provided directly from producers or dealers. By this system, the BAAC could supervise and assist client farmers to have good quality farm supplies at reasonable prices, the credit-in-kind system has been used for almost ten years and it has been appreciated by the client farmers. In 1988, the volume of business peaked at THB 3,500 million or 16 % of the total credit disbursed.

However, the credit-in-kind system could not overcome all of client farmers' problems. It is true that, with credit-in-kind, the client farmers can get good quality farm supplies at reasonable prices. But for farm product marketing, they still depend on the private local merchants where the rate of exploitation is high, for example they offer low prices, they cheat in weighing the produce and insist on unfair payment or delivery condition. So, in 1984, the BAAC started to launch the farm products collection program by encouraging and supporting the client farm products. BAAC has assisted its clients in negotiating with buyers on prices, delivery and payment procedures.

The BAAC has also set up tripartite marketing agreements between buying companies and farmers, which the bank undertakes to ensure fairness by the other two parties. With this system, the client farmers have an opportunity to learn how to market their farm products. At present, some farmers are advanced enough to undertake bargaining and to set up marketing conditions by themselves. The governments also supported this marketing system by providing a grant to BAAC for the construction costs of regional Farm Product Marketing Centers (FPMC) at Nakhon Sawan, Suphanburi, Khon Kaen, Sakon-Nakhon and Roi-Et. Now many provincial governors have expressed interest in having an FPMC in their own provinces. Most of the farm products marketed in the Marketing Centers was paddy.

Financial innovation and marketing linkage

Client farmers need to handle the business of farm supplies and farm product marketing on their own. Formerly, the job of supplying farm inputs to farmers and supporting the farm product collection scheme were undertaken by the BAAC credit officers. The BAAC attempted to encourage farmers to form themselves into informal groups called farmers clubs or "Chom Roms," where the client farmers develop the potential to act collectively and provide some level of assistance in the development of both pre-harvest and post-harvest management of farm products. These groups have been successful to some extent because of the membership of each club is only 50 - 60 families. With the small number of members their bargaining power are still weak.

After doing farm supplies and farm product marketing business for some period of time, the client farmers realized that they should have their own organization to manage farm supply inputs and farm product marketing. Thus, most of the farmers agree in principle in the idea of forming themselves into formal groups to handle the activities of securing farm inputs, to get credit on reasonable terms, to absorb new farm technologies and to market their farm products. With the encouragement of BAAC, and supported by the Cooperative Promotion Department and Cooperative Auditing Department, the client farmers have discussed and seen the possibility to organize their own societies, in the form of the Agricultural Marketing Cooperatives (AMC), where their problems of farm product marketing can be overcome. These AMCs could also get assistance from BAAC. So in 1989, the client farmers in Chiang Mai Province set up their own organization which was the ever first AMC in Thailand.The AMC's have the following objectives: to help the client farmers to have their own society to take responsibility for farm supplies purchasing and farm product marketing; to cooperate with the concerned government agencies and the private sector In solving problems and promoting the procurement of farm supplies and farm product marketing; to act as an intermediary in extending new farming technology to the client Farmers to improve their living standards; to help the client farmers to gain fairer terms in purchasing farm supplies and in farm product marketing; to help the client farmers

to gain access to a wider range of farm product marketing channels; to help the client farmers to gain mare experience and ability to operate their own businesses in the near future and so that can keep up with the dynamic changes in farm produce marketing mechanisms; and to take responsibility for the farmers 'general welfare.

Structural Organization of the AMCs movement

The AMC movement can be classified into four levels as follows:

Level	Organization
1. National level	The Thai Agribusiness Co, Ltd.
2. Provincial level	AMC
3. District level	AMC branch
4. Sub district/village	service center/coop shops

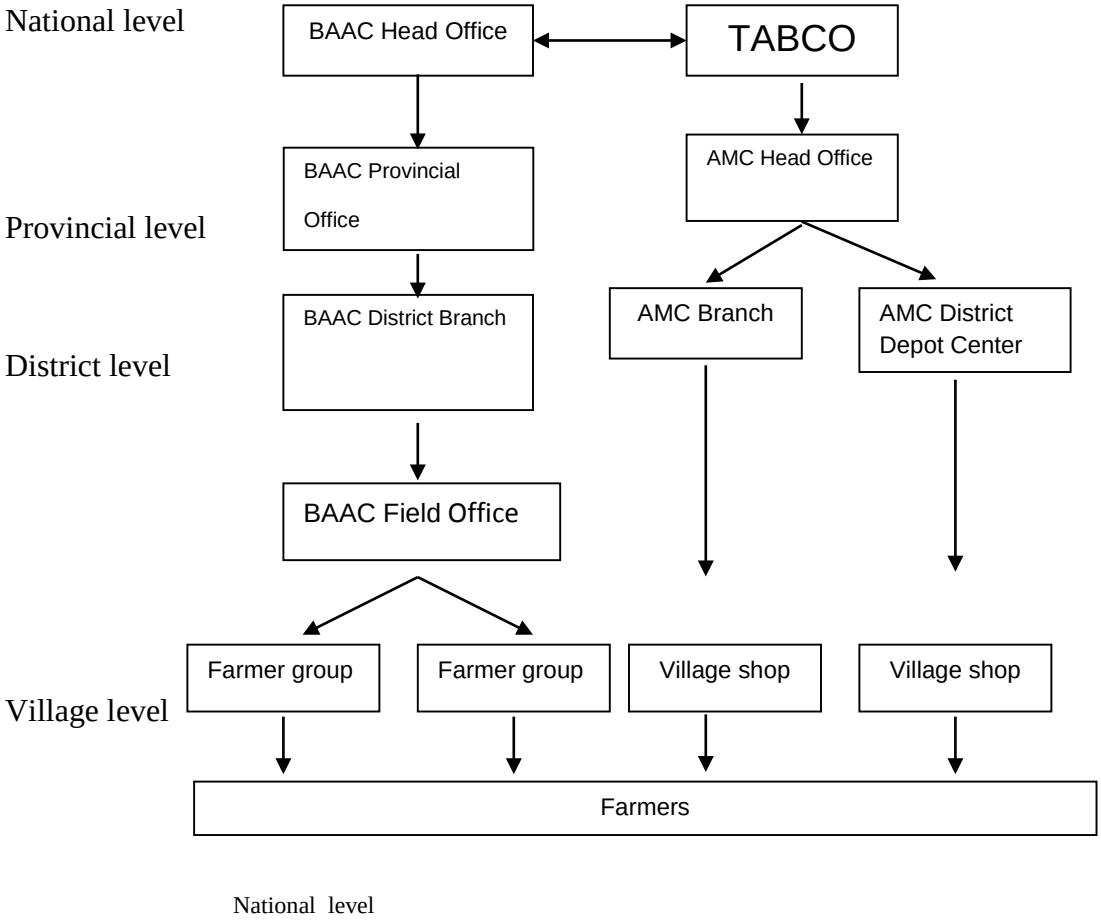


Fig. 1. The relationship between AMCs and the apex organization

The Apex organization of the AMCs is the Thai Agribusiness Company Limited (TABCO) registered July 2, 1992. Since 1989, BAAC cooperated with the related government agencies to support the client farmers to organize themselves into cooperative societies. At the beginning, a total of 64 associations were created over the whole

kingdom of Thailand. As the AMC is a society at the provincial level, each AMC does its own business with the local merchants on farm supply purchasing and farm product marketing. Because the volume of business is small, the AMC could not have enough bargaining power to negotiate with the local merchants.

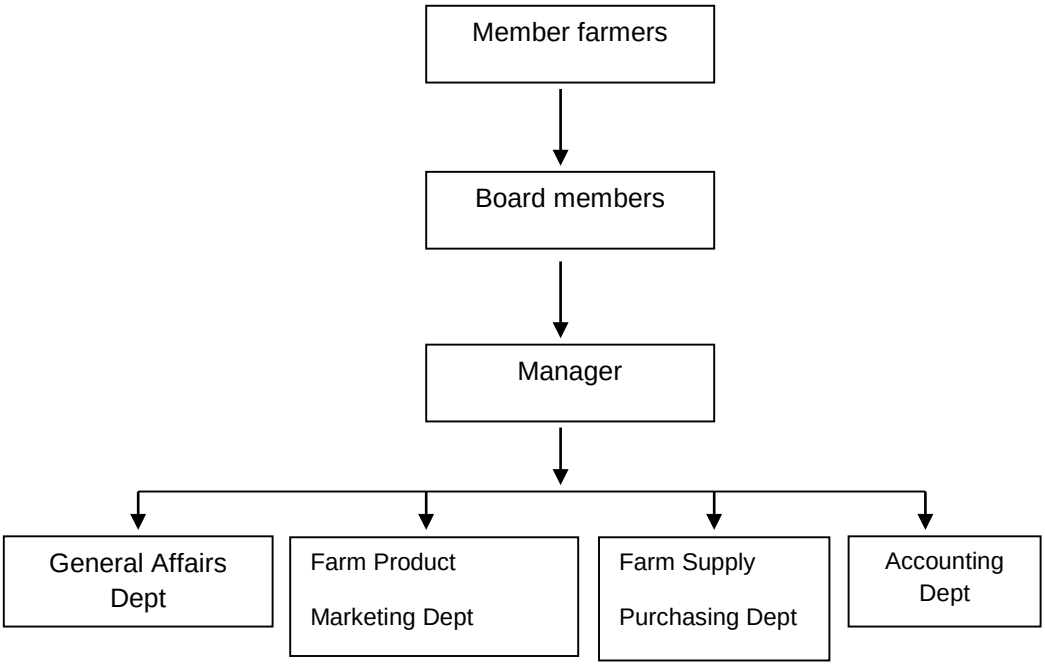
To gain a greater volume in both farm supply purchasing and farm product marketing, all the AMCs nation - wide have joined together and set up their apex organization. BAAC encouraged them to establish a joint venture company registered in the name "Thai Agribusiness Company Limited" or TABCO. There are 120 million registered shares, of which 90 % are held by AMCs and the remaining 10 % are paid up by BAAC. TABCO's functions are:

- to supply both domestic and imported farm supplies, consumer goods and to provide service to the AMCs;
- to perform coordination among the AMCs to exchange their farm or non- farm products, to collect farm products of the AMCs for domestic marketing and exporting;
- to provide management services to the AMCs, such as staff recruitment, supplying capable personnel;
- to provide training services to the AMCs, both its employees and board members; and
- to provide social security and services to the AMC members,
- to purchase or construct farm processing factories as joint ventures with the AMCs ; and
- to provide other activities as requested by the AMCs.

Provincial level

The AMC is a society at the provincial level, but because its members are scattered all over the province, the AMC set up branches at the district level in order to provide better services to its members.

At the provincial office, the board members are composed of at least 15 farmers who determine their business operation policies.



The main functions of AMCs are to:

- supply farm inputs, consumer commodities and other necessities to their members;
- collect farm products of the members for marketing or processing;
- promote new farming technologies and better living standards among its members;
- provide social security to its members; and
- be a marketing information center for its members.

District level

At the district area, the AMCs have set up branch offices for rendering service to their members. The sub-committee is composed of at least five farmers (two must be board members) who will set guidelines for business operations for the Branch manager. At the end of each month, the financial report of the branch office must be submitted to the AMC.

Village shop

To provide convenience supplies of goods and service to their members at the village level, the active members are encouraged to establish village shops which can get consumer goods and farm supplies from the AMC. In case the shop has not enough cash to pay for goods it is eligible to get up to 50,000 Baht in credit from the AMC.

BAAC's Finance Change

For more than 52 years, BAAC has been in the forefront as the only active agricultural financing bank in Thailand. Passing by the financial crisis in 1997, rural development emerged as the critically important element for economic growth and poverty reduction in the country. Thailand is one of the leading developing countries in the region to adopt strategies that require sustained and appropriate attention focused on reform in investments for agriculture and rural communities.

BAAC is geared to operate within the changing environments such as: broad macro-economic changes, competition in banking and financial markets and natural phenomenon that create both new opportunities and threats. The changing environment which demands BAAC to change its policies and programs.

As institutions like BAAC grow, interaction and communication expand among link agencies, communities, partner organizations and other institutions related with the activities of the Bank.

Paradigm shift in the management strategy

BAAC is on the verge of a paradigm shift in the management strategy as a development bank. Fulfilling our long-term vision and mission "to be a modern rural development bank with the objective of enhancing the quality of life of farmers and rural people", (Modernize, Country-minded and Rural Oriented) keeping in view natural resource management and environmental impact is far beyond BAAC's traditional role as purveyor of credit services only. The value chain finance (VCF) was new approach which introduce to BAAC by FAO became a new solution for fulfilling BAAC vision. The paradigm shift in the development management requires structural reforms, operational changes

and institutional strengthening and diversification. BAAC is serious in fulfilling its role in meeting these challenges together with integration of collaboration among players in the Value Chain.

THE RICE VALUE CHAIN

Thailand is a major producer and exporter of rice in the world. By the Office of Agricultural Economics forecast Production situation in the year 2560/61, it was predicted that 58.96 million rai (1 Acre is equal 2.529 Rai) will be cultivated as paddy fields. This will produce approximately 24.07 million tons of paddy. (Forecast: Data from the Agricultural Information Development Board, 2017).

The price situation in 2018 is expected to increase. The world rice output has fallen to 483.47 million tons last year, up 486.73 million tons. (US Department of Agriculture data, 2017). And rice stocks in government projects fail. As a result, the price of paddy rice in the year 2017/18 was higher. The price of jasmine paddy (15% moisture) sold by farmers Baht 15,500 / ton (Thai Rice Mill Association, 2017)

The above figures for the rice situation were significantly different from 2015. At that time the price of jasmine paddy (15% moisture) was Baht 11,000/ton. This was due to many variable factors such as Thai Government stock of rice was still very high, world economic situation weren't so healthy and high competition in rice production of neighboring countries. This situation forced Thai farmers to sell their paddies at a lower price than the loan program. However, the Royal Thai Government launched "Prolong rice sales project" to help the farmers and farmer institutions to keep the paddies in their warehouses and sell when the price of paddy turn higher.

Along with Thai Government Prolong rice sales project, BAAC also introduced "Rice Management by Farmer Institution to Support the Prolong rice sales project" This initiative concept came from BAAC through the farmer institutions especially Agricultural Cooperatives and other farmers institutions such as farmer groups, community enterprises to collect good quality of paddy from farmers which keep their paddy under the Prolong rice sales project. After that BAAC invited Agricultural Cooperatives and AMCs to transformed paddy into rice and pack under the brand of "A-Rice". The high quality rice packed has distribution branch offices and Agriculture Cooperatives chain for ready to sell to the consumers.

The objective of Rice Management by farmer institution is to support the Prolong rice sales project according to the following:

- To raise the price of paddy, increase farmers' income, and also link to the BAAC's Project Based;
- To Promote Farmer Institutions to mill paddy to Rice under the brand of 'A-Rice Certification' in which increase value and distribute marginal income return to Farmers;
- To manage the paddy from the Prolong rice sales project of Thai Government;
- To introduce high quality rice and fair prices for consumers.

OPERATION METHODOLOGY

Invite Agricultural Cooperative (Coop), Agricultural Marketing Cooperative (AMC), Farmer Community Enterprise and Farmer Institution to participate in the program. These farmer institutions can purchase paddy from two sources of paddy as follows:

- Buying paddy under the Prolong rice sales project according to BAAC loan program. The farmers' paddy is able to keep in their own warehouse or farmers institute's warehouse. The farmers or cooperatives who participate in this project request to sale their paddy after 1 month or when the price is higher than the price at

the beginning of harvest season. The farmers or cooperatives can sell paddy according to the price which is equivalent or higher than the credit limit specified in the loan program's criteria.

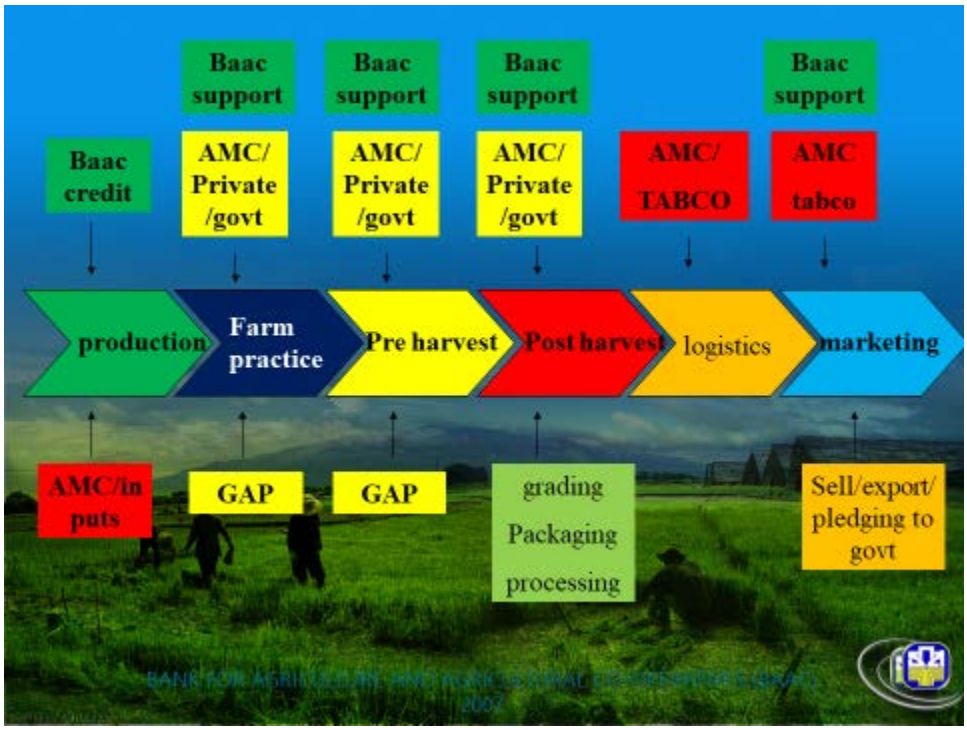
- 3.1.2 Bidding from the rice paddies of the loan program. After the repayment period.

Agricultural Cooperatives (Coops), Agricultural Marketing Cooperatives (AMC), participated in the program, can be approved to mill paddy into rice pack in various sizes according to the market needs.

Agricultural Cooperatives (Coop), Agricultural Marketing Cooperatives (AMC), who participated in the program distribute rice pack through Thai Agribusiness Co., Ltd. (TABCO) and then distribute to distributors/sellers such as BAAC branches nationwide, Bank Agency, Community Enterprise, and Modern Trade. Moreover BAAC introduce E-Commerce system and registered distributer nationwide. This project contributes the benefits which are:

- Fair to farmers who can sell paddy according to credit line, which is higher than market price.
- 2) Fair to consumers who buy Jasmine rice with A-Rice quality certification at fair price.
- 3) Fair to farmers' institutions and farmer organizations that can effectively operate the VCF. In the downstream jasmine rice has a reasonable return.
- 4) Fair to the public sector to allocate budget support.

Project results



Cooperate with the Ministry of Agriculture and Cooperatives, BAAC has accomplished on improving the quality of life of farmers by integrating cooperation among various networks on the basis of supporting, sharing and fairness. This coordination is creating "Public Private People Collaboration: PPPC". This PPPC is focussed on every step of activities from the upstream, middle stream to downstream. This means that BAAC supported the whole rice production to the marketing process. As the result, BAAC can solve the problem of production, gathering, processing and other related processes in the production process for farmers.

Focus on players on activities from upstream to downstream, the role and responsibility of every players are as follows:

- Upstream Activities "Public Private and People Enhances Productivity"

Associated with various government agencies and private sectors, the upstream activities was aimed at promote and increase the efficiency of rice cultivation. By using good seed which supplied by Department of Agricultural Extension and sold in local shop own by Agriculture Marketing Cooperatives (AMC). This local shop of AMC is certified by Department of Agriculture (DOA) and give Q shop certificate as standardize agricultural input provider shop. In addition to the public sector, there are private parties also participate by promote and educate the use of agricultural technology. To increase the efficiency of planting, maintenance and harvesting of rice.

- Middle stream Activities "Private and People manufacturing and distribution"

BAAC promoted farmers and communities together with Community Enterprise to collectg paddies and sell to Agricultural cooperatives and AMC. These Agricultural cooperatives and AMC were selected to perform as Mill operator and making rice packs. After that BAAC and other AMCs perform as distributor of rice products to the market. In this section related agencies such as Chamber of Commerce in each province, Department of Internal Trade, The Ministry of Commerce help these farmers' organizations to share the benefits in fairness manner.

- Downstream Activities "Private Channel Marketing to Consumers"

To promote rice in the project, A-rice is sold through various channels of the private sector who participating in the project. Some of them are also sold to the E-Commerce system of the BAAC on the site named. www.fromfarm.xyz

"PPPC" is part of the BAAC's long-term strategic plan.

In 2015, 1.56 million tons of paddies from farmers' families, 390,674 households, and 12,500 tons of A-rice bags were distributed to consumers. As a result of the project's effectiveness, the BAAC Board of Director has made this project a part of the BAAC's long-term strategic plan. Continued to upgrade the quality of life of farmers. And to create a competitive edge for the Thai rice industry in the future.

CONSUMER VALUATION OF CULTURAL HERITAGE: ESTIMATING THE VALUE OF CORDILLERAN "HEIRLOOM RICE" THROUGH THE GASTRONOMIC SYSTEMS RESEARCH (GSR) APPROACH

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ABSTRACT

The Cordillera Administrative Region in the Philippines is famous for rice terraces where indigenous people grow diverse traditional rice varieties, through which they preserve their culture. For these people, rice grains are heirlooms. However, triggered by poverty, mass emigrations lead to abandoned rice terraces and potentially to the disappearance of their cultural heritage. The Philippine government sees the popularization of traditional "heirloom" rice varieties among non-traditional consumers as a vehicle to improve farmers' livelihoods and food security, to preserve traditional practices that lend value to these rice varieties, and to conserve the Cordilleran cultural heritage. Heirloom rice is marketed as a high-end niche product. In this study, we estimated the value urban consumers place on cultural heritage by exposing them to a visual and auditory experience of heirloom rice culture preservation and by eliciting their willingness-to-pay for substituting their preferred rice with heirloom rice. We tested loss and gain information framings and assessed potential penetration of heirloom rice through the gastronomic systems research (GSR) framework.

Shoppers from the middle- to the high-income classes (N=136) attended an experimental auction in a supermarket in Metro Manila. These consumers were segmented according to their preference towards brown or white rice. Results indicate that 15% of white rice consumers were willing to substitute their preferred rice with heirloom rice and this market share increased to 30–38% after exposure to the cultural heritage preservation experience. White rice consumers exposed to the positive narrative were willing to pay significantly higher price premiums than those who did not receive information. Meanwhile, 39–42% of brown rice consumers were willing to substitute with heirloom rice but they were generally not affected by stories on rice cultural heritage preservation; the treatments did not affect their average valuations of heirloom rice. For both consumer types, the negative narrative generated larger discounts for heirloom rice.

These results suggest targeted marketing approaches to promote heirloom rice: by directly promoting heirloom rice through a gain information frame story on cultural heritage preservation or by first promoting the health benefits of brown rice consumption and then increasing the availability and visibility of heirloom rice as an alternative to standard brown rice.

Keywords**:** experimental auction, willingness-to-pay, heirloom rice, cultural heritage preservation

INTRODUCTION

The rice terraces found in the heart of the Philippines' Cordilleran Administrative Region (CAR) are world-famous man-made tourist destinations. In the CAR, communities of indigenous people have been able to preserve their cultures due to their isolation, as a response to Spanish colonization and the influx of lowlanders (Acabado and Martin 2015). A tangible example of the culture being preserved, aside from the rice terraces, is the diverse set of traditional

rice varieties that thrive in the environmental conditions of the Cordilleras. These varieties are deeply embedded in cultural and social practices such that these are traditionally considered as heirlooms, as these are passed on from one generation to the next (Santiaguel 2010). Despite the richness of their cultural heritage, residents in the CAR are some of the poorest in the country (Philippine Statistics Authority 2015); within the region, farmers are notably among the poorest (Guieb 2016). This has resulted in rural-to-urban migration, which is limiting the supply of agricultural labor needed to maintain the rice terraces (https://whc.unesco.org/en/list/722). As the rice terraces fall under disrepair, the traditional rice varieties that are being cultivated there through the centuries are also in danger of becoming extinct.

To improve the livelihoods of farmers and to preserve the rice terraces and the cultures of the indigenous peoples living in the CAR, the Philippine government and social entrepreneurs have begun enhancing the market engagement between CAR farmers and outsiders through the commodification of these CAR traditional rice varieties. In this sense, the concept of "heirloom" no longer just connotes inheritance within communities and families; rather, it has been transformed into a credence attribute (Glover and Stone 2017) that can add value to the rice varieties sold to non-traditional consumers of these rice varieties.

Currently, "heirloom rice" has found a niche in the export market (Estigoy 2010, Comanda 2015, dela Cruz 2015) but is not widely available locally in the Philippines. Heirloom rice is mostly sold as a high-end product. In order to determine market penetration potential of heirloom rice, it is important to understand (1) how much value the concept of cultural heritage adds to these varieties; and (2) how the story of preserving cultural heritage needs to be communicated to consumers to demonstrate and to capture this value.

To formulate culture-sensitive and context-specific narratives that may enhance the consumption of heirloom rice by the target audiences, it was important to understand their rice consumption from a gastronomic systems perspective (Cuevas, de Guia *et al*. 2017); i.e., socioeconomic and cultural contexts dictate the occasions in which target consumers eat; these occasions then dictate the dishes that people consume; these dishes are defined by the ingredients and the cooking methods used to make these dishes. The gastronomic systems research (GSR) approach allows one to estimate potential market penetration of novel food products such as heirloom rice.

METHODOLOGY

Experimental auctions and contextualization of heirloom rice consumption

Experimental auctions (Rousu 2015) were conducted in October 2015 at Robinsons Place Pioneer Supermarket, following a two-benchmark endogenous endowment approach. Respondents (N = 136) were randomly recruited from a population of shoppers in the middle- to the high-income classes and aged 18–80. Those who were willing to participate were told that they would each receive 1 kg of rice for free after the experiment. Each experiment was conducted in Filipino and started with an animator presenting white and brown rice, both in 1-kg packages and as loose grain, to the respondent. The animator then provided cooked rice samples for the respondent to taste one at a time, allowing them to drink water in between samples. The respondents were then asked for their preference between white and brown rice; this was their "benchmark" rice. Raw and cooked samples of the same heirloom rice variety were then presented to the respondent for inspection and tasting, respectively. The respondents were then asked to think of occasions in which they would eat the heirloom rice to contextualize the product within the gastronomic system. Respondents were randomly assigned to information framing treatments (Aldridge 2006) as follows: (1) the *control* group was not provided with any information on cultural heritage preservation and heirloom rice; (2) the "*gain frame*" group was provided with information emphasizing the positive consequences of consuming heirloom rice on the preservation of the rice terraces and of cultural heritage of indigenous people in CAR; and (3) the "*loss frame*" group was provided with information on the negative consequences of not consuming heirloom rice on the rice terraces and on the culture of the indigenous people in CAR. The respondents were then asked which variety they preferred between their benchmark rice and the heirloom rice. They were then endowed with their non-preferred variety and

asked which price premium they were willing to pay to substitute their non-preferred variety with their preferred variety. The advantage of this experimental design over using a fixed benchmark is that it enables endogenizing the benchmark and eliciting both positive and negative willingness to pay to substitute brown or white rice for heirloom rice. Participants were told that their price premium was subject to an auction in which they were bidding against a randomly drawn price, whereby the respondents would pay the randomly drawn price if their bid was higher or equal to it in order to get their preferred rice. If their bid was lower than the randomly drawn price, they took home the non-preferred endowed rice (either the benchmark or the heirloom rice). At the end of the experiment, a short survey was conducted to collect socio-demographic information from the respondents.

Rice samples

White rice and brown (unpolished) rice samples were sourced from Robinsons Supermarket Pioneer, Mandaluyong City, Metro Manila, Philippines, the venue of the experimental auction. Heirloom rice varieties (unpolished) were procured from the Rice Terraces Farmers' Cooperative. Raw rice grains were placed in transparent bowls for visual inspection of respondents. On the other hand, rice samples were cooked using a 1:2 rice-to-water ratio (v/v) in rice cookers (Model RC-103, Asahi Electrical Manufacturing Corporation, Manila, Philippines). During the experimental auction, these rice samples were placed in sample cups and presented to the respondents monadically.

Statistical analyses

The price premiums were recorded as positive numbers for respondents who were willing to switch brown or white rice with heirloom rice and as negative numbers for respondents who were not willing to do the switch, but were willing to pay to substitute heirloom rice for brown or white rice. Descriptive statistics were calculated using MS Excel and R (version 3.3.2). Significance testing for continuous variables were conducted using the one-way analysis of variance (ANOVA) and the Kruskal-Wallis test (in R). Categorical variables were compared using Fisher's exact test (in R).

RESULTS AND DISCUSSION

Sociodemographic characteristics of the respondents

The participants of the experimental auctions belonged to the middle- to high-income classes (Table 13), based on a slight modification of the published income classification from the Philippine government (National Statistics Office 2014, Cuevas, Pede *et al*. 2016). The average age of the respondents was 41 years and each household had, on average, four members. Respondents estimated that they were purchasing 78 kg rice per capita annually at an average frequency of four times a month. We did not find any significant differences between the treatments for a set of continuous variables in both the brown and white rice consumer segments. Moreover, most of the respondents from the two groups were Filipinos and finished tertiary education. More than half of the respondents were female; likewise, more than half of them were married and were household heads. In both groups, the majority of the respondents were employees. Likewise, most of the respondents stated that they did not have hired cooks, and they were the primary shoppers in their households. Within the brown rice segment, more respondents who were exposed to the loss frame treatment preferred to purchase vacuum-packed rice than those exposed to the gain frame and to those not exposed to the information treatments (Table 13). Meanwhile, there were significantly more respondents who preferred white rice and were not exposed to the information treatment who obtained information from the television than those who were exposed to the loss frame treatment (Table 13). Results (not shown) also indicated that the respondents assigned to the different treatments, regardless of rice segment, did not show significant differences for the sociodemographic attributes considered in this study.

Experimental auctions

During the experimental auctions, it was determined that 53% of the 136 respondents preferred brown rice as their benchmark while the rest preferred white rice (Table 13), indicating that for this market segment, there is already a growing acceptance of brown rice. The latter may be due to Philippines-wide campaigns promoting its consumption as a more nutritious option to white, polished rice (Hunt, Johnson et al. 2002, Cuyno 2003, Javier 2004). Moreover, brown rice has been associated with reduced diabetes risk (e.g., Zhang, Malik *et al*. 2010).

The shift towards heirloom rice was most dramatic in the segment of white rice consumers (Fig. 1). Filipinos traditionally tend to prefer white rice for everyday consumption (reviewed in Del Mundo and Juliano 1981, de Leon 2005). It is associated with affluence, long product shelf-life, ease of preparation, and an acquired preference (Mojica and Reforma 2010). Of these consumers, 15% were readily willing to substitute white rice with heirloom rice in the absence of supplementary information on cultural heritage preservation. However, when they were exposed to a story on the negative consequences of not consuming heirloom rice on the rice terraces and on the culture of the indigenous people in CAR, this market share increased to 30% and further to 38% when the story was framed in a positive way, i.e. emphasizing the positive consequences of consuming heirloom rice on the preservation of the rice terraces and of cultural heritage of indigenous people in CAR. The positive story was further found to induce a significant increase in WTPs by USD 0.72, while the negative story did not have a significant impact (Fig. 2).

Table 13. Descriptive statistics of socio-demographic information of the respondents[a, c, e]

	Brown Rice					White Rice					All
	Control	**Loss**	**Gain**	**All[d]**		**Control**	**Loss**	**Gain**	**All[d]**		
Age (yrs)	41.23	41.27	46.21	42.90		36.00	36.96	41.71	38.22		40.70 (14.64)
Household size	3.77	3.86	4.17	3.93		4.25	3.65	4.33	4.06		3.99 (2.14)
Annual income (USD)[b]	17.051.73	17.590.54	25.409.38	20.002.25		25.774.75	21.358.76	30.273.56	25.663.93		22.666.57 (18.093.97)
Per capita purchase	78	79	87	81		81	72	71	74		78 (55)
Monthly purchase	4	3	3	3		6	4	4	4		4 (5)
Female (%)	50.00	59.09	70.83	59.72		60.00	52.17	47.62	53.13		56.62
Filipino (%)	100.00	95.45	100.00	98.61		100.00	91.30	95.24	95.31		97.06
Married (%)	69.23	63.64	50.00	61.11		35.00	60.87	61.90	53.13		57.35
Household head (%)	50.00	59.09	54.17	54.17		60.00	60.87	57.14	59.38		56.62
Primary shopper (%)	76.92	86.36	87.50	83.33		80.00	78.26	85.71	81.25		82.35
Hired cook (%)	7.69	13.64	16.67	12.50		10.00	13.04	28.57	17.19		14.71
Occupation (%)											
Self-employed	15.38	18.18	20.83	18.06		20.00	8.70	14.29	14.06		16.18
Education (%)											
Secondary	3.85	4.55	8.33	5.56		5.00	8.70	4.76	6.25		5.88
Preferred packaging of purchased rice (%)											
Loose	34.62	13.64	33.33	27.78		40.00	34.78	42.86	39.06		32.37
Information source about rice (%)											
Radio	7.69	4.55	0.00	4.17		10.00	0.00	0.00	3.13		2.45
N	26	22	24			20	23	21			136

[a] Means are presented with standard deviations in parentheses. Ranges across all treatments are indicated by the minimum and maximum values in brackets.
[b] The currency conversion rate during the experimental auction (October 25, 2015) was USD 1.00 = PHP 46.53 (source: https://www.exchange-rates.org/Rate/USD/PHP/10-26-2015)
[c] A different lowercase letter in superscript beside each mean indicates significant difference at α=0.05 for each row when comparing across treatments per market segment (brown and white rice consumers), based on the Fisher's exact test for vacuum-packed and television.
[d] A different uppercase letter in superscript beside each mean indicates no significant difference at α=0.05 for each row when comparing between market segments (brown and white rice consumers), based on the Fisher's exact test for pre-packed.
[e] The three treatments, regardless of rice market segment, did not have significant differences for the sociodemographic attributes considered in the study.

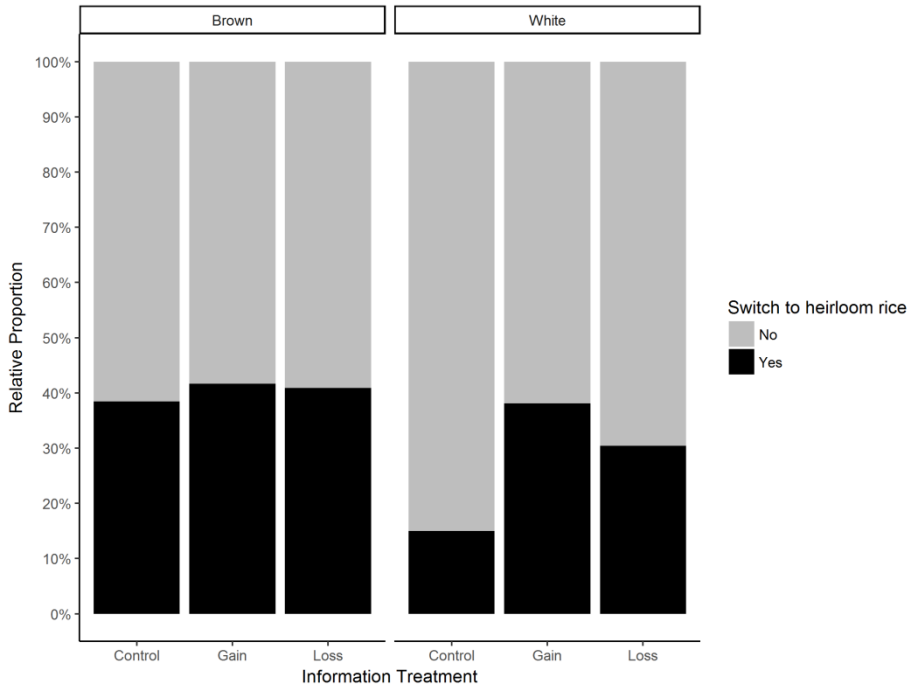

Fig. 1. Market shares of indigenous "heirloom" rice among urban consumer segments of brown and white rice before and after exposure to alternative framings of visual and auditory experiences on rice cultural heritage preservation (N = 136)

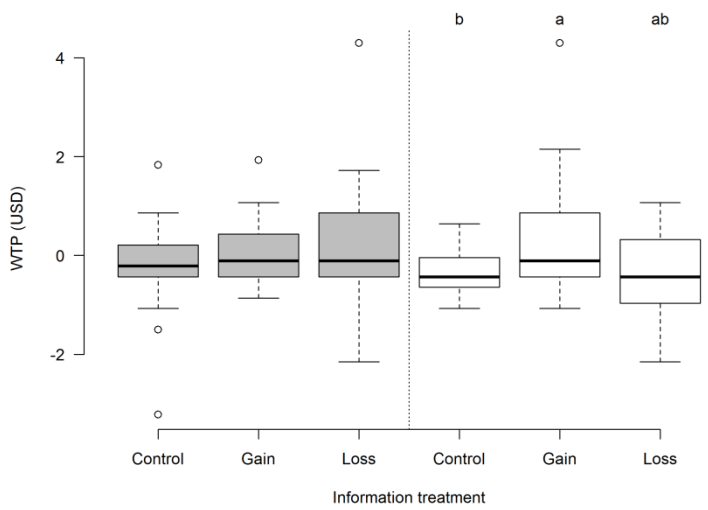

Fig. 2. Urban consumers' willingness-to-pay (WTP) for substituting brown (gray boxes) and white (white boxes) rice to indigenous "heirloom" rice before and after exposure to alternative framings of visual and auditory experiences on rice cultural heritage preservation (N = 136)

These results show that *social impact* and *experience* (conveyed through the information treatments in this study)—considered as evolving value drivers (Ringquist, Phillips *et al*. 2016)—appear to be at work in this more traditional market segment. More specifically, the results suggest that positively framed information provided increased premiums for heirloom rice. Perhaps, this market segment did not value nutritive benefits of brown rice as much as the respondents who preferred brown rice (Mojica and Reforma 2010). Perhaps, they were willing to switch to heirloom rice thanks to the positive feeling or the "warm glow" they received—generated by the positive story— from their conscious contributions towards the preservation of cultural heritage (Andreoni 1990).

Penetration of heirloom rice in the segment of brown rice consumers, in contrast, was higher; 39–42% of shoppers were willing to substitute brown rice with heirloom rice (Fig. 1) and these market shares were not significantly affected by information on cultural heritage preservation and information framing. Similarly, WTP averaged -USD 0.01, and was not significantly affected by exposure to information on cultural heritage preservation (Fig. 2). These market shares are close to the potential (maximum attainable) market share of traditional rice varieties in total rice consumption, which was estimated to be around 46.6% by experts, based on contextualizing the gastronomic system to Filipino dishes and occasions (Cuevas, de Guia *et al*. 2017). As a result, stories on cultural heritage preservation—no matter how they were framed—were not the right nudges to increase market shares even further in this consumer segment. These respondents were already consuming brown rice, perhaps because they were interested in the health benefits in the first place or because they wanted to differentiate themselves from white rice consumers (Mojica and Reforma 2010). Hence, promoting heirloom rice consumption to this market segment may need a different marketing strategy; perhaps including one that highlights the nutritive benefits of consuming heirloom rice.

It has been reported previously that loss aversion typically translates into higher WTPs when respondents are exposed to the messaging framed as a loss (reviewed in Oparinde, Birol *et al*. 2016). However, the experiments showed that WTP in both segments was more variable after exposure to the loss frame than in the other treatments (Fig. 2). This suggests that this message framing probably generated divergence among the respondents; thus, not clearly indicating if the respondents had loss aversion for cultural heritage and the rice terraces of the CAR.

Heirloom rice in the gastronomic system

Respondents indicated that heirloom rice has the highest market penetration potential through the consumption of rice-based dishes during lunch and dinner (Fig. **Error! Reference source not found.**). This finding is similar with results elicited from experts who put heirloom rice in the context of middle- to high-income urban rice consumers (Cuevas, de Guia *et al*. 2017). The market penetration for breakfast was not as high as for lunch and dinner (Fig. **Error! Reference source not found.**) because the frequency of breakfast as an eating occasion has declined over the years (Timlin and Pereira 2007), which could be attributed to the increasing opportunity cost of the meal preparer's time that comes alongside urbanization (Mason, Badiani et al. 2012). Special occasions occurred less frequently than lunch and dinner (Cuevas, de Guia *et al*. 2017); hence the limited market penetration for heirloom rice during these special occasions (Fig. **Error! Reference source not found.**). On the other hand, the respondents viewed *merienda* (snack) time as the least favorable time to switch to heirloom rice; though *merienda* occurs twice a day, the respondents most likely did not associate this occasion with rice grain consumption. Rice dishes associated with the *merienda* eating occasion are linked with churches and markets and therefore mostly consumed during the weekends (Fernandez 2002).

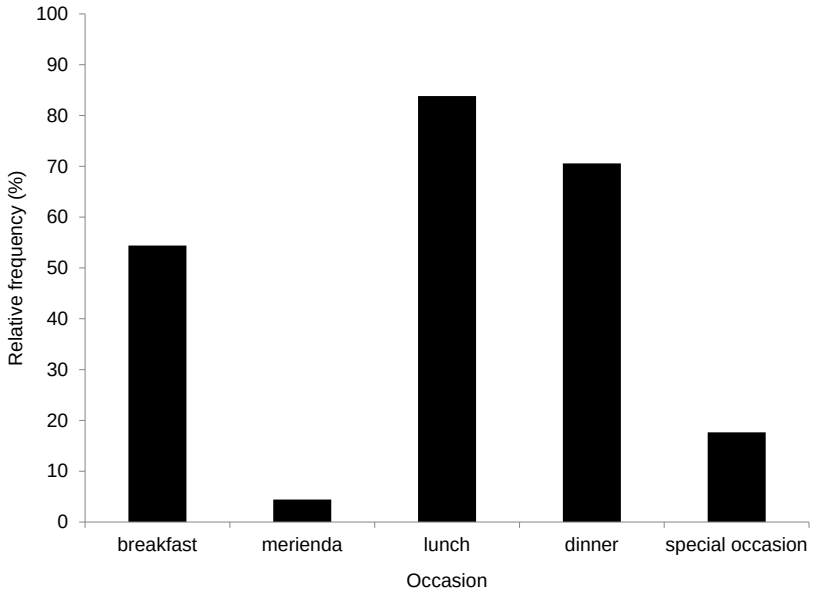

Fig. 3. Relative frequencies of occasions in which the respondents would eat heirloom rice.

As lifestyles change due to urbanization, the target consumers of heirloom rice will increasingly dine out. The most frequent occasions for dining out are lunch and afternoon *merienda* time (Neilsen Report 2017a); consumers typically spent these occasions in highly convenient establishment where food was typically served fast like convenience stores, bakeries, eateries, and doughnut shops (Neilsen Report 2017b). Hence, to reach out to the target consumers, marketing strategies nudging an increased consumption of heirloom rice ideally should also focus on the lunch occasions that are eaten out of the home, aside from dinner which is eaten more frequently at home. Famous restaurant chefs could play a market leader role here in endorsing and promoting signature dishes that are based on heirloom rice (de Guzman 2016).

CONCLUSION

Heirloom rice varieties are grown in the CAR and are symbols of cultural heritage. To preserve the cultures of the indigenous people cultivating these rice varieties, efforts are being made to commodify heirloom rice for the urban rice consumer. Our experimental auctions revealed that 15–42% of supermarket shoppers from the middle- to high-income classes in Metro Manila are willing to substitute white or brown rice for heirloom rice. Market penetration of heirloom rice was lowest in the segment of white rice consumers, but more than doubled after offering them a visual and auditory experience of cultural heritage preservation. If the experience was framed as a gain, by emphasizing the positive consequences of consuming heirloom rice on the preservation of the rice terraces and of cultural heritage of indigenous people in CAR, consumers' WTP for substituting white rice to heirloom rice increased significantly. Market shares were highest in the segment of brown rice consumers, but could not be further increased through the experience of cultural heritage preservation. This suggests that marketing strategies for white rice consumers should be distinct from those for brown rice consumers; i.e., marketing heirloom rice as a vehicle for preserving the rice terraces and cultural heritage appeared to be more effective for white rice consumers than for brown rice consumers if the marketing strategy successfully provides these consumers with the positive feeling of cultural heritage preservation. For the segment of brown rice consumers, marketing strategies emphasizing the health benefits of heirloom rice might prove to be more effective instead. Finally, marketing strategies for heirloom rice should target

lunch and dinner, the eating occasions during which respondents see that heirloom rice can substitute for the usual rice consumed in these occasions.

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OVERVIEW OF THE CAMBODIAN RICE MARKET, CHALLENGES AND THE WAY FORWARD

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ABSTRACT

Rice is the most important crop in Cambodia. It is the staple food and contributes to around 26% of the GDP, (MAFF 2017). It is estimated that the sector employs around three million people. The cultivated area increased to 3.6 million hectares with an estimated paddy production of 9.9 million tons. The annual paddy production exceeds the domestic consumption by around five million tons and this surplus is exported paddy or milled rice through informal and formal marketing channels. Milled rice exports through formal channels increased from 2010 onwards after the Royal Government of Cambodia issued a policy on the "Promotion of Paddy Production and Rice Exports". Since 2010 the rice sector and especially the milling sector modernized rapidly and now meets the standards required in the International market. Cambodia's rice exports increased rapidly in the past seven years and export data from the Secretariat of the One window service for Rice Export formalities (SOW-REF) show that it grew from 105,259 metric tons in 2010 to 635,679 metric tons in 2017. The main share of the exports is aromatic rice (63%) followed by long grain white rice (25%) and parboiled rice (12%). Under the Generalized Scheme of Preferences (GSP) Cambodia enjoys duty free imports into the European Union under the Everything But Arms (EBA) clause for Least Developed Countries. The EU is therefore the largest destination for Cambodian rice followed by China and ASEAN countries. Cambodia developed several aromatic rice varieties such as Phka Rumduol, Phka Romeat and Phka Rumdeng and Cambodian fragrant rice won the title of "World's Best Rice" for three consecutive years (2012 – 2014). A new challenge for the Cambodian rice sector is the increasing demand for organic and sustainable rice. Although still a niche market, traceability "from farm to fork" will require strictly monitored contract farming which is new to Cambodia. In common with neighboring countries, farmers in Cambodia predominantly use farm saved seed and due to lack of labor have moved from transplanting to hand broadcasting using seeding rates of up to 400 kg/ha. Direct seeding using mechanical seeders has the potential to lower seeding rates to 60 – 100 kg/ha which may give farmers the incentive to use certified seed and thereby increasing the quality of paddy delivered to the mills. Even though Cambodia's exports have increase significantly over the past years there are several areas where improvement is necessary to compete in the International markets. These areas include reduction of logistical costs through better administration, improved infrastructure, improvement of the supply chain management, promotion of the Angkor Malys certification mark, the adoption of Good Agricultural Practices and the promotion of value added by-products from rice.

Key words: Fragrant rice, Everything But Arms (EBA), traceability, quality of paddy, logistic cost, certification mark, Good Agriculture Practice (GAP)

INTRODUCTION

Rice is the most important crop in Cambodia. It is the staple food and the dominating crop in agriculture which contributes to around 26% of the GDP (MAFF 2017). It is estimated that rice production, processing and market employ around 3 million of the 15 million population. Paddy production occupies around 75% of the cultivated land and rice contributes around 15% of the total agricultural value added (IFC 2015).

The cultivated area for rice in Cambodia is around 3.052 million hectares in 2016. It comprises of two main seasons-wet season and dry season. Wet season covers around 74% of the total cultivated land

and dry season approximately 16% (MAFF 2017). Rice production has increased significantly during the last decade. The production volume has increased more than double from 2000 to 2016. The data shows that the estimated paddy production in 2016 increases to 9.9 million metric tons in 2016 compared to only 4 million metric ton in 2000 (MAFF, 2017). This leaves around 5.1-million-ton surplus of paddy and potential 3.2 million tons of milled rice for export (See Fig. 1).

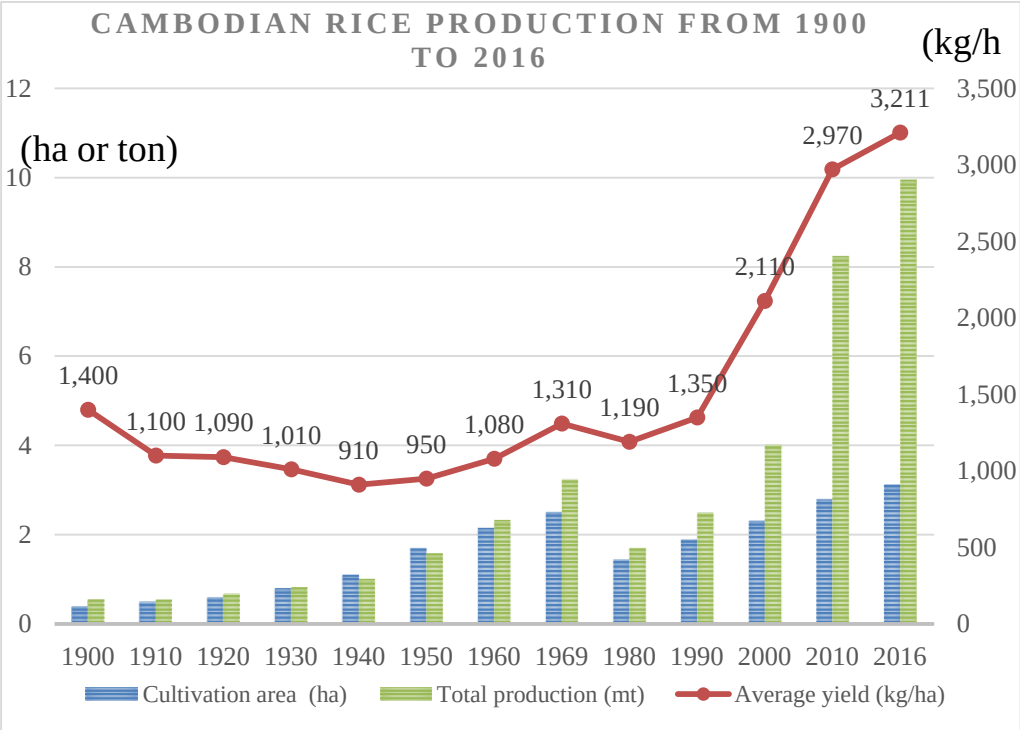

Fig. 1. Cambodia Rice Production from 1900 to 2016

Source: MAFF 2017

OVERVIEW OF RICE PERFORMANCE IN CAMBODIA

Export market

Cambodia's formal rice export has increased noticeably during the last seven years. In 2010 Cambodia exported only 100,000 metric ton of milled rice, while in 2013 the volume increased to around 378,000 metric tons and transformed itself from a pure paddy trader to a milled rice exporter (Trade map, 2018). Volume of export has reached 542,144 metric tons in 2016 (see Table1 below). Share of Cambodia's rice export volume in global rice export increased gradually from 0.15% in 2010 to 1.33% in 2016. This market share made Cambodia ranked 12th largest rice export country in 2016 (Trademap 2017).

Cambodian rice sector has gradually transformed the production quality and processing standard, which is accepted by international buyers. The transformation of the rice sector is driven by a number of factors including: 1) a more strategic, coordinated and export focus approach to the industry's development; 2) Improved and modernized milling capacity; 3) A domestic policy that opens door to access the international market; and 4) Generalized Preferential System (GSP) advantage to export to EU without tariff, (Cambodia CTIS 2014-2018).

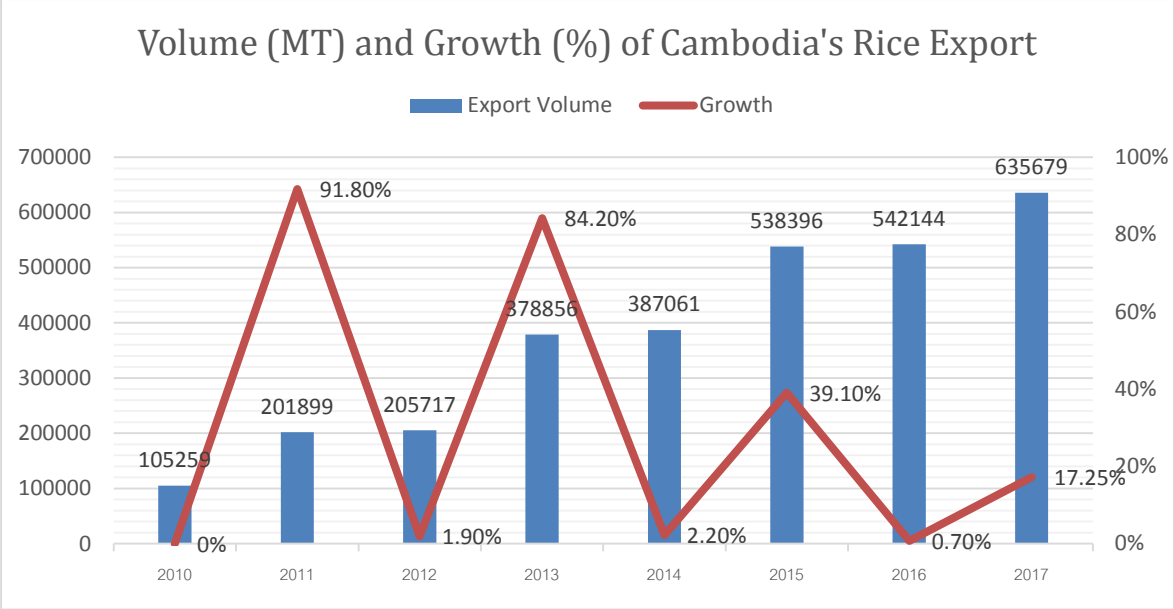

Fig. 2. Cambodia Rice Export Volume 2010 to 2017

Market destination

As a least developed country and under the Generalized Preferential System (GSP) Cambodia enjoys duty free imports into the European Union (EU) under the Everything But Arms (EBA). The EU is therefore the largest destination for Cambodian rice market followed by China and ASEAN countries. As shown in the graph below European market shares about 48% of the total export volume from 2012 to 2017. China, the second biggest importer of Cambodia rice, absorbs around 20% of the total export volume during the last six years. Rice export to China increased especially from 2015 when an MOU was signed between the governments of Cambodia and China to allow 100,000 metric tons milled rice quota to latter country per year in 2016, and 200,000 metric tons in 2017. The amount has increased to 300,000 this year, 2018. Malaysia shares 10% and other countries 22%.

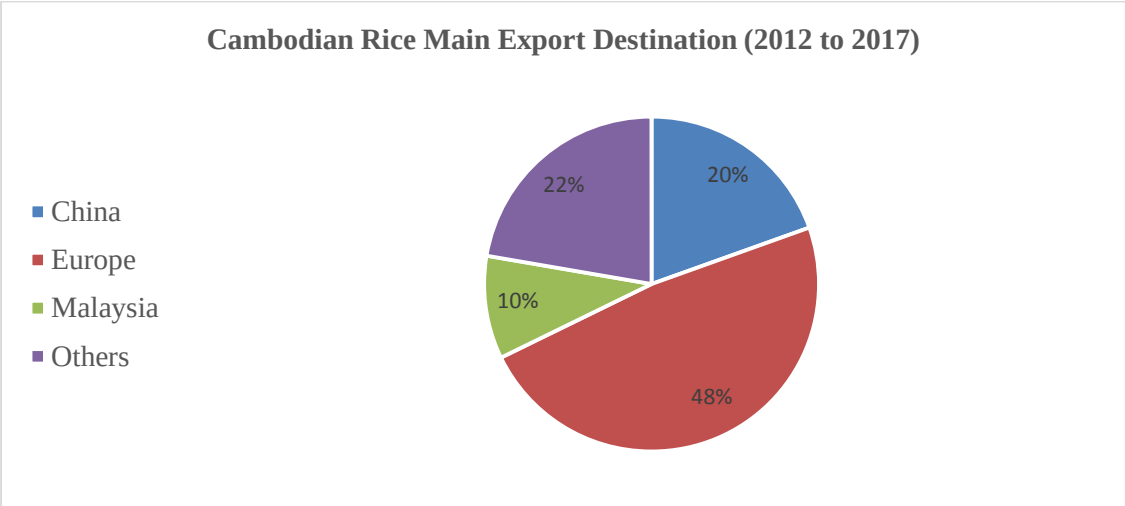

Fig. 3. Cambodian rice main export destination 2012 to 2017 (Source: MAFF 2018)

Export value

The value of rice export increased significantly between 2010 and 2016. In 2010, Cambodia earned about US$34 million from rice export to the international market. The value had an eightfold increase to US$285 million in 2015 and US$300 million in 2016. Between 2015 and 2016, although volume of rice export only increased 0.7%, the export value grew about 7% (Trademap 2017)

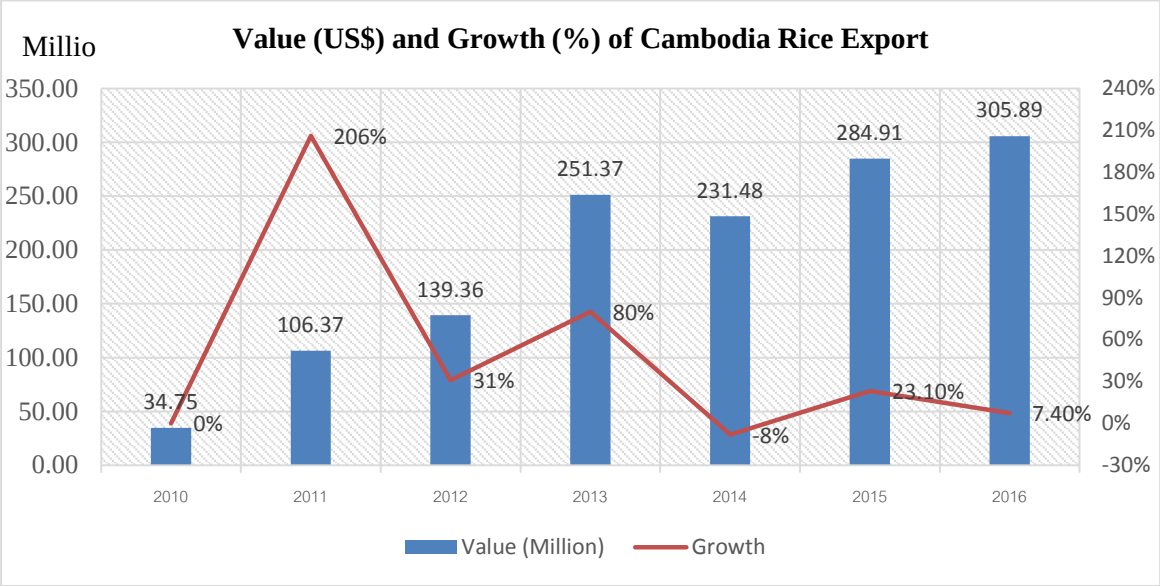

Fig. 4. Value and growth of rice export in Cambodia

Types of rice export s

According to Cambodia's Trade Integration Strategy report, 2014-2018, there are three types of rice exports in Cambodia. First, the informal and unrecorded of paddy flow through land and waterway crossing border to Vietnam and Thailand. Second, the informal and unrecorded milled rice export to Thailand via land border crossing. Finally, it is the formal channel of export through port of Sihanoukville and Phnom Penh.

The formal channel mainly exports four types of rice to the international rice market including Premium Jasmine Rice, Aromatic Rice, Long Grain White Rice and Long Grain Parboiled Rice. The first categories include *Phka Rumduol*, *Phka Romeat*, *Phka Rumdeng* and **Somaly** varieties. *Phka Rumduol* variety won the world best rice for three consecutively years in 2012, 2013 and 2014. After that Cambodia positions itself as the second rank of the world best rice. The aromatic rice mainly comprises of *Sen Kra Ob* variety, *Sen Pidor* and *Phka Chansensor* varieties. Long grain white rice and long grain par boiled rice are usually processed from white rice variety such as IR 66 and IR 504 04.

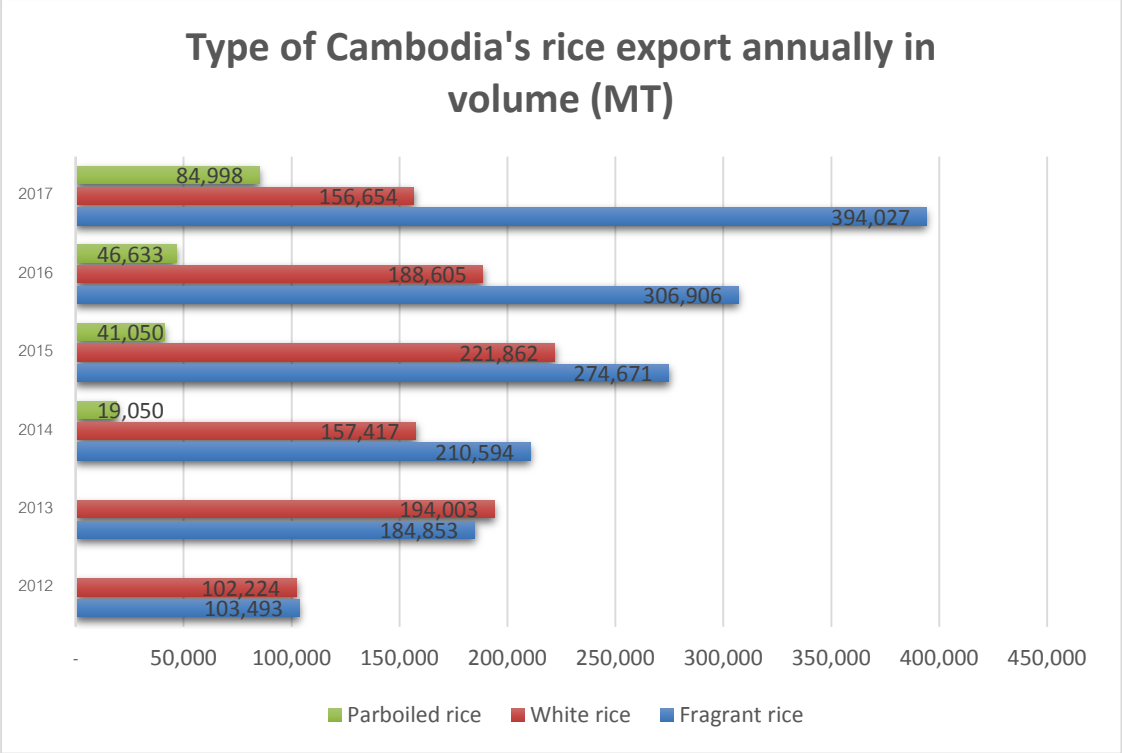

Fig. 5. Volume of cambodia rice export variety

Challenges in the Cambodian rice market

There is a change of consumer's behavior for rice consumption for higher health and safety standard. In China, consumers prefer health and safety food (Lu 2018). Consumers in Europe are also in favor of exotic varieties such as Basmati, Jasmine and organic rice. This demand shows a growth of 6% annually (CBI 2017).

Both buyers and consumers in Europe have a growing concern about sustainability and social affect from their consumption. This pressures rice millers/exports to have a traceability system in place – one that is aligned with the standard requirement. Sustainable Rice Platform (SRP) which is co-convened by IRRI and UNEP in 2011 with involvement of 29 institutions from public and private sector stakeholders, research, financial institutions and NGOs, is now implementing with some exporters in Cambodia in the form of contract farming to supply to few large retailers in Europe such as Mars Food. The Royal Government of Cambodia issued a sub-decree on contract farming in 2011 to facilitate farmers and private companies. However, the farming agreement seems inactive as it is quite new in Cambodia. Until 2014, there are few millers/exporters started to implement their contract farming with agriculture cooperatives (ACs) in Preah Vihear province for organic rice and the implementation of contract farming for SRP has just started in 2017. According the interview with some ACs of organic and SRP of contract farming, all members of the cooperatives have not joined the contract farming with millers/exporters yet because they do not still trust the contract.

Another challenge is a labor reduction in agriculture sector. Labor in agriculture decreases from 80% in 1993 to 41% in 2018 (MAFF 2017). It is projected that the labor will continue to decrease from year to year and remain only 29% in 2030 (see Fig. 6).

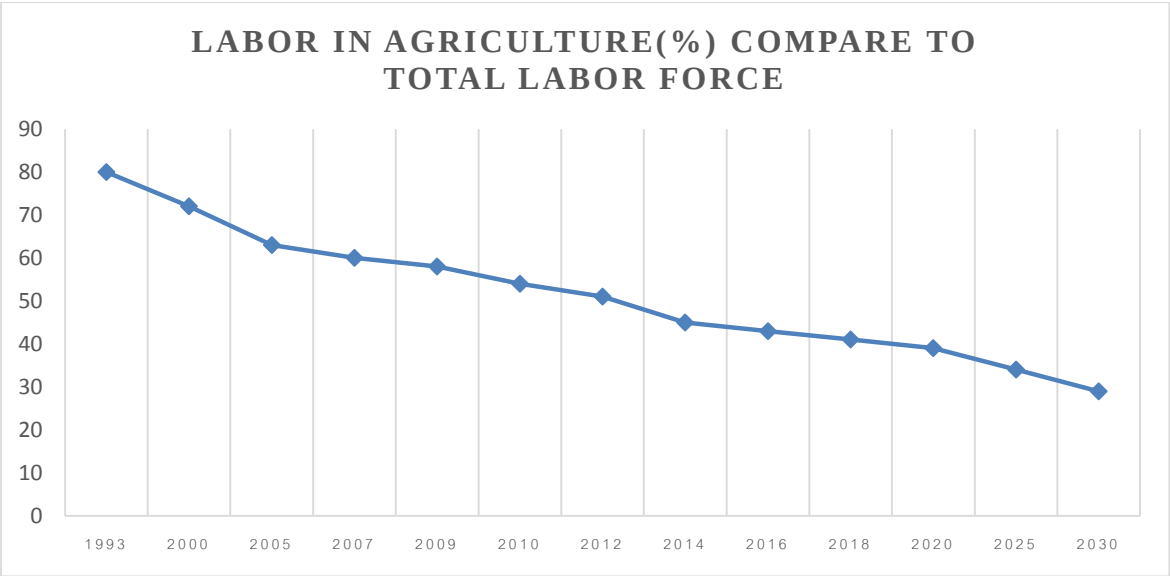

Fig. 6. Labor force in agriculture as compared to overall labor force

Due to labor shortage, farmers in Cambodia change practice from transplanting to broadcasting. As common to other neighboring, farmers use saved seed rather than buying certified seed for paddy production. In addition, Cambodian farmers use a large amount of seeds with an average of 230 kilograms per hectares for dry season variety and 134 kilograms per hectares for wet season variety. Some farmers use up to 400 kilograms of seed per hectare (CAVAC 2016). Using saved seed for many cropping cycles leads to poor quality of paddy and because they apply high seed rate, they have less incentive to buy certified seed for their production. The same study found that certified seed costs US$0.75 per kilogram while farmers' saved seed just cost them US$0.3 per kilogram. CAVAC has introduced mechanical direct seeders through few companies for dry and wet soil condition. It is shown that the machine can potentially lower seed rate to 60 kilograms per hectare for wet season variety and 100 kilograms per hectare for dry season variety.

Cambodian rice exporters still claim that farmers do not storage the paddy properly after harvesting, which leads to poor quality of paddy for milling (Chan and Kim 2017). Cambodia has higher electricity cost than Vietnam, Thailand and Myanmar. The cost of electricity in Cambodia in 2015 was US$0.177 per kilowatt hour that was higher than Vietnam whose price is only US$0.06, Thailand US$0.046 and Myanmar US$0.054. There was an effort to reduce cost of electricity for rice milling to 0.166 US$ per kilowatt hour but this price remains high for millers. Related by-products of milled rice such as husk and bran are not yet fully utilized or processed yet due to lack of knowledge and technology. Silica that can be produced from rice husk and rice bran oil from rice bran are not seen any production in Cambodia (Profound 2017).

Logistic and milling cost is still a main constraint for exporters in Cambodia. Even though there has been progress in simplifying export procedures and reducing the logistic costs, it is not competitive enough comparing to Cambodia's competitors (Goletti and Srey 2016). Chan and Kim (2017) showed that Cambodia's gasoline price is USD0.9 per liter, while Vietnam's gasoline price is USD0.81 per liter and USD0.51 per liter in Myanmar. Thailand's gasoline price is 1.04 US$ per liter but most trucks in Thailand are equipped with LPG that costs about half of the gasoline price. Cambodia roads are not easy access everywhere yet. Some areas are not possible for large trucks with 20-metric-ton capacity to access for collecting paddy. Farmers still need to use hand tractors to transport paddy to large trucks. In addition, the Cambodia government has tried an effort to rehabilitate railroad to reduce costs of transportation but it is still not ready and applicable for exporter to use this transportation mode yet.

Myanmar is an emerging competitor for Cambodia rice export to international market as it re-granted again Everything But Arms (EBA) initiative preferential trade regime in 2013 and the trade preferences for Myanmar is applied retroactively as of June 2012. Therefore, Myanmar seems to be a large low-cost rice exporter that competes with Cambodia. Global rice market is unpredictable. In addition, Thailand is

seen as a main competitor for fragrant rice and Vietnam for white rice (RGC 2014). As a result, Cambodia's export is stagnated between 2015 and 2016. Volume of export was 538,396 MT and 542,144 MT respectively, due to those factors including price of Thai rice failed down. In addition, Vietnam is also competitor that can increase its market share in EU because it just obtained quota for Free Trade Agreement for 20,000 MT of milled rice and it is effective in 2018. Lastly, Myanmar and Vietnam have set a policy to produce fragrant rice to meet demand in international market.

CONCLUSION

Cambodia can stay its optimal success in the market if there has been an effort from Cambodian Rice Federation (CRF), government and developing agencies to develop a certification mark "Malys Angkor". It is the first certification mark developed in Cambodia and launched in January 2018. CRF who owns the mark will need to work more to strengthen traceability and transparency \ in order to promote this mark for national and international market. It is recommended that high quality of Cambodian fragrant rice should be sold on the basis of brand and value, rather than on a price basis in the market (IFC 2015).

Besides SRP, Good Agricultural Practice (GAP) is generally recognised as a series of measures to increase food safety for domestic and foreign consumers. It is a kind of sustainable system of agriculture that provide health and safety to farmers and other operators along the supply chain. EUREPGAP became Global GAP in 2007, initiated by retailer association in Europe to address the concerns of consumers regarding safety, environmental impact and health, safety and welfare of workers and animals. Thailand already developed national standard, ThaiGAP, in 2008. Vietnam also has VietGAP. However, Cambodia does not start any initiative yet for Rice GAP. Since consumers' behavior change over health and safety is growing in foreign countries it might also affect local consumers. Cambodia government should also take measure to protect its population to live healthier and in better environment. Therefore, adoption of GAP in the country should be undertaken soon.

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CONSUMER PREFERENCES ON MALAYSIA's SPECIALTY RICE

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ABSTRACT

Demand for specialty rice among Malaysians shows an increasing trend in recent years. The consumption of high quality rice has increased due to higher living standards and health reason. To meet the demand, most of the quality rice was imported from various rice producing countries. The study was done to identify local consumer preferences towards specialty rice. It also aims to reveal the differences of preferences among the consumers between local specialty rice compared to imported rice. Generally, specialty rice produced by MARDI can be divided into three categories such as fragrant, colored and glutinous rice. The fragrance rice itself can be categorized into three types according to their characteristics like Basmathi, Jasmine and Normal types. From the survey, the results showed that 78% of the respondents who consumed white rice were willing to change their preference towards MARDI specialty rice especially the fragrant rice of the Jasmine type. In the case of colored rice, imported colored rice was most preferred by local consumers as compared to the local variety. Meanwhile Imported glutinous rice was more favored but locally produced black glutinous rice was well acceptable by the local consumers. It could be concluded that the consumer preferences towards local fragrance rice was mostly due to its physical characteristics and the aroma which is equivalent to the imported fragrant rice. Therefore, it is a great potential to produce fragrant rice locally using MARDI's varieties which is economically viable in the present local rice market.

Keywords: Consumer preferences, local specialty rice, physical characteristics and aromatic rice.

INTRODUCTION

The demand for specialty rice or high quality rice is showing an increasing trend that indicates that there are changes in the living standard and lifestyle of the Malaysian consumers. Moreover, their perception is more towards healthy and safety products while consuming rice in their daily diets (Hanis, A. *et al*., 2012). Malaysia has always been a net importer of rice with a self-sufficiency level of 72% in 2015. The national per capita consumption was at 88 kg in 2015. From 2010 to 2015, the trend was in a decreasing mode at -0.11%. Hence, the changes in consumers taste to high quality rice (High Quality Rice - HQR) require the country to import rice from the world HQR producer to meet the local demands.

Malaysia's total rice production in 2015 is about 1.756 million metric tons. This amount could not fulfil the Malaysian consumption which was at 2,716 million metric tons in the same year. Therefore, the deficit of rice was imported from world-producing countries, especially from Thailand, Vietnam, Pakistan and Cambodia with total imports of 0.96 million ton valued at RM1, 740.3 million in 2015.

Table 1 shows the total amount of rice imports according to the types of rice. It showed that an average annual growth rate had increased by 0.49% in a period of 2010 to 2015. Rice importation in Malaysia can be divided according to the types of rice with the following distribution: 80% for white rice with balance of 20% for specialty rice. The import of specialty rice was for fragrant rice (11%), glutinous rice (4%), basmathi rice (3%) and others (2%) known as Japonica and red rice (BERNAS, 2017). With the demand of HQR showing an increasing trend at 1.27% cumulative annual growth rate (CAGR), hence the chances of planting the HQR in Malaysia could be crucial in the future. As compared with other HQR types, CAGR of fragrant rice was the highest at 3.9%. The HQR was demanded by the consumers which could be attributed to higher income, lifestyle as well as health awareness.

Table 1. Total Malaysian rice imports by type of rice (tons)

Year/Type of rice	Fragrant	Basmathi	White rice	Others	Total	Total specialty rice
2010	83,946	49,919	754,407	44,170	932,442	178,035
2011	73,123	21,259	919,311	47,113	1,060,806	141,495
2012	107,607	28,084	816,148	26,783	978,622	162,474
2013	120,002	30,718	658,331	38,035	847,086	188,755
2014	97,273	26,529	707,440	53,058	884,300	176,860
2015	105,600	28,300	768,000	57,600	960,000	192,000
CAGR (2010-2015)	3.90%	-9.03%	0.30%	4.52%	0.49%	1.27%

Source: BERNAS and DOA, 2015.

In order to fulfill the farmers' needs in producing the local specialty rice, MARDI produced three categories of HQR. These are fragrant, colored and glutinous rice. The fragrant rice itself can be categorized according to their characteristics like Basmathi, Jasmine and Normal types. Four fragrant rice varieties was named as MRQ 50, MARDI Wangi 74, MARDI Wangi 76 and MARDI Wangi 88. The various varieties came with a different characteristic of the rice however the main goal was to increase productivity of local fragrant rice. These local specialty rice varieties were promoted to the farmers in order to reduce the amount of imports for HQR.

The first fragrant rice varieties known as MRQ 50 was launched by MARDI in 1999. However, it not really accepted by farmers because of its low yield. The second variety was MARDI Wangi 74 (also known as Mas Wangi) which was released in 2005. This variety is good for health especially for diabetic's dietary requirement because its characteristics was similar to the basmathi types. MARDI Wangi 76, which was launched in 2011, has characteristics which is comparable to the jasmine types. The latest variety was MARDI Wangi 88, which was launched in 2016. MARDI Wangi 88 can be promoted as fragrant rice with white rice characteristic especially among consumers who prefer medium soft rice (Mohamad Najib *et al*, 2016). The latest specialty rice that was launched in early 2018 was a colored rice named as MARDI Warna 98. This colored rice had high antioxidant content according to their color characteristics. This variety was made as a substitute or varied the choice of the Sarawak traditional colored rice variety. This colored rice can easily be found in the Sarawak daily market and was produced as a niche product.

There are many rice brands in Malaysia market based by types of rice. Types of rice differ based on their physical characteristics and quality. However, information on consumer preferences towards what types of rice preferred by consumers is still lacking. This information is important to the breeder and stakeholders so that the it was accepted in the market and suits consumers' preference as well. Local specialty rice was produced with the goal to reduce the import of HQR, especially the fragrant rice. In general, the objective of this study was to reveal the differences of preferences among the consumers between local specialty rice compared to imported rice.

METHODOLOGY

A study on consumer perception and preferences of specialty rice was conducted to identify the characteristics of the specialty rice chosen by Malaysians. The study involved a few surveys which were conducted at different pre-selected sites in Malaysia. A total of 400 respondents was surveyed in Klang Valley and 600 respondents at another six zones in Malaysia including Sabah and Sarawak. Besides that, the study also reviewed and analyzed data from past studies for comparison.

RICE CONSUMPTION PATTERNS AMONG MALAYSIAN CONSUMER

White rice is the main staple food commonly consumed by most people in Malaysia. There was a variation of pattern in the daily consumption among Malaysians. Figure 1 below shows the rice consumption patterns which indicates that 45% of the respondents consumed specialty rice as part of their daily diets. From that, 21% of those consumed was fragrant rice, 11.25% are basmathi rice, 11% of those consumed are both of the fragrant and basmathi rice. The rest 1.75% are brown rice consumers.

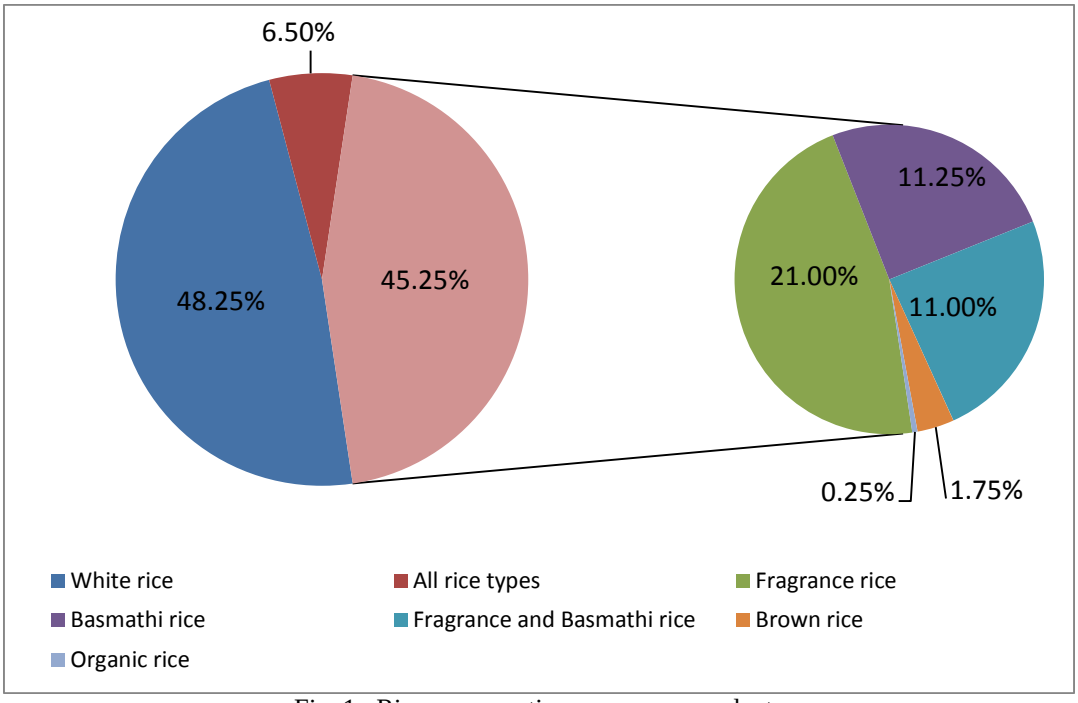

Fig. 1. Rice consumption among respondents

A study by Wong *et al*. (1992) and Syahrin *et al.* (2015) indicated that Malaysian consumers most preferred rice that contained more head rice, lower amylose content and long shape characteristic. Others studies concluded that the most important attribute of rice consumption was food safety, taste and size of grain (Ahmad Hanis, I.A.H *et al* (2012). Besides that, Syahrin, *et al.* (2008) found that 79% of the respondents who consumed white rice were willing to change their preference towards MARDI fragrant rice of Basmathi type, which were non-sticky and had low starch. Hence, this could be a substitute to imported Basmathi and Ponny rice. Consumers were also willing to pay a premium price for the demanded attributes. Hence, the high-quality rice needs to fulfill the characteristics and attributes that consumers preferred to make sure that the specialty rice can be able to gain market access at a premium price.

CONSUMER PREFERENCES TOWARDS SPECIALTY RICE

Consumer preferences for rice varieties vary according to their tastes and purchasing power. The quality of rice was subjected to a battery of tests on grain length, translucency, whiteness, aroma, stickiness and softness. These characteristics were mostly what the Malaysian consumers preferred. A survey was conducted among 400 consumers in Klang Valley to evaluate consumer preferences on local specialty rice as compared to white rice. The result revealed that the respondents preferred MARDI Wangi 76 more compared to other fragrant rice and white rice. The mean score for MARDI Wangi 76 are over 6.5 for all of characteristics (Table 2).

Table 2. Means Score of Consumer preferences on local specialty rice characteristics compared to white rice

Characteristics	White rice (MR284)	MARDI Wangi 74	MARDI Wangi 76	MARDI Wangi 88
Grain length	6.34	5.41	6.78	5.81
Transparency	6.24	5.68	6.83	5.90
Whiteness	6.53	5.82	6.84	5.84
Aroma	5.63	6.44	6.75	5.68
Starchiness	5.52	6.72	6.66	5.70
Softness	6.07	6.17	6.74	6.17

Source: Data survey 2017

Fig. 2 shows that 78% of the respondents who consumed white rice are willing to change their daily rice consumption to MARDI specialty rice. About 30% of the respondents most preferred MARDI Wangi 76, followed by MARDI Wangi 74 (27%) and 21% preferred MARDI Wangi 88. These results show the potential of producing specialty rice locally to meet the demands of the people. In addition, the government can reduce the import of specialty rice as well.

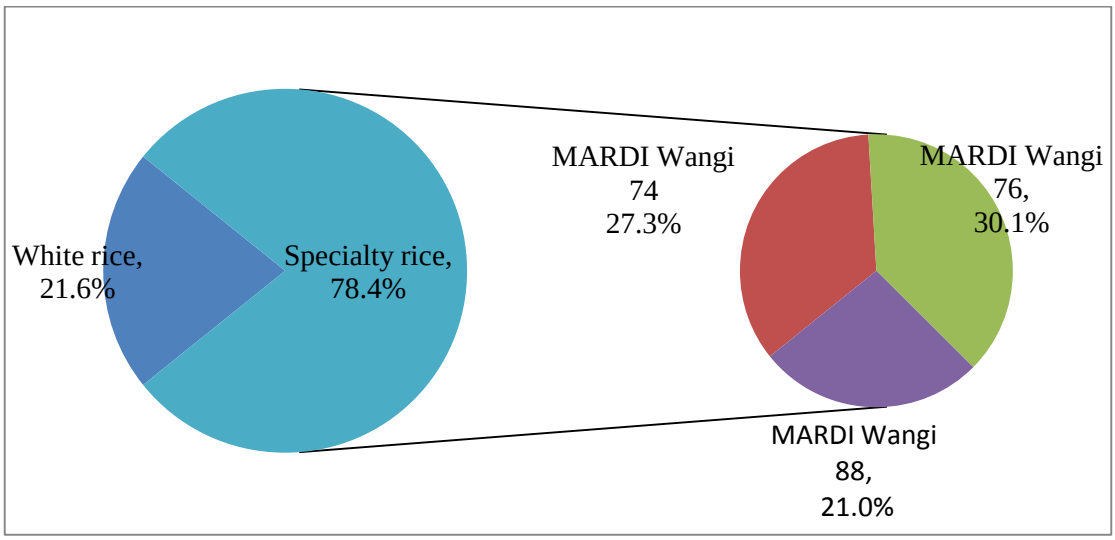

Fig. 2. Consumers' preferences towards local specialty rice.

Surveys were also conducted to identify consumers' preferences on local specialty rice compared to imported rice. Table 3 shows the means score of fragrant rice characteristics compared to imported rice. The result revealed that local fragrant rice (Jasmine type) was more preferred by consumers with mean (score=6.85) compared to the imported fragrant rice 1 (score=6.67) and imported fragrance rice 2 (score=6.16).

Table 3. Means of score fragrant rice characteristic between local and imported

Characteristics	Local	Import 1	Import 2
Grain length	5.76	6.68	6.41
Transparency	6.34	6.54	5.94
Whiteness	6.96	6.44	5.75
Aromatic	6.55	6.72	5.98
Stickiness	6.50	6.38	6.04
Softness	6.93	6.53	6.23

Source: Data survey 2014

Fig. 3 shows consumer preferences towards local specialty rice compared to two types of imported rice in the market. The characteristics of local specialty rice was preferred by the consumers are whiteness (score = 6.96), softness (score = 6.93) and stickiness (score = 6.50), while physical characteristics such as long grain (score = 6.68), translucency (score = 6.54) and aroma (score = 6.72).

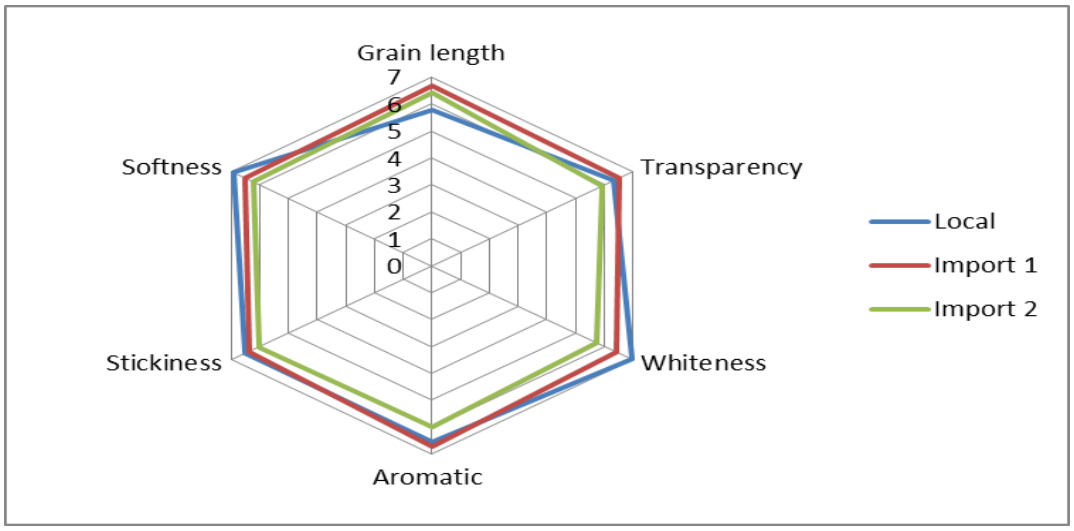

Fig. 3. Consumer Preferences towards Specialty rice compared to imported rice.

Fig. 4 shows the consumer preferences towards local colored rice compared to the imported type. The study stated that 54% of respondents most preferred the imported colored rice as compared to the local ones. The overall mean score for imported colored rice was higher at (score=6.99) compared to the local ones with mean (score=6.65). The mean score for every characteristic also shows that the imported red rice was higher than the local one in such characteristics as grain shape (6.70), color (6.89), texture (6.83), stickiness (6.92) and softness (7.13). This result indicated that research and development for improving this variety is a need especially in terms of characteristics preferred by the consumers.

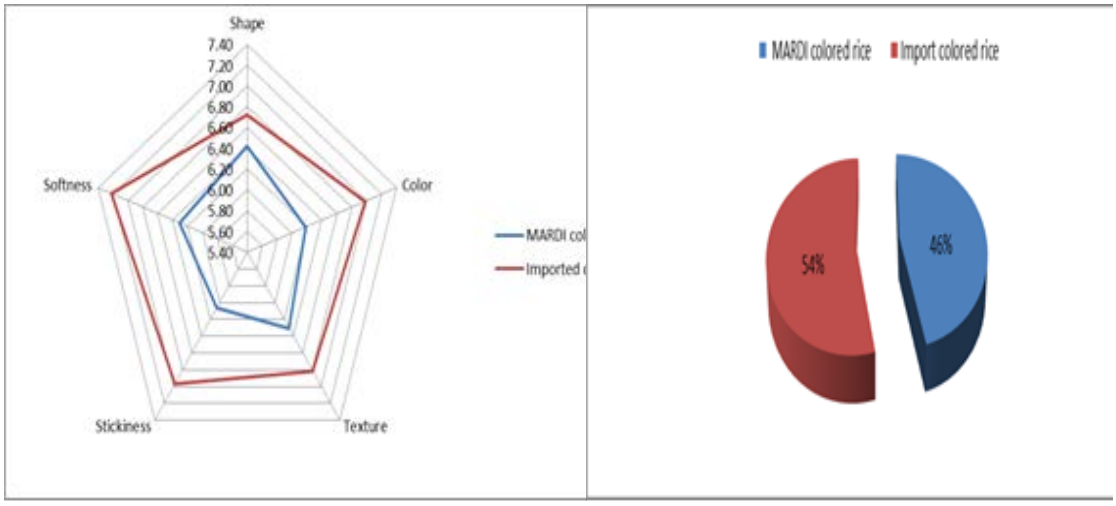

Fig. 4. Consumer preferences to local colored rice compared to imported

Fig. 5 shows the consumer preferences on local glutinous rice Siding as compared to the imported type. Majority of the consumers preferred the local type as such characteristic as shiny glutinous rice siding (7.41), color (6.88) and grain shape (6.62).. Meanwhile, shape for imported glutinous rice after cooking were more likely to be like the local type with a score of=7.07, elongation after cooked (score=6.97) and chewy (score=6.95). However, both local and imported glutinous rice have same score for stickiness with (score=6.95).

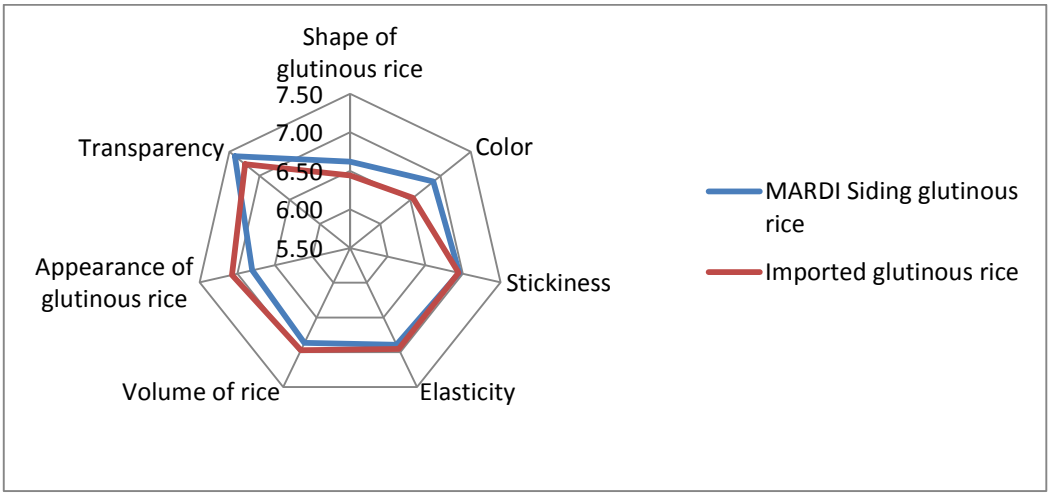

Fig. 5. Consumer preferences to local glutinous rice compared to imported

For black glutinous rice, majority of the consumers preferred the local black glutinous type. This indicates that all of the characteristics was better than the imported glutinous rice except for "elongation after cooked".. The mean score for grain shape (score=6.94), color (score=7.48), stickiness (score=6.91), chewy (score=6.92) and shape after cooked (score=7.31) which was way better than the imported glutinous rice (Figure 6). Overall, imported glutinous rice was more favored with mean (score=7.13) compared to local (score=7.04). But locally produced black glutinous rice was well accepted by local consumers (score=7.46) compared to imported black glutinous (score=7.03) (Fig. 6).

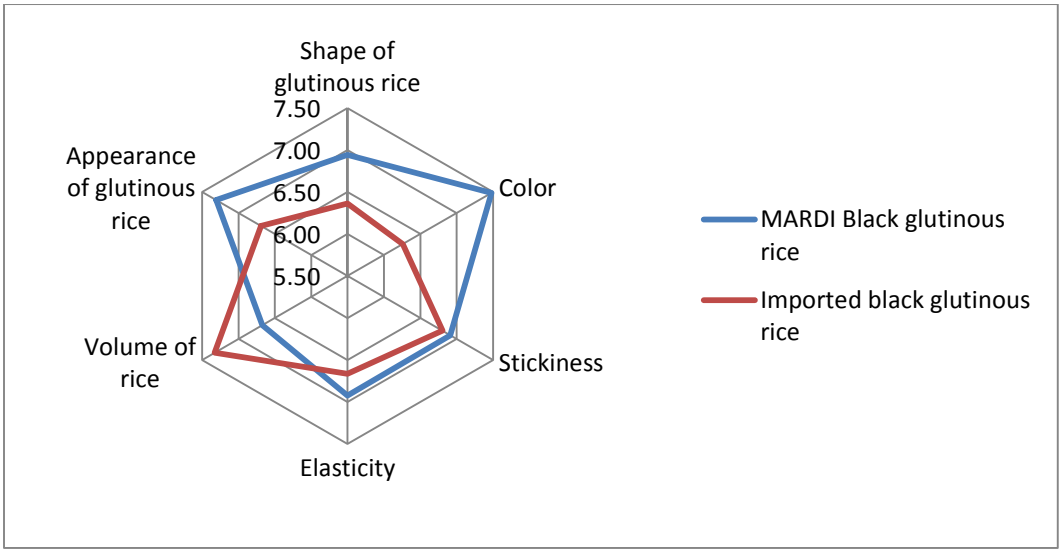

Fig. 6. Consumer preferences to local black glutinous rice compared to imported

PRICE DETERMINATION FOR SPECIALTY RICE

Specialty rice is well-known to have higher nutrients and vitamins than regular white rice. It is suitable being used as a dietary supplement. Specialty rice is differentiated in terms of fragrant, soft, starchy, sticky and length. Hence, the price of specialty rice in the market was higher and varies according to the quality, grade and brand. Price of specialty rice in market was influenced by characteristics of rice itself. The study conducted by Syahrin *et al.* (2015) on 35 types of fragrant rice and 17 types of basmathi rice in the market found that the price of specialty rice was highly influenced by the physical-chemical characteristics.

The physical-chemical characteristics of rice in the market were analyzed and compared to MARDI Wangi 76 and MARDI Wangi 74. The characteristic was important in order to identify the rice that were comparable in the existing market. The MARDI Wangi 76 was shortest and tapered compared to the other fragrant rice in the market. The value of alkali spreading gave a wide range of result and this indicates that the fragrant rice in the market were mixed from various imported countries and packed into one brand.

Table 3 shows the comparison of the characteristics and price of fragrant rice in the market. The characteristics of MARDI Wangi 76 rice are comparable to the fragrant rice in the market except for grain length and translucency. Besides that, the price of rice were varies according to their quality characteristics of the rice. A study by Syahrin *et al.* (2015) found that the price of fragrant rice in the market were most influenced by rice shape and higher alkali spreading value and lower amylose content. This study then evaluated the price of MARDI Wangi 74 that consumers were willing to buy at US$1.60/kg. This finding also parallelled with another study by Wong *et al.* (1992) and found that the price of fragrant rice in the market was heavily influenced by the shape, higher value of alkali spreading and lower amylose content.

Table 3. Comparison of the characteristics and price of fragrant rice

Brands	Head rice (%)	Broken rice (%)	Grain length (mm)	Grain width (mm)	Ratio L/W	Amylose (%)	Amylose (%) category	Alkali spreading	Actual price (US$)	MSRP (US$)
Fragrant A	68.26	31.74	7.4	1.71	4.33	14.8	Low	4(1),5(2), 6(3),7(4)	1.75	2.45
Fragrant B	96.76	3.24	7.23	2.13	3.39	14.8	Low	5.9	1.45	1.74
Fragrant C	98.78	1.22	7.42	2.12	3.50	15.0	Low	6.5	1.40	1.73
MARDI Wangi 76			6.59	1.99	3.31	15.1	Low	4		1.60
Fragrant D	66.57	32.43	7.33	1.7	4.31	15.3	Low	6.6	1.25	2.45
Fragrant E	99.38	0.62	7.26	2.04	3.56	15.5	Low	5.2	1.49	1.58
Fragrant F	96.01	3.99	7.34	2.9	3.77	15.5	Low	6.3	1.45	1.72

Source: Syahrin, et al. (2015). Currency conversion rate at MYR 1 equal to US$ 0.25

Table 4 shows the comparison of the characteristic and price of MARDI Wangi 74 with multiple basmathi types in market. MARDI Wangi 74 rice was more short and oval than other basmathi rice in the market. The price of basmathi rice in the market was influenced by the long grain of rice. Hence, the suggested retail price for MARDI Wangi 74 was determined at US$1.40/kg based on their characteristics preferred by consumers. Consumers were also willing to pay at premium prices for the demanded attributes.

However, for colored rice, it was categorized as a niche market and the price was floated according to grade and quality. The price of colored rice in the market especially in Sarawak in average was in the range of US$1.75 - US$2.75/ kg.

Table 4. Comparison of the characteristics and price of Basmathi rice

Brands	Head rice (%)	Broken rice (%)	Grain length (mm)	Grain width (mm)	Ratio L/W	Amylose (%)	Amylose (%) category	Alkali spreading	Actual price (RM)	MSRP (RM)
Basmathi A	62.30	37.70	5.4	1.79	3.02	24.8	Intermediate	6	1.87	1.88
Basmathi B	99.40	0.60	8.3	1.84	4.51	25.3	High	7	3.00	3.20
Basmathi C	99.46	0.54	7.51	1.83	4.10	25.9	High	7	1.85	2.50
MARDI Wangi 74			6.49	1.77	3.67	26.5	High	5		
Basmathi D	99.00	1.00	7.43	1.71	4.35	26.8	High	6.7	1.48	2.25
Basmathi E	72.81	27.19	7.39	1.58	4.68	26.9	High	6.9	1.85	2.13
Basmathi F	99.18	0.82	7.73	1.86	4.16	27.1	High	6.4	1.39	1.95

Source: Syahrin, et al. (2015). Currency conversion rate at MYR 1 equal to US$ 0.25

CONCLUSION

Malaysian consumers most preferred the local fragrant rice with jasmine type due to its physical characteristics and sense of aroma which is equivalent to the imported fragrant rice. Meanwhile, consumers most preferred to buy imported glutinous rice compared to the local type. However, majority of consumers most preferred the local black glutinous rice for its characteristic except for its elongation after being cooked. Therefore, it is a great potential to produce fragrant rice locally using MARDI's varieties which is economically viable in the present local rice market. As for local fragrant rice, it can be market to local store as well and can be competitive to the imports if the price was reasonable.

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PROMOTING RICE VALUE ADDITION THROUGH INCLUSIVE BUSINESS MODEL

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ABSTRACT

More than half of farm households in Thailand are in the rice sector. Majority of them are smallholders, and they are struggling with higher costs and lower yield rate, as well as rising competition in the global market. These reflect the need to move up the rice value chain based on innovation and institutional support.

This paper tries to illustrate how to apply a new business model of Inclusive Business to realize the value chain upgrading and to link smallholder farmers to the markets. The research has used the case-study method and longitudinal study with community enterprises and agricultural cooperatives. A key finding is that trust and collaboration among stakeholders is crucial to bring about mutual learning and value chain development. The study will continue to work closely with local and institutional actors to create a platform for Inclusive Business. Policy recommendation will also be formulated to mitigate institutional barriers and to broaden adoption of Inclusive Business by visionary and proactive farmer organizations in Thailand.

Keywords**:** Inclusive Business Model; Value chain development, Rice sector

INTRODUCTION

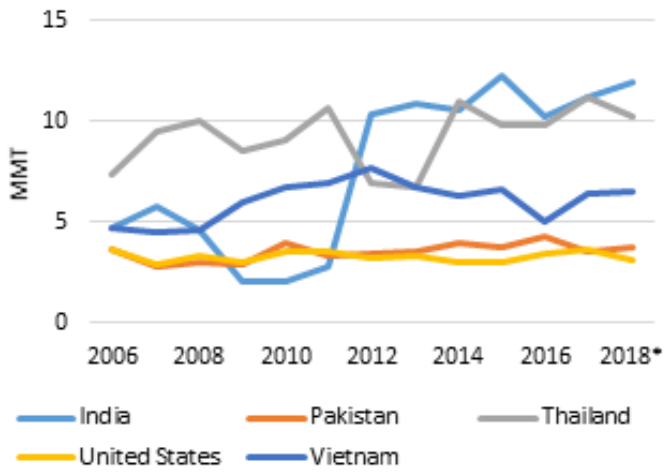
The rice sector covers 3.7 million households or around 60 % of Thailand's 23 million farmers. A half of Thailand's cultivated land is devoted to rice farming with annual output of 30 million tons of paddy rice or 20 million tons of milled rice. Domestic rice consumption is around 10 million tons of milled rice, and half of the harvest serves overseas demand. In 2017, Thailand exported 11 million tons of rice, up by 15 % year revenue rose by 15 % to US$5.37 billion. Of its total annual exports, 70 % is white rice, while the rest is Thai jasmine rice and parboiled rice.

Despite these ongoing developments, the Thai rice sector is facing challenging circumstances, especially in the context of global market. Thailand has been a major exporter in the world's rice market, mainly to China and the US. The current market situation shows that competition is multiplying and Thailand is facing stiffer competition from other producers. India, Vietnam, Cambodia, Myanmar, have overtaken Thailand as the leader in exports of white rice. This is mainly due to the following: 1) some importing countries tend to expand their domestic rice production areas and thus reduce the amount of rice imported; and 2) the expansion of rice production in the ASEAN region, especially in Vietnam and

Cambodia, which can approach Thai quality but at lower prices, thus replacing imports from Thailand, both in the ASEAN and European markets. Further, Vietnamese fragrant rice is starting to crowd out Thai jasmine or Hom-mali rice in the East Asian and American markets. These have been threatening Thailand's market share which has been declining, as results of reduction in both volume and value.

In terms of production, most rice farmers are considered to be in the small-scale category according to the farm size. The average land holding is about 3.5 hectares per household in which the majority of them holds only 1.5-2 hectares, while 30 % of them do not own the land they farm. During the past decade, Thai farmers faced with rising costs of farm inputs, labor shortage, and risks arising from climatic conditions, which had negative consequences for yields. According to USDA, the rice yield in Thailand is about 2.8 tons per hectare, lower than in neighboring countries, and cost is more expensive than competitors with an estimated cost of US$1,000 per hectare (Thai Ministry of Commerce, 2016). Meanwhile, government's price intervention policy, aiming to raise price prices, did not stimulate farmers to improve cost efficiency, quality management, and sustainability of farm land. Further, farmers were encouraged to borrow from banks to buy fertilizers and pesticides to maximize production volume.

Rice export competition (all types) [8]

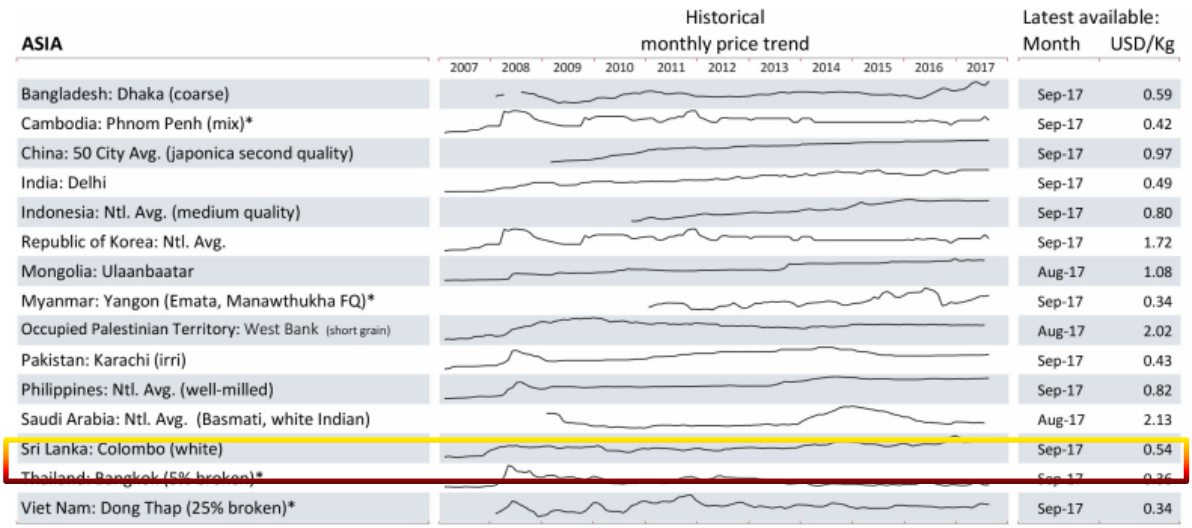


Source: USDA and PSD

Consequently, farmers did not pursue an entrepreneurial approach and create addition value to their rice. Thai smallholder farmers, with around 2 hectares that produced 6 tons of rice, could generally earn only US$2,400 per year (US$400 /ton; farm gate price of freshly harvested paddy), subtracts the costs of US$2,000, then the farmers obtained profits of US$400-500 per year/ household. As a result, a large number of farmers are still heavily in debt, in which average farmer household carries around US$3,700 in debt, plunging them into deeper poverty and forcing them to seek help from the new government. On the contrary, rice exporters always survive in the market. Despite higher costs, traders could switch to other markets whereby demand for Thai rice continues to grow, especially in the Middle East and African countries, yet strong competition and low prices would restrain their profit margins.

[8] Rice Export Competition (https://benchmark.televisory.com/blogs/-/blogs/rice-industry-outlook-2018 ; Accessed 25 April 2018)

Domestic rice prices in selected countries [9]



ASIA	Historical monthly price trend (2007–2017)	Latest available: Month	USD/Kg
Bangladesh: Dhaka (coarse)		Sep-17	0.59
Cambodia: Phnom Penh (mix)*		Sep-17	0.42
China: 50 City Avg. (japonica second quality)		Sep-17	0.97
India: Delhi		Sep-17	0.49
Indonesia: Ntl. Avg. (medium quality)		Sep-17	0.80
Republic of Korea: Ntl. Avg.		Sep-17	1.72
Mongolia: Ulaanbaatar		Aug-17	1.08
Myanmar: Yangon (Emata, Manawthukha FQ)*		Sep-17	0.34
Occupied Palestinian Territory: West Bank (short grain)		Aug-17	2.02
Pakistan: Karachi (irri)		Sep-17	0.43
Philippines: Ntl. Avg. (well-milled)		Sep-17	0.82
Saudi Arabia: Ntl. Avg. (Basmati, white Indian)		Aug-17	2.13
Sri Lanka: Colombo (white)		Sep-17	0.54
Thailand: Bangkok (5% broken)*		Sep-17	0.36
Viet Nam: Dong Thap (25% broken)*		Sep-17	0.34

Source: Rice Market Monitor, FAO, 2018

Lessons from the past help many smallholder farmers to learn and embrace a new mindset under which they are less inclined to wait for government support or sell their rice solely through middlemen traders. They are also encouraged to combine their rice farmyards and join hands as collective farming in order to increase the bargaining power and reduce costs, as well as adopt management practices to upgrade food safety and quality. In addition, soft loans were provided to support farmers to have processing facilities and to set-up farmer organization in forms of cooperatives or community-based enterprises in order to reap their own benefits from value added activities and trading. Many proactive farmers have modernized their approach by adopting better practices, creating their own rice brands, and selling their rice via traditional marketing and online channels, apart from diverting their crops and developing organic farming.

Nevertheless, it seems to be not easy for smallholder farmers to act as entrepreneurs and compete in trading business in the globalized world. Many factors still restrict farmers' capabilities to extend their roles into the demand side of the chain. This formed rationales for the study to explore and test a new business model of Inclusive Business as a tool for farmer organizations to upgrade their value creation and to tap into a broader market.

REVAMPING BUSINESS MODEL FOR FARMER ORGANIZATION

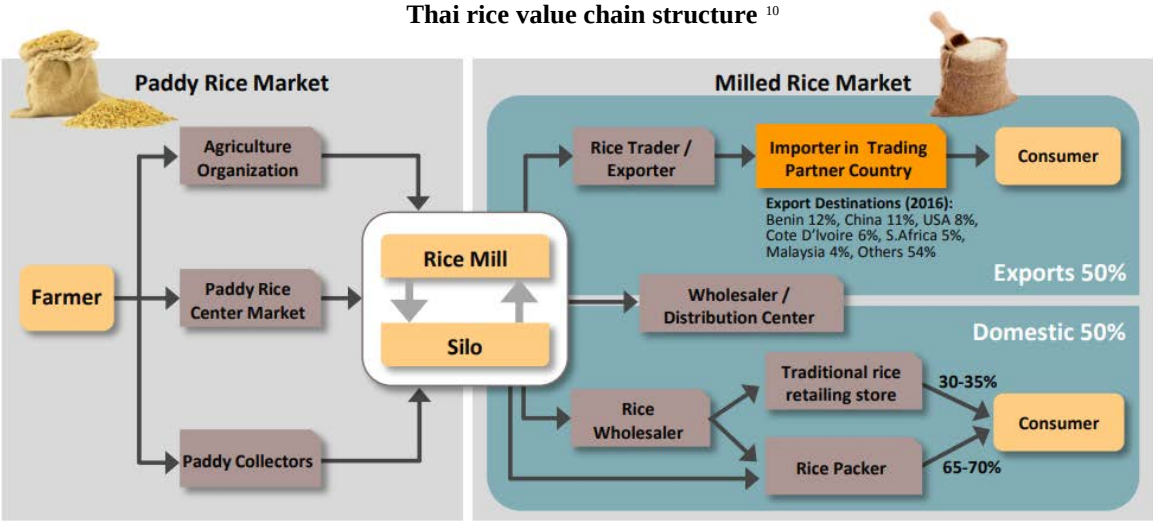
Farmer organizations' capabilities in value creation and marketing

Today, across Thailand, rice-farmers are gradually open in learning to adopt new knowledge and business skills. With regard to small-scale rice farmers, farmer groups and cooperatives have been working more actively in developing products and management system. This includes an increased consideration for more technology adoption, governance system, and logistics management. Nevertheless, the future broad attainment to such practices would not be straightforward due to internal and institutional limitations.

[9] Domestic Rice Prices in Selected Countries (http://www.fao.org/3/I9243EN/i9243en.pdf ; Accessed 25 April 2018)

A key factor that determines competitiveness of the small-scale farmer organizations in Thailand is to build up capabilities in their trading functions and partnership with other actors in the demand chain. Thai farmer organizations try to adjust to new context by enhancing market channels and value creation, so as to maintain market access and sufficient revenue, thereby being able to support local social-economic sustainability. Nevertheless, most farmer organizations need to pay much effort on their agricultural production and processing activities. There are thus a limited number of farmer organizations in Thailand that are ready to extend their roles into rice value chains and to compete globally.

Thai rice value chain structure [10]



Source: Trademap, Ministry of Commerce of Thailand, and compiled by Krungsri Research

In fact, Thailand has established the Agricultural Cooperatives Federation of Thailand (ACFT), including 76 provincial federations affiliated. These trading arms are supposed to act as a bridge between demand and supply sides of the chain, focusing on non-production activities such as market information, R&D, branding, and distribution, as well as technological services. However, the ACFT is still in transition period to develop business performance and closer collaboration with farmer organizations. Therefore, the current situation implies that, to foster competitiveness of farmer organizations and cooperative federation, they should be encouraged to revise business model that grounds between business entity and social enterprise for local economy.

Likewise, Patrawart (2015) analyzed business performance of agricultural cooperatives in Thailand, and found that the cooperatives were not sufficient to achieve both economic and social objectives, due to their internal characteristics of administration and personality of cooperative managers, and level of participation among farmer-members, as well as their capability in terms of marketing and trading business. In addition to the organizational factors, the limited capabilities in marketing and value creation can be explained by institutional constraints in terms of government measures to unleash entrepreneurial capabilities and marketing activities among cooperatives / farmer organizations. However, business eco-system in Thailand has been improving in the way to support grassroots economic development and community-based enterprises.

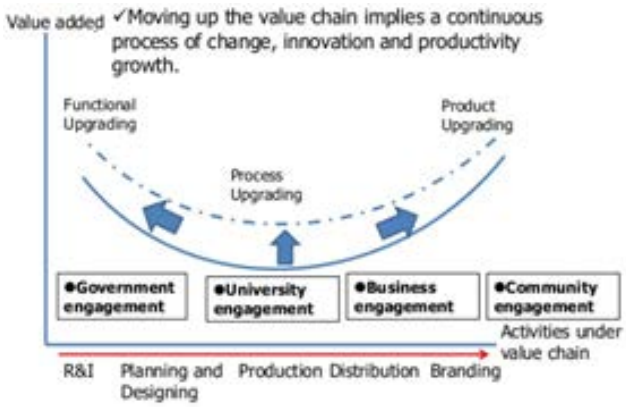
[10] Thailand Rice Industry Outlook, 2016-2018 (https://www.krungsri.com/bank/getmedia/b37c70d6-3cf8-4add-8afe-76f7dcceb402/IO_Rice_2016_EN.aspx ; Accessed 25 April 2018)

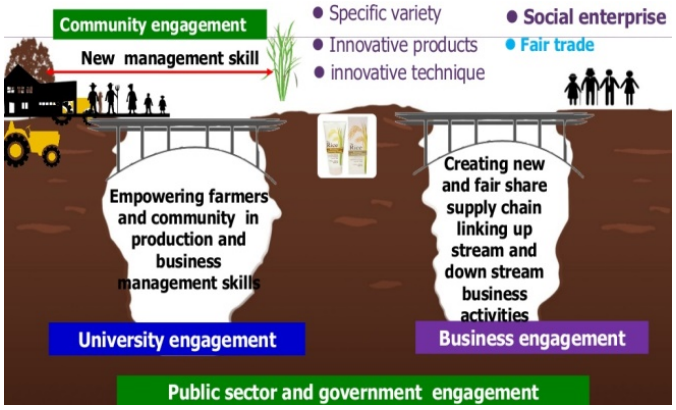
Fostering value creation economy and inclusive development

Inspired by the economic reform policy and the Sufficiency Economy Philosophy of the late King Bhumibol Adulyadej, the Thai government has formulated a national strategy towards value creation economy and inclusive growth.

Thailand's 4.0 Strategy and its 20-Year Plan were set to direct the country to become more technology-driven and with higher value addition to ensure economic growth together with qualities of human and natural environments. Accelerating adoption of technology and standards is thus a key to this strategy, and this can be done through collaboration between public, private, and knowledge partners (Pracharat Network).

Under Thailand 4.0 Strategy, the Government has given high priority to move up the value chain by utilizing modern technology, cultural identity, and creativity in order to respond to demand trend and create price premium. Thai rice farmers are expected to become 'smart farmers' and work together as farmer groups/organizations. These are considered more effective ways to access technologies and upgrade their productivity, quality, and value addition. The transition towards agriculture 4.0, however, is slowly getting underway, along with reforms in business eco-system.





Source: Modified from Stan Shi's referred by Somporn Isvilanonda, 2017 [11]

The previous development reflects the need for a catalyst for change through a platform and partnership of multi-stakeholders. These include local knowledge institutes, governmental agencies, private sectors, and NGOs / social enterprises that join hands in sharing motivation, information, resources, and technology. This kind of engagement is vital to mobilize support and collective force to prevent unfair practice by large trading firms and to influence government's policies. As depicted above, social enterprise and fair-trade business, together with societal partner, play a key role in bridging between smallholder farmers' production and downstream sides of the chain. And this research tries to explore how to cultivate and facilitate the roles of this model in realizing inclusive growth.

[11] Rice Policy in Thailand: Production and Economic Issues (https://www.slideshare.net/sompornisvilanonda1/rice-policy-in-thailand-production-and-economic-issues-1-june-20-2017 ; Accessed 29 April 2018)

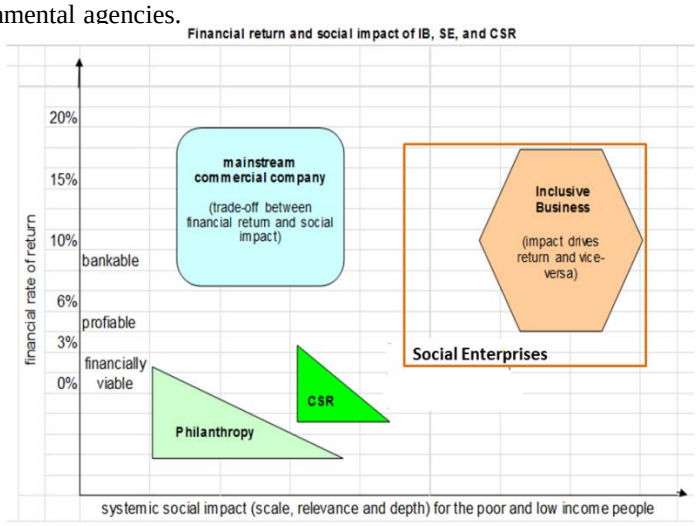
Conceptual background of Inclusive Business Model

According to practical guidance by FAO, Inclusive Business Model is for-profit companies, commercially viable, while enhancing participation of smallholder farmers in the value chain. More specifically, ADB defines Inclusive Business as private sector that involves the poor and lower income groups (those with an income level lower than $3 international poverty line or Base of Pyramid/BoP), both as suppliers, distributors, and consumers. International Finance Corporation (IFC) has been laying the foundation of this business model for a majority of people; so do other development banks Europe and G20 conference that perceive Inclusive Business Model as a tool to achieve SDGs.

Despite a common understanding, Inclusive Business in agriculture may focus on different aspects. Some focus on improving productivity of smallholder farming. Others focus on sourcing from farmers and providing them with better market access and equitable trading conditions. Despite a newly recognized concept, there was a vast array of initiatives that are in line with Inclusive Business. They include fair-trade practice and value-chain development programs. The concept of an Inclusive Business could perhaps be a model that compliments value-chain thinking with a practical steps and a set of plausible supportive measures, as well as a continual promotion through several forum ad international institutes.

Adoptions of Inclusive Business Model

Many patterns of unitization of Inclusive Business (IBM) have emerged in linking smallholder farmers to the markets. First, some IBM companies prefer to work with farmer/agricultural organizations rather than individuals. Local producers such as cooperatives and farmer-owned enterprises will be guided by the IBM companies that play role as intermediary actor in demand side, through practices of fair-trade contract farming and out-grower schemes (top-down IBM). In the context where market linkages are initiated by local producers, IBM tends to be informal in which farmer-traders play key connectors. In many cases, the traders are members of the rural community who facilitate not only direct market linkages but also support their suppliers (bottom-up). The third pattern is driven external partners or combination with many stakeholders. This starts from the assumption that the existing market is not effective in terms of equity and that new skills and knowledge need to be developed to facilitate favorable linkages for all partners. These collective actions are often led by NGOs and local universities and supported by governmental agencies.



Source: Investment Experts' Group, APEC, 2015 [12]

[12] Inclusive Business in APEC Study

Enabling factors for Inclusive Business

To enable broader adoption of Inclusive Business Model, favorable business environment is needed in many ways. First, challenges facing Inclusive Businesses is to manage their supply chain as results of fragmented production network, transaction and logistics costs. Creating a platform for communication is a key factor to facilitate collaboration and partnership with external partners, especially learning institutes and service providers. Second, Inclusive Businesses often lack trading skills and purchasing / bargaining power. They are typically small with limited financial resources, and these characteristics have impacts on the reliability of market access for member-farmers. In addition to demand information, Inclusive Businesses need support in terms of networking and financial capital, as well as trust-building for co-investments and scaling-up of their businesses. Another challenge is to promote inclusive agribusiness to transform the mindset among agricultural organization, and to reorient farmers from subsistence farming to 'farming as a business'.

Source: G20 Inclusive Business Framework, 2016 [13]

Inclusive Business in the context rice sector of Thailand

This research takes rice production in Thailand as a context of study. Inclusive Business in Thai rice sector can be traced back to the early 1990s when Urmatt (www.urmatt.com) started engaging rural communities in northern Thailand to produce basmati rice through a fair-trade contract farming with hill tribes of north-east Thailand. By converting chemical farming to natural and organic production, Urmatt invested in knowledge transfer to smallholder farmers to upgrade rice for premium prices and market access in international markets. Local value capture is also increased through processing by-products, such as rice bran keenly sought by the cosmetics industry and the medical community. Farmers' incomes have increased dramatically as a result, and new products have been developed such as chia seeds and organic eggs. Moreover, environmental degradation is averted in the process, while social capital in the rural areas contributes to stronger safety-net in the region.

(https://aimp2.apec.org/sites/PDB/Supporting%20Docs/Forms/Supporting%20Docs.aspx?RootFolder=%2fsites%2fPDB%2fSupporting%20Docs%2f3139%2fProposal%20Attachments%20%28if%20any%29&FolderCTID=&View=%7bCA72D0E0-295E-45DF-B491-F7BF6581A22F%7d ; Accessed 5 May 2018)

[13] G20 Inclusive Business Framework (http://g20.org.tr/wp-content/uploads/2015/11/G20-Inclusive-Business-Framework.pdf ; Accessed 1 May 2018)

The case of Urmatt show how SMEs, which account for over 97% of Thai business entities, can adopt business model for inclusive growth. Meanwhile, Inclusive Business Model can also be utilized by some capable agricultural cooperatives (around 3,500 cooperatives) and community-based enterprises (70,000 enterprises) in Thailand. The business model will be a catalyst that unleashes potential among the local economy enterprises, and transforms them from sufficiency-based towards profit-making and sharing economy. This research selected two prominent case-studies of a cooperative (Banlad Agricultural Cooperative, Ltd.) and a community-enterprise (Tung-thong Yangyuen Organic Community-Enterprise) that have been operating business in accordance with Inclusive Business Model, aiming to understand their transition path and actual implementation, as well as results of Inclusive Business Model.

PARTICIPATORY ACTION RESEARCH THROUGH COLLABORATIVE PLATFORM

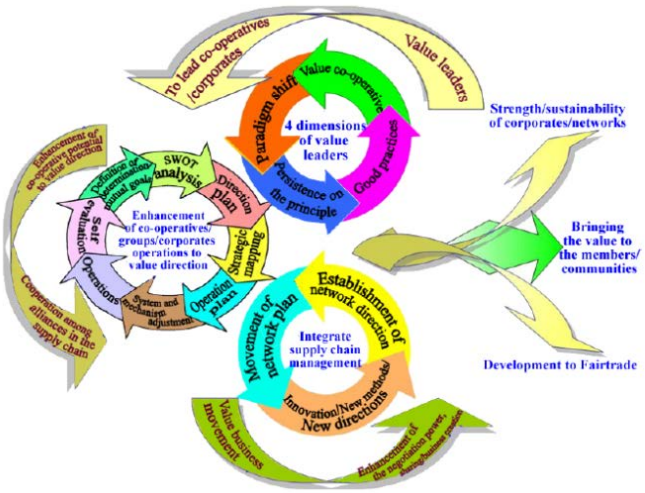
Conceptual framework

This study has been guided by a concept of 'Value Network and Fair Trade' derived from our previous action researches. The concept focuses on connecting strategic partners along the value chain and network of societal stakeholders. According to Patrawart (2007), to facilitate value creation and market access, smallholder farmer organizations need to develop cooperation with external partners, and a partnership platform for all related actors to play roles and share resources and capabilities. Similarly, to enable cooperatives and community enterprises to adopt Inclusive Business Model, collaborative platform has been constructed to allow related organizations to take part in upgrading capabilities of the enterprises, thereby enhancing their ability to increase the price premium and competitiveness in today's market system.

Based on this concept, platform creation involves three key dimensions (see figure below):

1. Developing entrepreneurial leaders based on four-dimensional characteristics, cooperative spirit;
2. Improving business operation through strategic management; and
3. Utilizing integrated supply chain management and the fair trade principle

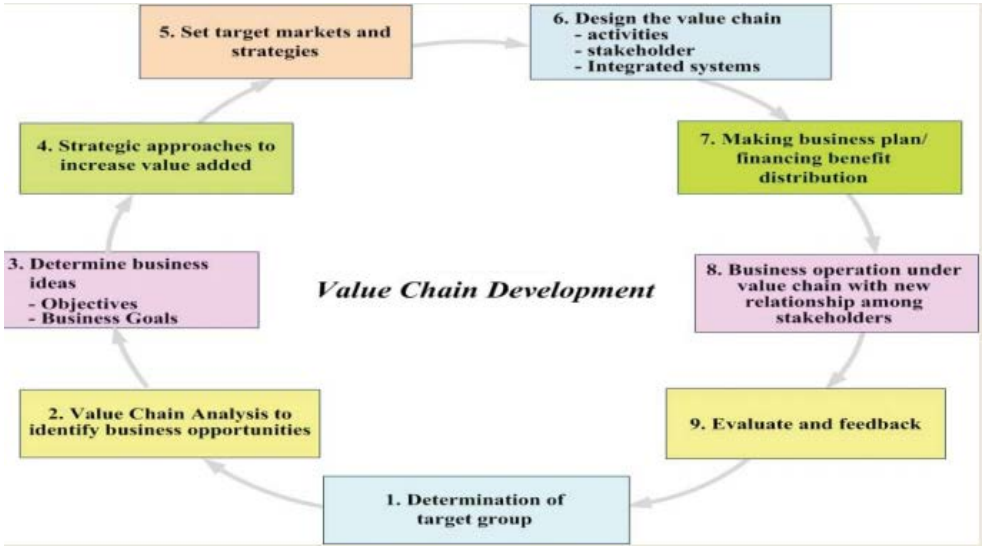
Value network and fair trade platform



Source: Patrawart (2007)

This framework of value chain upgrading through public-private partnership has been utilized in previous researches on co-operative development in Thailand. Several steps have been planned to conduct the case studies, using lessons learned from earlier works of value chain development such as

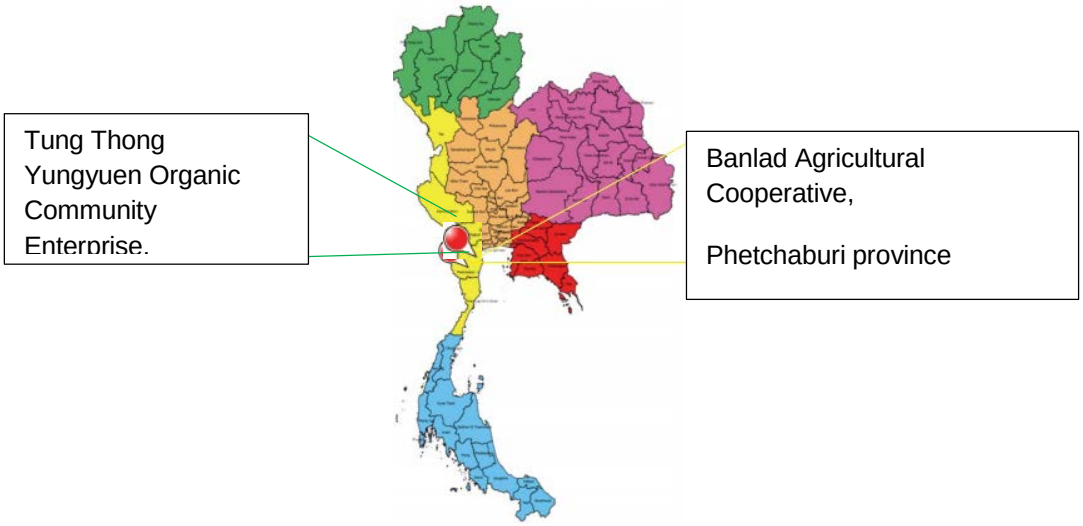
Satjatham Value Network of Hommali Rice, Kitchakut Fruit Value Network, Sampran Value Business Cluster (Patrawart, 2007).



Source: Patrawart (2007)

Methodology and context of study

This research employed the participatory action research approach using case study methods led by the Co-operative Academic Institute (CAI), Kasetsart University. The platform creation and activities to develop the value chains of Inclusive Business have been collaboratively operated by many organizations including cooperatives, community enterprise, SME exporter, local agricultural-related agencies. The pilot cases of promoting adoption of Inclusive Business Model among cooperative and community enterprise have been conducted in two provinces in Thailand; Tung Thong Yungyuen Community Enterprise in Suphanburi province and Banlad Agricultural Cooperative in Petchaburi province. The results of case studies are expected to be applicable to cooperatives and community enterprises in other to broaden adoption of the business model in other provinces in Thailand.



RESULTS FROM CASE STUDIES: BANLAD AGRICULTURAL COOPERATIVE AND TUNG-THONG YANYUEN ORGANIC COMMUNITY-ENTERPRISE

Case Study 1: Banlad Agricultural Cooperative, Phetchaburi Province

The action research resulted in a creation of platform for collaboration. Smallholder farmers in Banlad district have been supported by many actors, thereby preparing their readiness to be included in IBM. 40 farmers have been upgraded in terms of functions, process, and products, through a continual process of learning (14 activities), and GAP rice system was set up based on participatory guarantee system. The capacity building activities have been conducted through the platform that allowed many external alliances can take part, especially the Rice Seed Center in Rachaburi province, aiming to obtain standard recognition and more access in broader markets within this year of 2018.

After the action research, comparative assessments were conducted to estimate changes in farmers' performance. Twenty-four farmers were found to have higher performance in terms of environmental awareness, business vision / Thailand 4.0, production planning technique, sustainable development practice, branding and managerial skills, as well as fair-trade and value chain development process. The study validated the applicability of value chain and network framework to facilitate adoption of IBM by farmer organization. In addition, assessment was also conduct to identify supportive measures need to improve business eco-system for IBM. The analysis revealed that key factors for IBM in the case of Banlad include visionary leaders, previous experiences in trading and service businesses, financial readiness, and progressive mindset to adopt innovation and new business model.

Nevertheless, many challenges still exist for BAC to overcome, especially how to collectively adjust production patterns from chemical farming to non-chemical and organic farming in the future. Based on the challenges, a logical framework was constructed as a guideline for strategic planning for IBM development in Banlad district. The strategy is based on an objective "to enhance capabilities among smallholder farmers to develop from GAP rice to organic production so as to attain the vision of inclusive growth". Further, this strategic direction was cascaded down to a road map of action and practical business plan for further adoption and implementation of IBM in Banlad district.

The business plan for IBM was approved by the 40th executive committee of Banlad Agricultural Cooperative. Consequently, the future plan of IBM will be implemented by sub-committee of IBM and IBM working group under supervision of BAC directing manager. This include practical actions such as a plan to purchase GAP rice from standardized farm in this year of 2018. There are 23 farmers that will benefit, with estimated quantity of rice (Chainat and Suphanburi Rice) around 100 tones, price at about US$44,000 (1,375,000 baht), and net profit margin at US$6,762 (209,630 baht). In addition, the brand of 'Banlad's IBM Rice' will be initially promoted (5 kg. and 1 kg. packages) aiming to serve target markets mainly from farmer-members in Banlad district (9,000 households) and local universities, hospitals, and restaurants in neighboring areas. Meanwhile, 1 kg. package of rice will be promoted to general consumers outside Banlad so as to introduce the concept and business model of IBM as a tool to encourage smallholder farmers and inclusive growth in Thailand.

Thong Thong Yangyoun Community Group, Supunburi Province

In the first year of project, 31 farmers have been upgraded in terms of functions, process, and products through the process of seven learning activities. The comparative assessments has shown improved performance in terms of environmental awareness, business vision / Thailand 4.0, production planning technique, sustainable development practice, branding and managerial skills, as well as fair-trade and

value chain development. Meanwhile, the assessment of eco-system supporting the IBM adoption in this case reflected the need to uplift administrative capacities of this enterprise in order to enhance participation and engage more in business development through IBM approach.

To enable further development based on IBM, we formulated a strategic direction of "driving the community enterprise towards organic farming and better livelihoods and sustainable community development". The strategies to achieve this goal include 1) creating mechanism to develop capabilities among famer-members towards organic production (Smart Farmers) 2) implementing IBM development plan for rice sector together with strategic partners in public and private partners 3) implementing action plan for enhancing value creation of commodity and processed products developed by wife-groups in the Tung Thong neighborhood areas.

This case study of IBM Rice was preceded in parallel with market trial activities, organized by Kasesart University's Market for Community-Support Agriculture Project and KU Food Market, and interactions with customers provide deeper demand information for IBM rice project to redesign the products in line with customers' preferences. Further, information received from the market trials were also utilized by the project of Color Rice and Riceberry Packaging Development Project, thereby helping the IBM rice to improve its package as well. Besides, overall results of consumer survey revealed that target customers in the university were satisfied with the pilot products in levels of high-very high satisfaction.

With regard to future development of IBM, this case study showed that restructuring and upgrading of administrative functions did help TungThong. CE to take in and implement IBM project. Other key factors were to form strategy working group as a core team to convince and coordinate with other famer-members, and to set up a learning center on IBM at TungThong. CE as a forum to discuss and absorb IBM practice. In addition, to expand product variety from rice to processed product, we encouraged wife-groups to produce fried-banana snack and sell them through online application. This activity, among a set of technical, managerial, and market trainings, was found to be an effective tool to engage more farmers to join IBM rice project due to their wives have been convinced, thereby drawing more attention and participation from rice farmers as well.

KEY RESEARCH FINDINGS AND RECOMMENDATIONS

The global agenda of sustainable development leads the international community to achieve the SDGs, and IBM is one of a collective efforts promoted in many global fora. Adoption of IBM has shown benefits not only for large and SME firms but also farmer organizations that are capable to make use of this new practice. Although cooperatives and community enterprises may apply IBM into their ongoing business operation, diffusion of this innovation for farmer organization in Thailand is not straightforward and thus required supporting system. Coordination mechanism is needed to connect related stakeholders and create trust for partnership among parties from upstream to downstream of rice value chains as well as public actor supporting along the chain. Such coordination should also be linked with partners in target market as well so as to gain market insights and requirements in terms of food safety and standards. Based on these findings, a key recommendation is to develop a central unit or platform for sharing knowledge and information, as well as sharing resources and budget from various parties with particular specializations. The IBM Development Platform should place emphasis on following tasks 1) providing three dimensions of learning for smallholder farmers to upgrade their capabilities in all aspects 2) facilitate value chain development process 3) connecting and encouraging trust and collaboration among multi-stakeholders in order to realize the same goals.

Despite the need of the Platform, one concern commonly raised during the focus groups is fragmented support from governmental agencies and this also results in time-consumed for farmer organizations and farmer-members to participate while taking care of their farming activities. Therefore, integrated programme and dialogue with local people should be conducted in accordance with their demand and also with target markets. In addition to the platform creation, much policy issues could be derived from case studies in order to mitigate existing constraints as follows:

- Smallholder farmers (except community leaders) often lack of experience in modern agri-business, entrepreneurial mindset, and managerial skills. To facilitate adoption of IBM by farmer organizations, these internal characteristics of participants need to be upgraded in order to prepare them for business development, value creation, and upgrading process.
- Farmer organizations normally use conventional channels to distribute and market their commodities and products. This is based on the traditional perception of farmer organization to separate trading function from production activities, and allow trading firms to reap more benefits from their produce. Also, farmer organizations may have to invest in trade and logistics infrastructures (e.g. silo, dry field), as well as capital to finance their purchasing/ bargaining power and distribution costs. A limited number of farmer organizations that are capable of adopting IBM should thus be selected and supported taking into account their readiness.
- Technological transfer and product innovation will be helpful for zero-waste management of agricultural supplies and the problem of contract-farming in which some buyers cannot accept all of the produce from farmer-members. IBM adoption by farmer organizations should thus be developed in parallel with product innovation together with knowledge / technical partners.
- Regional branding needs a strong effort from farmer-members to produce based on the same quality and standards with consistent and timely delivery. A majority of farmers' organizations in Thailand seem to have a lack of governing system to control such collective production, resulting in weaker good will to create a common brand or to collectively respond to upcoming demand trend, thereby limiting their ability to engage in IBM and competition in the markets.

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RICE BREEDING AND MECHANIZATION FOR VALUE ADDITION IN LAOS PDR

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ABSTRACT

In rainfed lowland rice ecosystem, farmers adapt to climate change by changing planting pattern from traditional hand transplanting to dry direct seeding in order to avoid early drought. Therefore, breeding for new aromatic photoperiod sensitive variety which is flowering in early October was developed for direct seeding purpose. In addition, labor shortage is common and it has increased the cost of employing labor. Thus traditional use of labor for planting and harvesting rice is not practical any more in some areas of central Laos. Increase of labor cost has increased the cost of rice production, resulting in lower labor productivity and reduced competitiveness of rice in the international markets. Mechanization may help minimize the labor shortage problem and improve the quality of rice in central Laos.

Transplanter, Seed drill and Broadcasting require less labor than hand transplanting, but produced crops with 8%, 10 and 9% lower mean yield compared to hand transplanted crops respectively. Combine harvesting requires less labor than hand harvesting, however, farmers need to dry combine harvested paddy rice either by sundry or artificial dryer. In addition, combined contracting service fee is quite expensive at 15-20% of total production. Optimum field size of 2,000 to 3,000 m^2 could be harvested by combine 4.5ha per day and reduces time for combine harvesting 1ha of rice field compared with original field size of less than 1,000 m^2. Mean yield loss from combined harvesting was 1.5% of the total yield, which should be well acceptable in the industry. Establishment methods did not appear to have effect on yield loss percentage.

Delay in harvesting was affected head rice returned, and when time of harvesting was delayed to 35 days after 75% flowering, head rice decreased greatly to 35% under flatbed dryer and 29% under sundry. Highest head rice returned was obtained when paddy was harvested at 25 days after 75% of flowering and this was 48% when dried in the flatbed dryer, and 32% under sun drying. Drying combined with harvested paddy rice using artificial dryer produced higher head rice return of 45% compared with sun drying with head rice returned of 38% and hence increases the market value.

Setting up mechanization production board should be considered by the government in order to direct mechanization business to the bank and other government institutes for encouraging mechanization activities. The board could organize to provide credit to farmers who wish to develop their rice field, and also set up community artificial dryer in their village. It could assist provision of long term credit to rice millers association for setting up commercial artificial dryer in the miller as well as credit to combine harvesting association to reduce cost of harvesting to promote farmer using service from the combination.

Keywords**:** Aromatic, Photoperiod sensitivity, mechanization, seed drill, transplanter, broadcasting, combine harvest, artificial dryer, sundry, delay harvesting, head rice

INTRODUCTION

Rice production is the main farming activity in Laos, accounting for over 80% of the total cultivated area. Lowland rice is grown under two main agro-ecosystems, namely rainfed lowlands covering 88% and irrigated lowlands covering 12% (DOA., 2016). Due to climate change rainfall pattern is affected, causing early drought occurring more frequency (Inthavong., et al, 2011 and Xangsayasane *et al*., 2014) and changing planting pattern from traditional hand transplanting to direct seeding in center part of the country. In addition, some years flood has occurred during end-August to September affecting production losses (Xangsayasane *et al*., 2012). Therefore, current breeding objective is focused on selection for photoperiod sensitivity, flowering in early to mid-October, and flood and drought tolerant with aromatic flavor.

In Central Laos, where rice production for commercialization is practiced, the labor shortage is common in these areas and has increased the cost of employing laborers. Thus traditional use of laborers for planting and harvesting of rice is not practical any more in some areas. Increase of labor cost has increased the cost of rice production, resulting in lower labor productivity and reduced competitiveness of rice in the international markets against neighboring countries.

Hand transplanting needs about 40 people to complete 1ha/day, including pulling the seedling and hand transplanting (Xangsayasane *et al*., 2016). The most common method practiced to save labor is broadcasting, however, this method may reduce the time of planting greatly, but often crop establishment is rather slow and not uniform and patchy. This may be related to uneven surface of paddies and also light cultivation after broadcasting causing seeds positioned at different soil depths. There are several methods practiced or tested in Laos such as drum seeders, seed spreaders, seed drills and transplanters to overcome the shortcomings of broadcasting. Transplanter has been commonly used and replaced hand transplanting in northern Asian countries. Its advantage over hand transplanting is reduced labor requirement and faster speed of operation compared to hand transplanting. It is sometimes used for high quality seed production of rice in Laos where hand transplanting is not feasible any more with increased labor cost. The other planting method is seed drill, which is gaining popularity in Savannakhet due to saving of labor cost compared to transplanting (unpublished). Compared to broadcasting, it can provide better establishment and also drill planted crops are easier for weed control. Performance of seed drill may be compared with broadcasting where direct seeding is already practiced and with hand transplanting where it is still practiced.

Hand harvesting has been a common practice in Laos, and this commonly requires about 35 labor/days to harvest 1ha of rice field and thresh grain. Combine contracting service has commenced recently in Khammouan, Vientiane capital and Vientiane provinces and it is expected that the adoption of combined technology will increase with time, particularly as labor availability becomes even more limited (Xangsayasane *et al*., 2016). However, limitations of combined adoption is associated with high combined fee charge, although the fees are expected to be reduced as combined contracting service becomes more common and combined harvester efficiency increases. The other limitation for the adoption of combined harvester is associated with availability of drying facilities, as combined harvested paddy is difficult to sundry in the farm.

The Lao government is promoting mechanization for improving quality of rice grains, especially in dry season rice production. In addition, utilization of mechanization is believed to reduce cost of rice

production and overcome labor shortage issues in the agriculture sector. This mechanization includes crop establishment methods such as the use of transplanters and seed drills, combined harvesting and artificial dryers. However, it seems to be that the size of rice fields in Laos is rather too small for efficient use of machineries. This small paddy size is due to farmer's use of draft animals for land preparation with hand transplanting. In addition, most of the rice fields are located on sloped land, where small field size with levee is required for holding standing water in the wet season. Currently, mechanization is introduced to Laos as commercial operations in many provinces, and therefore, with the cost of fees incurring, farmers may need to increase their rice field size to gain maximum benefit from mechanization. The percentage of milled rice returns is one factor determining price of paddy by rice miller.

This research is aimed to study whole cycle of mechanization application for rice production in Central area of Lao PDR, to determine suitable crop establishment methods to reduce cost of rice production, factors affecting combined harvesting efficiency, particularly field size, and drying methods for optimum head rice recovering from combined harvesting.

MATERIALS AND METHODS

Development of new varieties for direct seeding

New glutinous aromatic with submergence tolerant and blast resistance population was developed by research collaboration between the Rice Research Center (RRC), National Agriculture and Forestry Research Institute (NAFRI), Ministry of Agriculture and Forestry (MAF) in Laos and BIOTEC center, National Science and Technology Development Agency (NSTDA) in Thailand. Hybridization was done in 2009 between TDK1*4/HNN//IR85620-34-141///RD6*3/JHN and using Marker Assisted Selection (MAS) to select traits of interest (Table1). TDK303-140-3-93 derived from BC3F2 (TDK1*4/HomNangnuan), developed by marker assisted backcrossing (MAB) at NAFRI through the Mekong breeding program, carries fragrance phenotype *(badh2)* from Hom Nangnuane. IR85620-34-141 carries *sub1* developed by MAB at IRRI. RGD07529-1-1-38M-1-0 derived from RD6*3/JaoHomnin, developed by MAB at Rice Gene Discovery Unit (BIOTEC) carries qBL1 and qBL11. Field selection was done based on morphology and plant types. Total of 20 fixed lines from RGD10033 population was tested on replicated yield trials at Rice Research Center in DS2014/15 and WS2015. On farm demonstration was done in WS2016 and WS2017 in Vientiane, Bolikhamxai, Khammouane and Savannakhet provinces.

Table1. Characteristic of parental lines

Breeding lines	Genetic backgrounds	Fragrance	Cooking quality	Submergence	Blast resistance
TDK303	TDK1	Badh2 ^{HN}	Glutinous	non	unknown
IR85264	TDK1	non	Glutinous	Tolerant (Sub1)	unknown
RGD07529	RD6	non	Glutinous	non	Broad spectrum resistance *(qBL1 and qBL11)*

Seed drill and transplanter

The study was done in 5 villages: Pakpung, Hatkhanhien, Tung, Paketue and Navangthong. Seed drills were provided by NAFRI to three villages (Pakpung, Hatkhamhien and Paketue). The seed drill was attached to hand tractor for planting rice. In the dry season, soil was prepared in December under dry condition and then rice was seeded by seed drill in the first study. Dry rice seed was put in the seed box attached with seed drill and seeded under dry soil condition. After seed germinated and seedlings were 5 to 10 cm, field was irrigated. Transplanters were owned by farmer group in Hatkhanhien, Tung,

Paketue, while in Pakpung it was serviced by Takokkung center. Total of 2,000 seedlings trays was provided to farmers for growing seedlings before planting rice by transplanter. Broadcasting and hand transplanting were done by farmers. Land preparation was done by farmers as their usual practice. Fertilizer was applied at about 100-150 kg/ha of NPK. Rice was harvested by combine from NAFRI and grain yield was adjusted to 14% moisture content.

Combined harvesting efficiency- field size and yield loss

We harvested a total of 76 rice fields in dry season with combined areas of 15.3 hectares, of which 12.3 ha was harvested from enlarged field in three target villages, 5 hectares (26 fields) in Pakpung, Paksan district, Bolikhamxai province, 4.3 hectares (18 fields) in Hatkhamhien village, Xebangfai district, Khammouane province and 3 hectares (12 fields) in PakEtue village, Nongbok district, Khammouane province. About 3 hectares (20 fields) of original field size less than 1,000 m^2 in each village was also used for this study. Size of each enlarged field ranged from 1,023 to 8,560 m^2 depending on the slope and toposequence. In the sloped areas, top soil was removed from higher position to the lower position of the field. KUBOTA-DS700 was used for this study of combined harvesting efficiency in our target villages. The time required for the combination to complete harvesting was recorded for each field, and combined harvesting efficiency was calculated in each field after the field size was determined. Farmers in different villages had planted rice with different methods, including hand transplanting, transplanter, seed drill, drum seeder and broadcasting. Paddy rice harvested by combined was dried to reduce moisture content by sun drying and flatbed dryer to adjust to 14% moisture content. Yield loss from combined harvesting was collected in 8 sites and yield loss was determined by randomly collecting grain on the soil surface in one square meter soon after the combine harvested the area.

Effect of drying methods

The experiments were conducted on-farm with participation of farmers in 5 villaegs (Pakpung village, Paksan district, Bolikhamxai province; Tung and Hatkhamhien villages, Xebangfai district and Paketue and Navangthong villages, Nongbok district, Khammouane province). Paddy harvested by combine was dried either by the sun and flatbed dryer. Dried paddies were collected for milling quality evaluation. In DS2014-15, a total of 16 paddies samples were collected from different farmers who participated in the experiment in 5 villages. Of these samples 8 samples were collected after sun drying and 8 samples were collected from flatbed dryer. In WS2015, a total of 18 samples were collected from farmers in 4 villages. Of these samples, 8 samples were from flatbed dryer and 10 samples from sun drying. In DS2015-16, a total of 14 samples were collected from farmers in 2 villages. Of these samples, 6 samples were from flatbed dryer and 8 from sun dried. Flatbed dryer had 4-ton capacity and was used to dry paddy from combined harvester and rice paddies harvested in a similar manner were sundried by placing paddies on tarpaulin sheets. Paddy was dried for about 10 to 12 hours in flatbed dryer to reduce moisture content to 14 to 15%, while it took about 17-18 hours under sun drying (dried from 8 am to 5 pm, and paddy thickness was 5 cm). Under sun drying, paddy was turned out in every 2 to 4 hours and when paddy was dried to 14% moisture content, the samples were collected for milling quality evaluation.

Effects of rice harvesting time

The experiment was conducted in the Rice Research Centre, Vientiane, Laos. TDK8, a commercial rice variety was used for this study. Transplanting was done by transplanter when seedling age was 15 to 17 days. In DS2014-15 transplanting was done on January 10, 2015 and in DS2015-16, transplanting was done on January 15, 2016. Fertilizer was applied at the recommendation rate of 90:30:30 of N, P_2O_5 and K_2O. Randomized Complete Block Design was applied with three replications. Paddy rice was harvested by hand at 25, 35 and 45 days after 75% flowering. Each sample was dried under the sun and flatbed dryer until moisture content was reduced to 14%. A 125g of rough rice sample with moisture content of approximately 13% to 14% was used to determine milling recovery. Rough rice sample was dehulled by using a Satake laboratory sheller. Brown rice was recorded before milling in a McGill mill number 2 for

one minute. The milled rice sample was collected in a jar and was allowed to cool before weighing; the weight of the total milled rice was recorded. Whole grains (head rice) were separated from the total rice with rice-sizing device and recorded. The percentage of milling recovery was calculated as follows:

$$\text{Brown rice } (\%) = \frac{\text{Weight of brown rice}}{\text{Weight of rough rice}} \times 100$$

$$\text{Total milled rice } (\%) = \frac{\text{Weight of Total milled rice}}{\text{Weight of rough rice}} \times 100$$

$$\text{Head rice } (\%) = \frac{\text{Weight of Head rice}}{\text{Weight of rough rice}} \times 100$$

RESULTS AND DISCUSSIONS

Development of new varieties for direct seeding

Table 2 shows results from yield trials of 20 promising lines in RRC. Of which 9 promising lines produced grain yield significantly higher than check varieties (Xebnagfai2 and Xebangfai3). All of 20 promising lines were test physical grain quality and panel evaluation at RRC and one promising line (RGD10033-77-MAS-438-46) was selected for on farm demonstration (Table 3). Grain yield in on-farm has showed promising compared with commercial varieties and have yield advantage than commercial varieties ranging from 20 to 32% (Table 4).

Table 2. Yield trial at RRC in DS2014/15 and WS2015

No	Name	Maturity	Plant	Panicle	Grain	Remarks
1	RGD10033-77-MAS-43-B	118	97	10	4,090*	
2	RGD10033-77-MAS-149-14-B	118	90	8	3,659	
3	RGD10033-77-MAS-149-16-B	129	99	10	4,030*	
4	RGD10033-77-MAS-149-17-B	128	94	10	4,376*	
5	RGD10033-77-MAS-149-18-B	123	91	8	3,545	
6	RGD10033-77-MAS-291-20-B	121	93	9	3,601	
7	RGD10033-77-MAS-291-23-B	121	89	8	3,797	
8	RGD10033-77-MAS-291-24-B	126	91	9	3,810	
9	RGD10033-77-MAS-291-25-B	125	94	10	4,140*	
10	RGD10033-77-MAS-298-27-B	125	99	9	3,962*	
11	RGD10033-77-MAS-438-46-B	125	96	9	3,930*	
12	RGD10033-77-MAS-438-47-B	127	100	10	3,901	
13	RGD10033-77-MAS-524-76-B	129	97	8	3,386	
17	RGD10033-77-MAS-291-23-B	120	94	10	3,850	
18	RGD10033-77-MAS-327-43-B	123	91	9	3,645	
19	RGD10033-77-MAS-438-46	121	97	10	4,232*	Promising
20	RGD10033-77-MAS-438-50-B	124	97	10	4,078*	
21	RGD10033-77-MAS-327-42-B	126	100	9	4,020*	
22	RGD10033-77-MAS-291-21-B	125	101	9	3,824	
14	DS14-YT1-14	130	97	9	3,409	
15	Xebangfai 2	118	111	9	3,726	
16	Xebangfai3	125	114	9	3,705	

	Mean	124	97	9	3,851	
	CV (%)	2.9	7.8	2.1	451.8	
	LSD (5%)	1.4	5.0	14.1	7.0	

* significant difference compared with Check (Xebangfai2)

Table 3. Grain quality and panel evaluation

Name	1,000 grain	Paddy lengt	Brown rice	Milled rice	% Total	% Head	Panel
XBF4	28.2	10.1	7.0	6.9	64.1	50.6	Soft and aroma
TDK8	31.9	11.4	8.0	7.8	53.6	40.7	Soft and no aroma
RD6	24.6	8.9	6.8	6.5	60.0	43.7	Soft and aroma

Table 4. On farm demonstration of XBF4

Districts	Farmers	Areas (ha)	Variety	weight	Yield	Yield
Paksan	Mr Bounhep	0.28	XBF4	1,200	4,286	100
Paksan	Mr Bounhep	0.32	RD6	1,200	3,750	88
Nongbok	Mr Fai	0.4	XBF4	1,400	3,500	100
Nongbok	Mr Fai	1.92	RD15	4,620	2,406	69
Xebangfai	Mr Sivone	0.45	XBF4	1,760	3,911	100
Xebangfai	Mr Sukhon	0.45	RD15	1,200	2,667	68
Phonhong	Mr IL	0.8	XBF4	2,500	3,125	100
Phonhong	Mr IL	0.96	RD6	2,400	2,500	80

Seed drill and transplanter

Mean grain yield of machine transplanted fields was about 20% lower than that of hand transplanted fields (Table 5). Quartile yields show its yield distribution across fields is uniformly lower than hand transplanting and broadcasting. Seed drilled crops produced similar yield to that of hand transplanting, but the number of fields established from seed drill was small in our experiments and also the farmer did gap filling when the initial establishment was not good. Grain yield of crops established from broadcasting was 7% lower than that of hand transplanting, but this was not significantly different from hand transplanting.

Table 5. Comparison of yield obtained from 4 establishment methods of 76 fields examined in the dry season

Methods	Number of	Total harvested	Mean field	Mean yield	Relative yield
Hand transplanting	21	3.8	1,532	3,638	100
Transplanter	25	4.7	1,393	3,362 ns	92
Broadcasting	19	4.2	3,000	3,090 *	85
Seed drill	11	2.6	1,924	2,894 *	80
Total/mean	76	15.3	1,962	3,246±324	

ns = not significantly different from the hand transplanted yield, * = significantly different from the hand transplanted yield.

Combined harvesting efficiency- field size and yield loss

Combined efficiency was estimated in relation to the size of paddies by measuring the time required to complete harvesting a paddy and relate this to the size of measured paddies. The results of combine harvesting of about 15.3 ha from 76 fields of various sizes have shown that combine speed was low when harvesting smaller paddies particularly less than 1,000 m^2. Combine harvesting efficiency increased with the increase in field size (Table 6). In the fields that we enlarged in size to about 2,000-3000 m^2 the efficiency was about 0.64 ha/hour and no further efficiency gain is expected over 3,000 m^2 fields. The combine efficiency gain in the enlarged field size of 2,000-3,000 m^2 over the small traditional fields of less than 1,000 m^2 would be about 52% (daily harvesting area ratio of 5.1ha/3.35ha). It appears about 3-5 paddies/ha may be optimum size for rainfed lowland rice in Central Laos.

Table 6. Yield and combine harvesting efficiency in the fields for different field sizes

Field size (m^2)	Mean size	Fields	Yield (kg/ha)	Speed	Efficiency
<499	322	11	3,313	0.364	2.9
500-999	766	8	3,521	0.472	3.8
1,000-1,499	1,146	19	3,280	0.541	4.3
1,500-1,999	1,680	16	3,542	0.544	4.4
2,000-2,999	2,280	12	2,984	0.637	5.1
>3,000	4,808	10	3,825	0.630	5.0

Mean yield loss from combine harvesting in two dry season experiments varied from 0.8 to 2.2% of the total yield (Table 7). Crop establishment methods did not appear to have effect on yield loss percentage. The mean yield loss was about 1.5% which should be well acceptable in the industry. The loss depends on several factors, but higher combine speed would increase grain loss. As combine harvesting does not involve separate threshing and handlings of grains as in manual harvesting, the loss found here should be considered to be less than the expected loss from hand harvested crops.

Table 7. Yield loss from combine harvesting at 29 farms

Date	Farm	Village	Combine loss		Yield
			kg/ha	%	kg/ha
DS2014-15	8	5	78	2.2	3,676
DS2015-16	21	2	27	0.8	3,728
Total/Mean	29	7	52	1.5	3,702

Effect of drying methods and milling quality

The mean head rice return under flatbed dryer was 44.5% which was higher than mean head rice under sun drying of 37.9% (Table 8). In most cases, about 9 to 10 hours of drying was required to bring the moisture content from 28% after combine harvesting to 14-16%. Participating farmers made comments that sun drying required much more work, while flatbed dryer did not require constant attention. It should be pointed out that the sun drying was conducted throughout the day, and the higher head rice percentage may be obtained if sun drying was done in the morning only from 8 am to 1 pm, but it would take three days for drying to reduce moisture content to 14%. Improvement in techniques in both drying methods could reduce broken rice percentage.

Table 8. Drying methods and milling quality

Number of	Type of drying	% brown	%	%	% rice	%	% head rice
8	Flatbed dry	77.3	64.2	22.7	13.1	19.7	44.5
8	Sun dry	76.8	62.4	23.2	14.3	24.5	37.9

Effects of rice harvesting time

When time of harvesting was delayed to 45 days after flowering 75%, broken rice increased greatly up to 42% in DS2014-15 and 47% in 2015-16, while head rice decreased sharply up to 13% and 8% respective, even drying by flatbed dryer (Table 9). Highest head rice returned of 48% was found when paddy was harvested at 25 days after flowering 75% and dried in flatbed dryer, and when paddy was dried under sun drying head rice returned reduced to 32%. When paddy harvested at 35 days after flowering 75% and dried in flatbed dryer, head rice return reduced to 35%, and 29% under sun drying.

Table 9. Time of harvesting and mean milling quality in DS2014-15 and DS2015-16 for paddy dried in flatbed dryer and the sun

Flatbed dry				
	% brown rice	% milled rice	% head rice	% broken rice
25 DAF	76	60	48	12
35 DAF	76	60	35	25
45 DAF	74	54	13	42
Sun dry				
	% brown rice	% milled rice	% head rice	% broken rice
25 DAF	76	59	32	26
35 DAF	77	60	29	31
45 DAF	75	55	8	47

CONCLUSION

Development of new varieties for direct seeding

Variety suitable for direct seeding in the wet season should possess photoperiod sensitivity, flowering in early October to avoid rainfall at harvest time, as direct seeding needs to plant in May before rain comes. In addition, variety should be tolerant of flood, resistant to blast disease, and have good milling quality, good eating quality and also aroma flavor to meet market requirement. Therefore, promotion of XBF4 (RGD10033-77-MAS-438-46) should be done to ensure farmer will have an access to this variety for future production.

Drill and Transplanter

One potential factor that's affecting grain yield is rather wide rows used for transplanter and this may be a disadvantage for transplanter planted crops particularly during the dry season (DS), when hand transplanted crop has rather narrow row spacing. The use of transplanter needs to be assessed carefully particularly as farmers use young seedlings. They are prone to submergence damage, and hence the transplanter should be avoided in low lying areas where flood is likely to be a problem and also avoid areas where golden apple snail is a problem. Seed tray is an important component of transplanter

technology, about 200-220 trays would be required per hectare for establishing a crop with sufficient plant density.

Seed drill appears promising as long as the planting condition is favorable for the drill planting. This was achieved by innovative farmers positively engaging in the use of seed drill, and they often have become contractors and they extended the use of technologies to other smallholders in the nearby villages. The areas drills are spreading have more sandy soils and early planting of rice using drill is an advantage, especially in flood prone plain. However, this planting technique requires of using photoperiod sensitive varieties that flower in early October, as the crop with photoperiod insensitivity such as TDK8, a commercial variety may mature too early in early October, and this could possibly cause a problem particularly if harvested by combine and rain falls at the time of harvesting.

Paddy size and other factors affecting combined harvesting efficiency

Optimum paddy field size for maximum combined efficiency appears to be around 2,000-3,000 m^2 and paddies could be amalgamated to this size for improved combined harvesting efficiency. The advantage of larger field size may also apply to other field operations such as land preparation and mechanized planting and this advantage for different operations may be examined in the future. In addition, farmers in our villages believe water is saved with enlarged fields, perhaps also as a result of land leveling. Water management time may be reduced with the reduction in the number of levees. Combined adoption depends on the decision by at least three different groups (farmers, millers and combined contractor). A mechanism is required to ensure that all bodies involved in combined harvesting will work together for the common goal of development of mechanized rice production so that all bodies will get benefit in a longer term. The combined contracting business appears profitable, and further development of the business is encouraged. The current combined contracting fees in Laos are expensive partly because of short term credit the contractor has signed on and increasing credit term will assist lowering fees, hence further promoting adoption of combined harvesting. There is strong link between the farmer adoption of combined harvesting and availability of facilities to dry paddies, and for the adoption of combine harvester we need to ensure the paddies harvested can be dried properly.

Effects of drying and grain quality evaluation

Highest mean head rice returned was 44.5%, if paddy was dry under flatbed dryer which was higher than mean head rice under sun drying of 37.9%. This indicates that paddy needs to be dried under artificial dryer to achieve higher head rice return and hence net profit. However the higher head rice percentage may be obtained if sun drying was done in the morning only from 8 am to 1 pm, but it would take three days for drying to reduce moisture content to 14%. Improvement in techniques in both drying methods could reduce broken rice percentage.

Effects of rice harvesting time

Time of harvesting is a main factor affecting head rice return, and when harvesting was delayed to 45 days after 75% flowering, broken rice increased greatly and head rice decreased sharply. The optimum time for harvesting is 25 and 35 days after 75% flowering to achieve maximum head rice return. In addition, flatbed dryer has increased head rice return after milling compared with Sun drying. Therefore, optimum time of harvesting with proper drying techniques could increase head rice return and can meet the requirement of white rice market in local and international market.

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LEARNING ALLIANCE: OPPORTUNITIES TO ALIGN STAKEHOLDERS FOR TECHNOLOGY ADOPTION AND SUPPORTIVE MARKET CONDITIONS

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ABSTRACT

Producing high quality rice and obtaining price premium for smallholder producers have been a challenge for Asian rice farmers due to poor postharvest management, inappropriate technology, and unsupportive market conditions. This is an exploratory study of whether a multi-stakeholder platform called the Learning Alliance (LA), could facilitate the creation of conditions that enable the adoption of improved technologies and practices, and ultimately align varied stakeholders for innovation. We tackle five cases in Southeast Asia, focusing on Myanmar and the Philippines where the International Rice Research Institute tested the LA approach to improve village–level rice quality and enhance linkages for selling in larger markets.

Based on these cases, we provide important lessons learnt, challenges, and insights on how multi-stakeholder platforms can be optimized to support learning and change in rice postharvest to markets, with the smallholder rice farmers ultimately benefiting from the process.

Keywords**:** Rice, multi-stakeholder platform, postharvest technologies, market

INTRODUCTION

There is a challenge for rice postproduction in Asia, with farmers dealing with increasingly scarce resources, under variable weather conditions. Consequently, the magnitude of postharvest losses range from 15% to 25% (Gummert, *et al.*, 2010; Quilloy, Flor, and Azucena, 2015). Marketability most especially, is affected when farmers produce low quality rice. Quality loss caused by poor postharvest management, inappropriate technology, and lack of understanding of factors that affect rice quality result in low prices for farmers. In Myanmar, particularly in the lower delta, farmers do not produce high quality rice and have difficulties in marketing it. As a result, much of the milled rice in the markets contains yellow grains (LIFT, 2012) and this low quality rice is not suitable for export. Producing more rice with high quality is therefore an important factor in achieving the country's goal to be one of the world's rice exporters again.

Technology options to improve rice production and postproduction have been tested and partially adopted in different countries in Southeast Asia (Rejesus, Martin, and Gypmantasiri, 2013) Demonstrations and testing of these technologies have shown that quality can be improved and losses along the postharvest chain can be reduced to 10% or less (Gummert, *et al*, 2010; Singleton and Azucena, 2017.) This could provide an opportunity for rice farmers to produce high quality rice and sell it to

premium markets, thus, increasing their income. Given the reluctance of local market actors to pay higher prices for better quality, facilitating better linkages with premium markets have also been identified as a pre-condition to support uptake of technologies. To make optimal use of technology and increase farmers' income, there is a need to examine the rice value chain, determine the key actors and understand how they interact with each other with the objective to link farmers better with those premium markets (Flor, 2017). In this context, a Learning Alliance (LA) was used as a participatory multi-stakeholder process to identify, understand, and address the challenges. Using the principles of social learning and innovation, LA is characterized by continuous interactions and learning cycles to identify and address aspects required for socio-technical change at different levels.

This paper presents case studies to examine how participatory learning methods, applied in a multi-stakeholder platform, may have played a role in project processes and the outcomes that emerged related to linking smallholder farmers to market. The study describes rice postharvest projects that used participatory approaches —Participatory Impact Pathway Analysis (PIPA) method and established learning alliances (LA). The common factor within these cases was that these were facilitated through research projects within the International Rice Research Institute (IRRI). These approaches helped representative stakeholders in rice postharvest to plan, implement, and share resources with the combined goal to produce high-quality grains with minimize physical postharvest losses.

Multi-stakeholder learning through the LA

Learning is an explicit concept in the LA. In this context, learning becomes a product of interaction among stakeholders, which is regarded as experiential learning (Roling, 1992). International agricultural research projects bank on the concept of experiential learning, through adaptive research and Learning Alliance to facilitate research for development mechanisms (Flor, 2015). These approaches are shown to improve the link of science to policy and development (Schut *et al*. 2017). With this, the LA is considered to be a context-specific learning mechanism, which is governed by rules that define the actors to be involved and their roles that will help bring the innovative goal forward.

The LA framework is situated on the heels of psychology of learning (Bandura, 1977) and the sociological notions of shared learning (Agyris and Schon, 1958). Moreover, it is articulated in the traditions that understand learning as a process of critical reflection that can lead to transformation (Mezirow, 1991 and Dirx (1998) or emancipation (Freire 1970 and Mezirow).

Participatory method: PIPA approach

A common method in network building used in the four cases was to started with a multi-stakeholder analysis of the current postharvest innovation system. Three of the four cases had a Participatory Impact Pathway Analysis (PIPA). The PIPA is a guided exercise in which participants from different sectors identify the underlying causes of a shared problem. In Myanmar, the identified problem was that the farmers were not producing a rice crop with good quality and therefore could not sell it with good profit. Participants then examined opportunities, formulated their visions of success, and mapped the network of people in the value chain relevant to their community. Coming from various sectors, they interact and discuss sometimes differing views. They then bring together what they found out and make explicit possible change pathways (impact pathways) to overcome the problem. Lastly, they identify strategies for the project to support the different groups facilitating change in each pathway, which is carried on into a multi-stakeholder platform called the Learning Alliance.

METHODOLOGY

We used a case study approach to explore how LA had been applied and to what outcomes. The selection of cases was purposive to ensure similarity in that all cases are projects relating to rice postharvest, facilitated by the same research organization, and were implemented through an LA approach. We found cases, from Myanmar, Philippines, Cambodia, Vietnam and Indonesia.

We then implemented a review of secondary materials including trip or activity reports, project reports, and monitoring interviews by project staff from 2012-2016 for all five cases. Thematic analysis was done for the following general categories: implementation method, stakeholders and interactions, initial outcomes, and market linkages. Two of five cases enabled linkages to the market, so we further examined these cases, and focused the analysis on the process to enable the linkages, as well as outcomes from those.

RESULTS

The International Rice Research Institute (IRRI), is one of the agencies that uses the LA approach to carry out the dissemination activities of the projects in rice postharvest. The LA approach was applied at IRRI since 2009 and ran across several projects and countries in Southeast Asia, namely: Cambodia, Philippines, Vietnam, Indonesia and Myanmar. Table 1 outlines the five cases of Learning Alliances in these countries.

The initial problems discussed during the PIPA workshops that were usually conducted as the inception for the Learning Alliance, and the range of topics changed as the LA group evolved over time. At the end of a learning cycle, for each activity, a facilitated reflection exercise is conducted to generate feedback, specifically asking the following questions: What worked? What did not work? What can we do differently next time? Who else should be involved? Based on these questions, a new learning cycle will emerge consisting of the updated or newly planned activity/ies that will take the initiatives further (ADB Final Report, 2013; MyRice Final Report, 2017, LA Final workshop report, 2015). It means that the learning cycles are linked to project cycles, thereby also limiting its scope.

Table 1. Description of the Learning Alliances in the five cases including country, years of implementation, key problems addressed, topics, stakeholders and funders.

Country	**Problem identified during PIPA**	**Topics**	**Stakeholders (aside from farmers and farmer groups)**	**Funding agencies (IRRI-implemented)**
Myanmar (2012-2017)	Farmers get low profit from rice	Variety Postharvest Market options Business models for PH technologies	DOA, DAR, Private companies, NGOs, millers, and traders	UNOPS, ACIAR, and SDC
Vietnam (2013-to present)	Current rice production in Vietnam is unsustainable	Improving postharvest management Sustainable rice straw management	Academic and research institutions in 5 regions in Mekong River Delta, Loc Troi, TruMilk, GrainPro	ADB and BMZ
Indonesia (2016-to present)	(No PIPA conducted)	Mechanized land leveling	Assessment Institute of Agricultural Technology, Farmer cooperatives, distributors	SDC

Philippines (2009-2013)	Rice postharvest prac affects rice quality	Safe storage system and drying for quality seeds	PhilRice, LGUs, CRS, Kaanib and Kadtu taya Foundations, GAMAPAKA, DA research centers, manufacturers, GrainPro Inc., AFPTI	ADB
Cambodia (2009-2013)	Rice postharvest prac affects rice quality	Combine harvesting, drying through flatbed or recirculating dryers, safe storage	MAFF, DAM, PDAs, GrainPro Inc.	ADB

*****UNOPS-United Nations Office for Project Services), ACIAR-Australian Center for International Agricultural Research; SDC-Swiss Agency for Development and Cooperation, ADB-Asian Development Bank, BMZ- German Federal Ministry for Economic Cooperation and Development; AFPTI- Advocate for Philippine Fair Trade, Inc.

Cases with LA linked to markets

Of the five cases reviewed, two had Learning Alliances that had activities which engaged markets. These LAs aimed at linking the farmers with product outlets that would enable them to obtain price premiums, or increased profits from adopting improved practices. The iterative learning between stakeholders was assumed to support the alignment of different groups and co-create knowledge towards using improved rice postharvest throughout the supply chain.

Myanmar case

IRRI's project entitled "Improving livelihoods of rice-based rural households in the lower region of the Ayeyarwaddy Delta" was implemented from 2013-2016, using the Learning Alliance approach to support adaptive research and participatory demonstrations in close collaboration with NGOs (Groupe de Recherches et d'Echanges Technologiques or GRET and Welthungerhilfe), and government partners (the Department of Agriculture and the Department of Agricultural Research).

The objective of the project was to identify improved rice varieties and management or post-harvest practices, which entail increased rice productivity and income, as well as to improve extension. To initiate this, a PIPA workshop was conducted where everyone identified that the low quality rice hinders farmer from getting a premium price.

Building on this problem, the group agreed to establish a Learning Alliance to facilitate the learning process among stakeholders. A total of ten Learning Alliance activities were conducted, ranging from meetings, demonstrations, capacity building, and development of communication materials. The activities were facilitated by IRRI, as a neutral broker between mostly local organizations. After each learning activity, the group reflected on the learnings and identified new and relevant topics. For the Myanmar case, Learning Alliance activities engaged a total of 183 male and 37 female participants from 2012-2015.

Philippines case

From 2009 to 2013, the Learning Alliance in the Philippines is an approach in two projects, with parallels in both Cambodia and Vietnam. One is titled "Addressing the Pre- and Postharvest Challenges of the Rice Supply Chain," which focused on mechanisms that will

address the postharvest challenges; and another project titled "Strategic Research for Sustainable Food and Nutrition Security in Asia" which aimed at improving the food and nutrition security. The Learning Alliance in the Philippines comprised of regional field officers of the Department of Agriculture, Philippine Rice Research Institute, and NGOs and Farmer organizations. Initially, the group has identified causes to the rice postharvest issues in the Philippines and why this was happening. The stakeholders jointly identified the challenges, and developed collaborative mechanisms to address these.

Building on the initial problem regarding lack of technological options, the stakeholders jointly tested technologies to improve rice postharvest quality, including mechanical harvesters and dryers, as well as good storage practices using hermetic storage. As the group went through learning cycles, value- adding activities were conducted to optimize the use of technologies. Activities conducted were: (1) capacity building of operators and users of these technologies, (2) facilitating cross country learning to facilitate knowledge sharing across three regions and countries, and (3) establishing new networks for collaboration comprising of new stakeholders to explore market opportunities for smallholder farmer groups.

The iterative learning cycle approach of the LA members included adaptive research trials on hermetic bags to assess quality of stored rice. Researchers also introduced the Reversible Airflow Flatbed Dryer in farmer cooperative groups.

Learning Alliance activities in Myanmar

Table 2 describes the activities conducted by the LA in Myanmar. After the PIPA workshop, during which the lack of dryers was identified as a key problem, a flatbed dryer was built by the NGOs for the community. IRRI agreed to provide the technical support for the flatbed dryer, as the entry-level technology. At this point, the learning was focused on the technical aspect of using the machines to obtain better quality rice. Furthermore, once some stakeholders have tried and seen this was possible, they also wanted to explore incentives for adopting this practice. In doing so, the use of flatbed dryers needed engagement with millers and traders since they ultimately would need to buy the better quality rice at a price premium to enable the farmers group to return the investment.

As the learning progressed, the group also became interested in other technologies that may help them improve their rice quality. Researchers from the project introduced new practices and technologies such as hermetic storage and timely and effective harvesting, which enabled farmers to implement effective postharvest practices and further produce high-quality rice. These practices included threshing immediately after harvest, drying using a flatbed dryer, using communal storage systems, and bulk selling. Table 2 illustrates the range of learning topics tackled and activities undertaken based on the socio-technical challenges encountered along the way by noting the key learning from each activity. The LA meetings and activities provided a feedback mechanism to assess (1) What worked, (2) what didn't work (3) [If it didn't work] what should be done about it (4) who should be involved in the next activities. The subsequent activities were defined from the response to these questions.

Table 2. Learning cycles from the activities in Myanmar

Timeline	Activity	No. of Participants	Key learning/s
2013 July	PIPA workshop	20	Main problems and technologies of interest. Established village-level learning alliance and agreed to establish a flatbed dryer
2013 December	Arranged coordinated use of flatbed dryer	38	Established flatbed dryer, capacity-building on operation, and mechanisms for collective use
2014 March	Miller used the dryer	32	Millers tried the dryer and reported higher milling recovery; encouraged farmers to use the dryers Discussed dryer operations and maintenance; negotiations on drying fee Discussion on trust between traders and farmers on providing incentives for high quality grains Drafted guidelines how to use inventory storage (mechanism where farmers can store grains jointly and wait until price is higher)
2014 May	Market visit	17	Visited wholesale and export markets in Yangon to interact with traders. They also learned about quality, varieties, and pricing of grains; visited seed farm for good seed sources
2014 November	Thresher demonstration	27	Demonstrated lightweight threshers for easier transportation Participants shared lessons on using dryers and inventory storage with good selling price.
2015 February	Market visit	19	Interacted with Shwe Bo farmers, producers of high quality Paw San variety, to share good practices; farmers who plans to sell interacted with traders
2015 February	Message design workshop	20	Farmers with first-hand knowledge about the dryers designed communication materials to reach more farmers to encourage collective drying and selling
2015 April	FBD demo and grain quality assessment	28	Potential users asses quality of sun dried compared to mechanically dried grains
2015 June	Final Learning Alliance meeting	19	Documented the complete learning cycle of testing postharvest options to selling to better markets; reflect on the highs and lows of the alliance throughout the project cycle; and discuss opportunities to continue the alliance
	TOTAL	220	

Source: IRRI, 2015

Learning Alliance activities in the Philippines

The case of Learning Alliance in the Philippines included activities in Mindanao, which engaged a total of 297 male and female participants from 2009 to 2013. Members started with trying out hermetic storage and demonstrations of reversible airflow flatbed dryer (RAFBD). The iterative learning cycles involved the Philippine Rice Research Institute, IRRI, and Catholic Relief Services (CRS), a faith-based NGO and community-based foundation (KAANIB), which aides smallholder farmer groups (GAMAPAKA) in Mindanao, Philippines through an Agro-enterprise project. For this initiative, IRRI and PhilRice helped CRS establish three reversible airflow flatbed dryers to be used by farmers organized in clusters in three villages.

Table 3. Learning cycles from the activities that focused on Reversible Airflow Flatbed Dryer and Hermetic Storage in the Philippines

Timeline	Activity	No. of Participants	Key learning/s
November 2009	PIPA workshop	51	LA members identified that the Philippines need to improve its Postharvest systems using better technologies for drying and storage
2010 April	PhilRice established mechanical dryer for demonstration; training of hermetic storage practices	30	IRRI Superbag can be used for smaller scale hermetic storage (50kg). Members also learned that it is important to have trained operators to achieve efficient drying system
2010 March	Farmers and seed growers undergo adaptive trials for Superbags	29	Seed growers /farmers have noticed how rice quality is affected by storage. However, Superbags are not readily available and are expensive; Local Department of Agriculture purchased the bags to make it available to farmers and sold them in retail at cost.
2011 October	Post-Production to Market training course conducted at IRRI HQ for project partners and other interested organizations	3	Representatives from Catholic Relief Services , Kadtuntaya, and Kaanib Foundations proposed building a Reversible Flatbed Dryer for the communities in Bukidnon as one of the cases used in the exercise.
2011 November	Local government officials developed Business cases to document lessons learnt and profit generated (if any) from using Superbags ; dryer demonstration continued with	40	Superbags were mostly used by Seed growers. Farmers also use them as safe keeping but some farmers have not reduced their seed rate to prevent losses from rodent damage; Taguibo Farmers' Association appealed to have an RAFBD established

	members from other provinces		
2011 October	Developed video of farmer testimonial on the use of Superbags	27	GrainPro, Inc deployed more superbags in the local agricultural shops and Catholic Relief Services further firmed up the plan for the Reversible Airflow Flatbed Dryer for GAMAPAKA Community
2012 March	Visit of PhilRice for finishing the establishment of dryer	n/a	Farmers found that the drying time took longer because the group used a locally-sourced binder that caused cracks in the bin. PhilRice and GAMAPAKA agreed to replace the mix needed to make the bin sturdier. Community members suggested some modifications in the operation, but was turned down because the efficiency will be compensated.
2012 June	Dryer was established in one site turned over to GAMAPAKA (farmer group)	8	The farmers said they have benefited from the dryers. They said that of all the mechanical dryers that were given to farmers, the RAFBD is the type of dryer that the farmers need. But the capacity is just 4 tons
2012 December	Final LA meeting	34	Documented the complete learning cycle of testing postharvest options, like the RAFBD to selling to better markets
January 2013	Business plan and dryer for Taguibo Farmers' Association established	47	Farmers in Bukidnon and Butuan shared their learnings on using Superbags, and RAFBD.
2013 February	Kaanib Foundation proposed to build 2 more dryers	28	Potential users asses quality of sun dried compared to mechanically dried grains
	TOTAL	297	

Source: IRRI, 2013

It can be observed that earlier in the learning process, stakeholders tested the effectiveness of these technologies through demonstrations and adaptive research. And then, a wider expansion of networks was explored for other topics of interest. This also entailed activities that made the technologies available to smallholder farmers, i.e. the Department of Agriculture purchasing Superbags in bulk so that Filipino farmers, particularly seed growers, can buy it in retail and local shops buying for the sake of making it available for consumers who can only afford to buy in retail.

Similarly, in the establishment of a flatbed dryer, the uptake of the technology can be attributed to intermediaries between technology providers (PhilRice) and the community. In the case of GAMAPAKA, the building and managing the RAFBD happened through the LA linkages. In 2012, it was decided that

the dryer will be co-managed by GAMAPAKA and the managing board of the clusters. Only 50% of the GAMAPAKA members were part of the clusters then.

Market linkages

While LA members in Myanmar were collectivity trying out technologies, they also pointed out that lack of market incentives for producing better quality grains. Thus, a market visit was conducted for members to understand the wholesale and export market and the requirements of the exporters in terms of quality, timing and volumes. During this visit, participants took note of the township-based selling mechanism represented by a trader. Upon interacting with traders and visiting additional markets, the LA members realized that the Bogale rice is priced the lowest among bigger markets, and that producing good quality grains will have higher price in the other markets. Some members who dried using the flatbed dryer and stored grains hermetically for three months at the GRET communal storage sold their grains at a higher price. Upon reflection, the group agreed to test whether the flat bed dryer technology could help them bring better quality grains, which in combination with selling in premium markets translates of better price.

To do this, a social learning activity was conducted with the group to understand the potential of selling high-quality rice to the wholesale market in Yangon. One farmer who used the flatbed dryer to dry his crop, worked with a local rice mill under guidance from the wholesale market traders for milling his paddy according to the quality standards required by the market. A sample was then sent to the wholesale market in Yangon and a price offer made by one trader, which was significantly higher than the local price. The farmer then shipped his milled rice and gained US$140/ha more profit (after deducting the additional milling and transportation cost) compared to compared with selling in the local market (LIFT, 2014).

To encourage more farmers to use the dryer so that they could benefit from collective selling, an information awareness campaign featuring the benefits of using the dryer was conducted, targeting other potential users. The LA members with assistance from the facilitators also developed materials for traders and millers to encourage providing incentives on quality from mechanically-dried grains.

The market linkages in the Philippines case were coordinated through an NGO and farmer cooperative. The KAANIB and CRS organize trainings and meetings, and also link with government agricultural technicians. With CRS, KAANIB made arrangements to help farmers sell by bulk. The farmers keep or sell 40% as they like, but 60% of the farmers' produce will be included in bulk selling. The project also provided other equipment (hand tractors, etc.) for use among the clusters. The farmers paid to the cluster leaders for rent of these equipment and the fees were managed by the cluster officials. Each cluster has its own bank book. The collection can be used for maintaining the equipment or for re-investing on other equipment.

After the turn-over to the local NGO, GAMAPAKA (Smallholder Farmers of the Parish of Kalabugao) in 2012, it was decided that the dryer will be co-managed by GAMAPAKA and the managing board of the clusters. Only 50% of the GAMAPAKA members are part of the clusters. This co-management means that not only GAMAPAKA members but other farmers from the clusters (in Kalabugao and Hagpa) will be using the dryer. The decision to set-up the dryer in Kalabugao was because Hagpa is further away from the main road; farmers from Hagpa pass through Kalabugao when they bring out their produce. It was more efficient for all farmer users to have it in that village. A year after using the dryer, the farmer group reported that the farmers have already dried 95,000 kg rice and corn using the mechanical dryer. Upon using the dryer for two seasons, GAMAPAKA earned US$612 and have sold to local trader.

Other key lessons from the LA process

The main thrust of the LA was to provide an avenue for technological learning. From the suite of technologies being tried out, varied stakeholders learned about different techniques and equipment. In trying these through LA activities, they further examined what conditions would be needed for more farmers to implement those.

A key learning was about finding the incentives for farmers to shift their practices. The linkages with market actors were useful in this. In one LA meeting, millers shared that they are convinced that they can obtain higher milling recovery using machine dryers, thus, encouraged farmers to produce good quality. Training on assessing grain quality was conducted so farmers could assess their harvest better and negotiate for higher price. LA members also reported using reapers and combine harvesters as an improved harvesting mechanism. Arrangements for coordinated use of these machines for various villages were put in place.

One of the key lessons, however, is that the LA is hinged on a project, thus, its implementation is bounded by the project cycles. For both Myanmar and Philippines case, the responsibility for continuation and sustainability of LA was handed over to the community when the project ended. Due to funding constraints, and project implementation timeline, there was a limited opportunity to evaluate the sustainability of the LA approach and its effectiveness and trace the organic community-based initiatives arising from it, after the project.

Although the LA has been used successfully to engage market actors and align varied stakeholders towards equitable incentive mechanisms that will be conducive of farmers changing their practices, this is not always easy. It takes time to align different stakeholders. The cases show that although there were activities tried, they were not always resulting in the expected or aimed for changes.

CONCLUSION

This paper sought to understand how an innovation platform, called the Learning Alliance, supported learning that led to facilitation of technological and institutional innovations in Southeast Asia, particularly, in Myanmar and the Philippines. Guided by an action research framework that encouraged iterative learning cycles, the LA in Myanmar and the Philippines was used as a learning mechanism that started by jointly learning about improving rice quality through good postharvest practices and technologies, which later on brought changes in postharvest system.

In Myanmar, the LA supported use of good postharvest technology and practices that improved the rice quality and aligned varied stakeholders that enabled created opportunity for farmers and stakeholders. It also enabled the group to undertake collective action that resulted in exploring larger markets where price incentives are given for better quality rice. It also provided a safe dialogic space where views of all members, including women, were considered. In the Philippines, the LA enabled members to create value-adding activities that will help expand its network where opportunities towards organizing for community development were explored.

Through the LA, the involvement of varied stakeholders who are linked to markets, brought the learning process further. It did not only entail jointly making technologies optimally work, it can also bring opportunities to improve the rice value chain. However, it is not inherent in the platform.

Currently, at IRRI the LA approach continues to be utilized to support multi-stakeholder process for agricultural research for development. However, the LA needs more buy-in from other stakeholders to

make it more sustainable. In the context of Agricultural Research for Development, its effectiveness and efficiency needs to be critically assessed, and design mechanisms for scaling out developed and applied.

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MYANMAR'S RICE INDUSTRY AND POLICIES TOWARDS VALUE ADDITION AND EXPORT

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ABSTRACT

Myanmar has the potential to increase its rice production, quality and exports. The rice industry remains the most important contributor to GDP, income and employment generation. Rice is grown in 34% of the the country's total cultivated area in 2016. The labor engagement rate of rice is the highest and nearly three-fourths of farm household income. On the consumption side, rice contributes about 66% of the population's daily calorie intake. Per capita rice consumption rate is about 155kg in average. Myanmar's agricultural sector has good market forecast to accommodate higher rice exports. China is turning into a large net importer, and the European Union opened its profitable market for duty-free imports from Myanmar. Regarding the destination of rice export, it was mainly to China via border trade which was operated by high proportion of about 51.62% of the total trade volume in 2017/18. In the past, agricultural policies have intended to increase productivity through tax reduction, credit extension, seeds and fertilizer subsidies, price subsidies and food stockpiling. Paddy yields persist low compared to neighboring countries because lower levels of input use, ineffective weed and pest control, and poor water management. Myanmar controlled rice exports through export licenses which brought the favorable effects of low price to consumers, but, it also penalized farmers by significantly reducing their incentives to produce rice. In early 2017, a new agricultural sector policy was focused on improving farmer incomes and increased competitiveness. Recently in 2018, the minimum reference farm gate price of paddy was set to manage the price volatility during harvesting season. Myanmar's rice value chain remains largely traditional. Improving the efficiency and quality of postharvest operations to reduce losses and improve the quality of rice will result in increased profitability of rice production. The critical interventions of the rice value chain are to improve productivity and efficiency of value chain segments and exporting high-quality rice and value added products. Economic liberalization, sector policy reforms, and better openness to innovation and international cooperation present promising signals for the Myanmar rice sector. Currently, mechanization, communications, and investments in new milling facilities are happening very rapidly. However, the seed system, extension service, finance, and land and water management are slowly scaled up. Higher rice export requires providing public services and a favorable investment macroclimate to improve farm productivity, efficiency of milling and trade logistics. A value chain modernization approach will be critically required with institutional innovations through strengthening public private coordination for the future of Myanmar's rice industry.

Keywords: Agricultural policy, rice industry, rice exports, The minimum reference farm gate price, value chain, institutional innovation

INTRODUCTION

Rice is a vital crop for Myanmar and for Asia. Actually, rice dominates the agricultural sector which is the largest and most productive part of the Myanmar economy and is comprehensively tangled into the social and economic lives of the Myanmar people. Myanmar's land and water resources are therefore an asset for its own people as well as for its neighbors. Myanmar is a rice surplus country and it has the distinct potential to increase rice production, rice quality and exports over the medium and long run. Changes in rice economy might have a direct and profound influence on the entire Myanmar economy.

At the same time, domestic and international consumers are demanding greater diversity, nutritional quality, and safety from their food systems. Therefore, future development of Myanmar's rice-based cropping systems must be commenced in the framework of a diversified and sustainable food system that raises productivity and living standards for the benefit of all stakeholders. Moreover, Myanmar's rice industry will require improvements in technology, institutional innovation and governance of all stages along the rice supply chain.

There is growing awareness among stakeholders in agricultural development that production along the supply chain is still short of its potential. Therefore, the various forces that have influenced on the rice industry are critically important to all stakeholders especially for decision makers for long-term rice industry development strategies.

The paper proceeds as the scene in terms of rice industry contribution to the country's economy, production trend of Myanmar's rice industry, then looks in depth at rice consumption, domestic demand and rice exports. In addition, key policy issues that need to be addressed will be discussed to ensure a bright future for Myanmar's rice economy and finally conclusion.

CONTRIBUTION AND PRODUCTION OF MYANMAR RICE INDUSTRY

Rice contribution to country economy

Rice remains a strategic sector as the most important food crop. It is making important contributions to the country's GDP, income and employment generation in Myanmar. In 2015-16, about 65.4% of the total population (52.2 million) is engaged in the agricultural sector in Myanmar. Rice is cultivated on 7.2 million ha representing 34% of the total crop sown area in 2015-16. Since rice is labor intensive, the labor absorption rate is highest in the rice industry and nearly three-fourths of farm household income is derived from rice farming and related activities, especially in the major rice grown areas in Myanmar (Department of Planning, 2016).

Journey of Myanmar's rice industry: harvested area, yield and production

The development of Myanmar's rice industry over the past century was accompanied by different policies under many government eras (Fig. 1). Even though there has been a consistent increasing trend in cultivated area, yield and total production of rice since the end of the Second World War, exports have not reached the level attained during the British colonial government era. In the early 1940s, the country produced about 8 million tons of paddy and became the world's largest rice exporting country, reflecting the export-oriented commercial agriculture system encouraged by the British government.

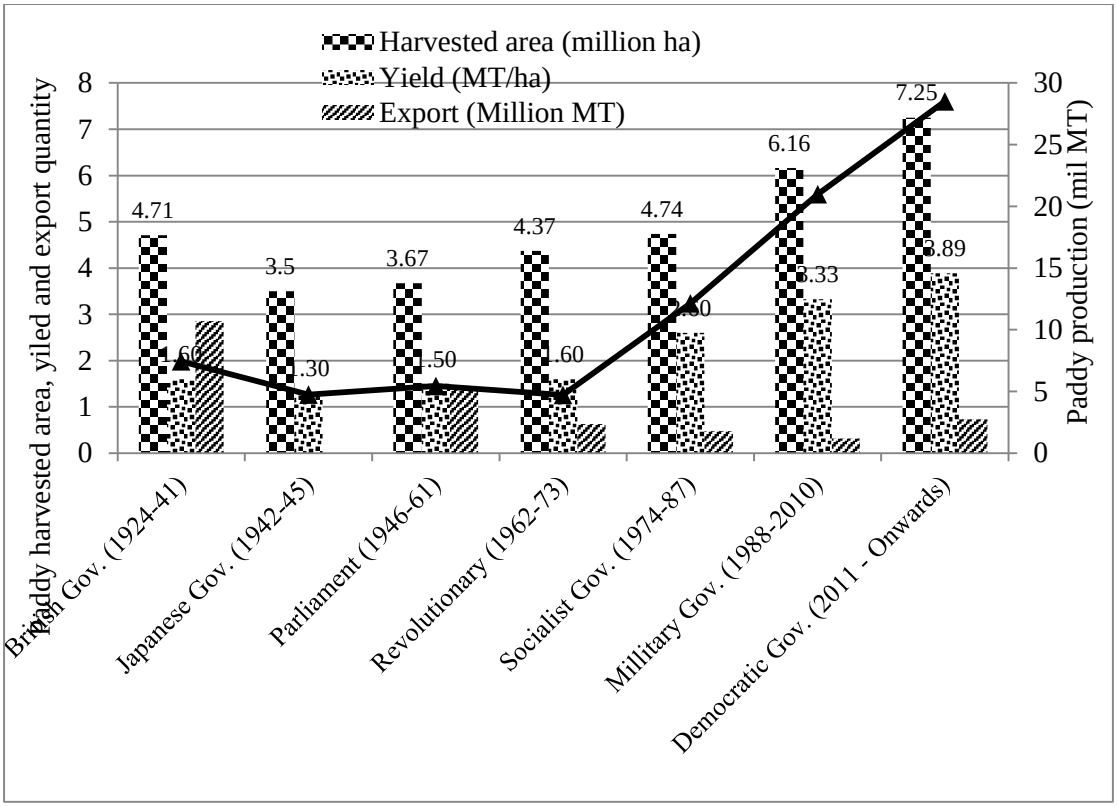

Fig. 1. Rice sector developments in different government era in Myanmar

Source: Theingi Myint 2007 and Department of Planning. 2016.

In 1995, Myanmar became a member of the World Trade Organization (WTO) and of the Association of South East Asian Nations (ASEAN) in 1997. The Myanmar government adopted market-oriented policy reforms consistent with economic globalization under the structural adjustment program via the encouragements of these two institutions. The policy reforms incorporated the removal of state control mechanism over production and marketing in agriculture, including the rice industry, in order to develop greater trade and industrial linkages among member countries (Wong and Wai, 2013).

The government of Myanmar changed to democracy and has started determined efforts to dispose of its recent history of isolation and preventive policies especially for economic reforms since 2011. The first notable policy in rice industry was the Farmland Law and the Vacant, Virgin and Fallow lands management law which was introduced in 2012. Land used rights became officially transferrable and eligible for mortgaging, and seasonal crop choice has been liberalized either. The second transformation was rice export tax, which was also reduced from 10% to 2%, although rice exporters must still obtain an export permit. The private sector expanded its role in paddy trading and milling by organizing the Myanmar Rice and Paddy Traders Association (MRPTA), then re-named as the Myanmar Rice Federation (MRF) in 2012.

Current production of Myanmar rice industry

In Myanmar, major paddy producing areas were categorized by ecological zones such as the delta, dry zone, coastal zone, and mountainous areas. Delta areas encompass of the Ayeyarwaddy, Bago and Yangon regions, dry zone includes including Mandalay, Sagaing, and Magway regions, coastal region is Thahnintharyi, Mon and Rakhine States, and mountainous areas are apart from above three areas in the country where are mountainous. Paddy grown area, yield and production by season in 2016/17 for each of the four main agro-ecological zones is shown in Table 1. Among the ecological zones, the delta

region is the largest cultivated are in both seasons. The highest yield is found in dry zone during monsoon season and delta in summer season. Coastal areas are the lowest production among the regions (Table 1).

Table 1. Paddy productions by ecological zone and season, 2016-17

Growing season in Ecological zone	Cultivated Area	Harvested Area	Yield[a]	Production[a]
	('000 ha's)	('000 ha's)	(tons/ha)	(mn tons)
Monsoon				
Delta	3,089	2,998	2.41	7,218
Dry Zone	1,295	1,292	2.76	3,564
Coastal	825	825	2.22	1,836
Mountainous	957	956	2.40	2,296
Total	6,167	6,071	2.46	14,914
Summer				
Delta	697	697	3.13	2,184
Dry Zone	205	203	1.97	400
Coastal	25	25	2.57	65
Mountainous	70	66	6.54	432
Total	994	992	3.11	3,082
Total (2 Seasons)				
Delta	3,787	3,695	2.54	9,403
Dry Zone	1,500	1,495	2.65	3,964
Coastal	851	850	2.23	1,901
Mountainous	1,023	1,022	2.67	2,729
Total	7,161	7,063	2.55	17,996

[a] Milled rice equivalent (using a milling ratio of 0.65 kgs of milled rice per 1.0 kg of paddy).

Source: DOA, MOALI, 2016.

In 2016/17, about 83% of the annual production is harvested during the monsoon season and the remaining only 17% during the summer season. About 48% of the total production in monsoon season was grown from the delta (Table 2). About 24% is produced in the dry zone; the rest is produced from the coastal regions and mountainous areas. In the summer season, about 71% of paddy production comes from the delta, 13% of total production grows in dry zone and the rest are from coastal and mountainous areas. Total paddy production comprises of primarily zone 52% in delta and 22% in dry zone in 2016/17 (Table 2).

Table 2. Myanmar paddy production share by ecological zone and season, 2016-17

Ecological zones	Monsoon		Summer		Total (%)
	Season (%)	Total (%)	Season (%)	Total (%)	
Delta	48.4	40.1	70.9	12.1	52.2
Dry Zone	23.9	19.8	13.0	2.2	22.0
Coastal	12.3	10.2	2.1	0.4	10.6
Mountainous	15.4	12.8	14.0	2.4	15.2
Total	100.0	82.9	100.0	17.1	100.0

Source: DOA, MOALI, 2016.

DEMAND OF MYANMAR RICE INDUSTRY

Domestic rice consumption

Rice constitutes a high share of the caloric diet of the population of ASEAN countries. Rice consumption by ASEAN countries accounts for 22% of the world total. The growth in the region's total rice consumption is driven by population growth of 1.1% annually, outweighing small declines in average per capita use (Wailes *et. al*, 2012).

Rice is the most important food crop of Myanmar and it remains a strategic sector in terms of its contribution to gross domestic product (GDP), income, and employment generation. Rice is the major source of the energy for the Myanmar people as it contributes about 73 and 80% of the total daily dietary energy requirement in urban and rural households, respectively (CSO, 2012). Regarding the calorie intake, World Bank study in 2015 showed that rice and cereal contributed about 66% while percentage of food spending was about 21.4% in 2015.

Generally, rice also carries the largest weight in the Consumer Price Index, accounting for 17% on average and 27% for low-income groups (CSO 2012). The average share of rice in total household expenditure declined from 30.1% in 1989 to 13.6 % in 2005 and, with the exception of the world food price crisis of 2008/9, continued to fall to 13.0% in 2016. The trend line in Fig. 2 is showing clearly the decreasing trend of rice expenditure in Myanmar (Theingi Myint *et al*., 2016).

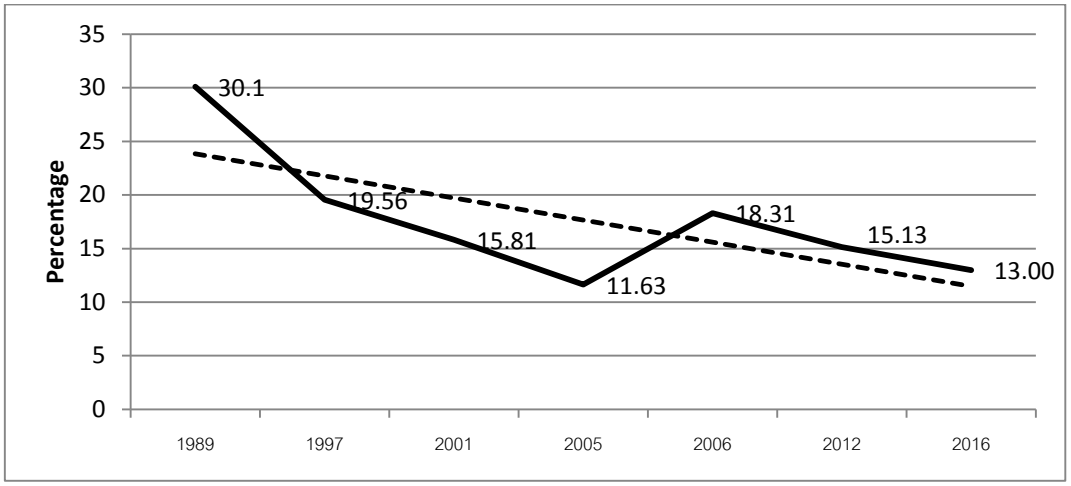

Fig. 2. Percentage of average rice expenditure in Myanmar (1989-2016)

Source: CSO, 2015 & Theingi Myint et al., 2016.

According to the Central Statistical Organization data in 2015, the rural rice expenditure share in food expenditure was greater than that of urban over two decades because income growth, relative price changes and urbanization have altered dietary patterns in Myanmar (Fig. 3). According to the recent consumption study in 2016, average per capita consumption in Myanmar was 155 kg per year. The minimum per capita rice consumption was 43 kg per year and maximum rate was 326 kg per year. the average per capita rice consumption of urban people in Union was 133.07 Kg and rural people was 164.80 Kg. Total union rice consumption was about 8 million ton per year in which total rice consumption of urban was 2 million ton per year and rural people was 6 million ton per year.

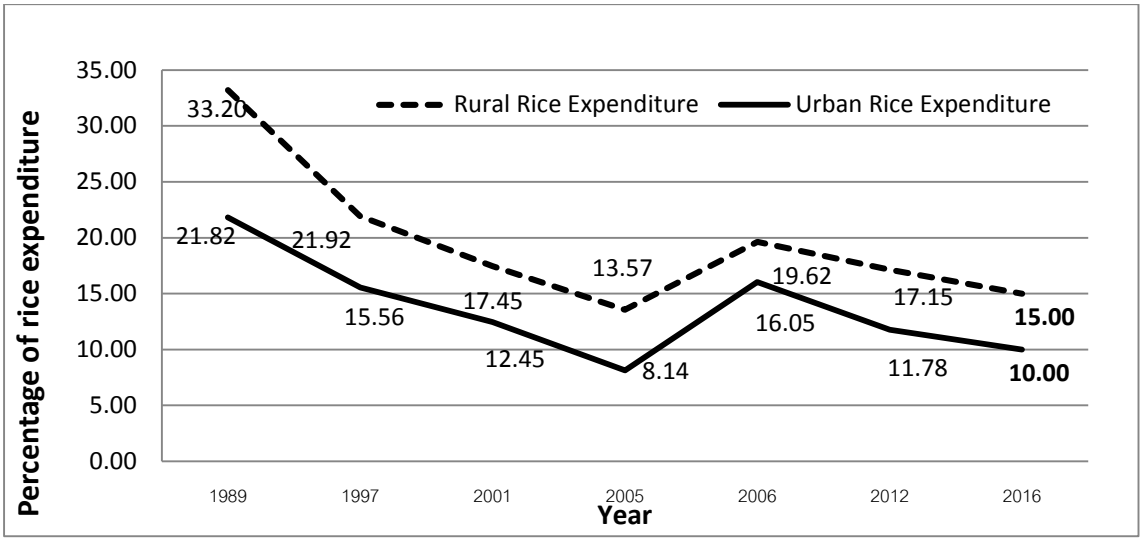

Fig. 3. Average rice expenditure percentages of rural and urban households in Myanmar (1989-2016)

Source: CSO, 2015 & Theingi Myint *et al*., 2016.

Among the urban consumers, per capita rice consumption of different income groups was not significantly different from each other in quantity terms, while the lower income landless consumers consumed more rice than higher income landless. However, farmer consumed more rice regardless of their farm size. Therefore, effect of income on rice consumption was found in landless consumer, no income effect in rice consumption of urban and farmer consumers in Myanmar (Theingi Myint *et. al*., 2016).

Myanmar'S rice export: volume, type and destination

Myanmar's rice sector is characterized as market oriented whereby farmers and private sector are active stakeholders. Within the context of a market economy, Myanmar has consistently set the highest priority on the rice sector as food security is a first priority, then the social and political significance for the country being not only self-sufficient in rice but also a rice export.

The target of rice production that fulfills both domestic and export requirements was set by of the Myanmar Agricultural Sector. The target is the paddy production must reach at least 19.40 million metric tons, about 60% of which is for local food consumption and 40% for international trade by 2030. The target will be achieved by 7.70 million hectares (ha) of rice harvested area with an annual average yield of at least 4.20 MT/ha per cropping season.

Regarding the liberalizing export policy through border trade, in 2012/13 rice export was reached the highest o 1.3 million ton during 48 years. After that 2015/16, the exports were increased up 1.8 million ton, calling for the continuation of reforms to achieve the above export targets. However, rice export was decrease due to the heavy flood in 2015/16 (Table 3). Even though the export was lagged behind the target, there are good market prospects to accommodate higher rice exports for Myanmar. The global demand for rice is projected to continue growing, at least during the next 10-15 years. China

is turning into a large net importer of rice, and the European Union opened its lucrative market for duty-free imports from Myanmar.

Regarding the destination of Myanmar rice export, it was mainly exported to ASEAN plus three group especially to China during 2012/13 to 2014/15. Myanmar rice export to ASEAN plus three group was 53.6% in 2012/13 and it was up to 76.1% total export volume in 2014/15. Some export amount went to EU which was gradually increasing during 2012/13 to 2014/15 from 5.4 % to 11.1% of total export volume (Table 4).

Table 3. National Rice Balance 2008 to 2016 ('000 tons, milled rice equivalent)

Year	**Production**	**Consumption**	**Exports**	**Ending Stocks**
2008/2009	11,200	18,800	1,052	548
2009/2010	11,642	10,890	700	600
2010/2011	11,060	10,100	1,075	485
2011/2012	11,473	10,200	1,357	401
2012/2013	11,715	10,400	1,163	553
2013/2014	11,957	10,450	1,688	372
2014/2015	12,600	10,550	1,734	422
2015/2016	12,200	10,650	1,800	518
2016/2017	12,500	10,750	1,600	668

Source: USDA

Table 4. Myanmar rice export by destination, 2012/13 -2014/15

Destination Group	Percentage of rice export destination		
	2012/13	2013/14	2014/15
EU	5.4	5.7	11.1
ASEAN	18.2	11.8	5.4
(ASEAN) + 3	53.6	73.8	76.1
Middle East	0.7	0.7	1.8
Africa	14.2	0.2	0.2
Other	7.9	7.8	5.4
Total All Trade	100	100	100

Note: Border Trade involves Thailand - under ASEAN Group; China - under (ASEAN) Plus 3 Group; and Bangladesh and India under Other Group.

Source: Ministry of Commerce and Customs via Myanmar Rice Federation

Rice export of Myanmar is mainly made up of white long grain, white short grain and broken rice. However, white long grain export was decreasing trend from 2012/13 to 2015/16 (74.86% to 29.54%), it was increased up again 42.83% of total rice export volume in 2016/17. White short grain and broken rice export were found increasing during these years while glutinous rice and other rice export were decreasing (Table 5).

Table 5. Myanmar rice export by type of rice, 2012/13 -2016/17

Type of rice	2012-13	2013-14	2014-15	2015-16	2016-17
			(Percentage)		
White Long Grain	74.86	68.47	45.13	29.57	42.83
White Short Grain	15.25	9.44	30.09	43.92	31.66
Parboiled Rice	0.01	0.22	0.98	1.69	0.94
Glutinous Rice	1.63	2.32	0.97	0.52	0.14
Other Rice	0.74	0.00	0.35	0.00	0.00
Broken Rice	7.52	19.55	22.48	24.31	24.42
Total	100	100	100	100	100

Rice export was increased up to around 4 million metric ton in 2017/18. The rice export was mainly to ASEAN by border trade up to 2016/17 however, oversea trade to other destination was also upturn to nearly half of the total export in 2017/18 (Table 6). The major buyers of Myanmar white rice are China, Bangladesh and Cote d'ivoire and the top three importers of broken rice are Belgium, China and Indonesia in 2017/18 (Ministry of Commerce, March 2018).

Table 6. Rice export by Type of trade in 2017/2018 (up to 23 March 2018)

Type of trade	Trade Volume (MT)	Ratio of trade by type
Border Trade	1811747.627	51.62
Oversea Trade	1698266.070	48.38
Total	3510013.697	100.00

Source: Ministry of Commerce, March 2018.

POLICIES TOWARDS VALUE ADDITION AND EXPORT

In the past, Myanmar agricultural policies have targeted to increase productivity through tax reduction, credit extension, seed and fertilizer subsidies, price subsidies and food stockpiling. Trade restrictions have also been enforced to control increased prices of agricultural commodities and to ensure sufficient supplies for domestic markets, as with rice during the 2007-2008 crisis. The above policy responses, however, are no longer considered passable in the face of growing complexities in food security ecosystems. Paddy yields remain low compared to Myanmar's neighbors because of lower levels of input use, particularly improved seeds and fertilizer, inefficient weed and pest control, and uncertain water management (Denning and others 2013).

Over the last six decades, and up to as recently as three years ago, Myanmar's food security strategy focused on making sure that rice was available at affordable prices. The motivation behind this strategy was that Myanmar's urban residents and large rural population of landless poor (estimated at 30 % of the total rural population) are important consumers of rice whom access to affordable rice is critical to their survival from both economic and political perspectives. To pursue this strategy, the low price of rice benefited consumers, but, unfortunately, it also penalized farmers by significantly reducing their incentives to produce.

Fortunately, policies have improved over the last two years. In early 2017, the Ministry of Agriculture, Livestock and Irrigation (MOALI) published a new agricultural sector policy focused on improving farmer incomes and increased competitiveness. Recently in 2018, the minimum reference farm gate price of paddy was set to manage the price volatility during harvesting season. Economic liberalization, sector policy reforms, and greater openness to innovation and international cooperation present encouraging signals for the rice sector and for the agriculture sector as a whole. A recent

statement from the Myanmar Rice Federation suggested an export target of 4 million MT is achievable by 2017/18. The challenge now is to work at improving productivity at three critical segments of the rice value chain.

Myanmar should aim to produce and sell increasing quantities of different qualities of rice more efficiently. Higher rice exports necessitate providing public services and a favorable investment climate to all farms, small and large, that would improve farm productivity, efficiency of milling and trade logistics serving both export and domestic markets. This strategy will allow Myanmar's rice value chain stakeholders to better serve their local and overseas clients, earn higher incomes, capture the growing market of higher value rice, and diversify risks along different markets.

Myanmar's rice value chain involves many stakeholders and remains largely traditional in nature. Improving the efficiency and quality of postharvest operations to reduce postharvest losses and improve the quality of the rice output will result in increased production of rice for domestic and export markets. For getting better quality paddy, the milling industry would be accelerated by modernization, creating non-farm jobs and stimulating economic growth. Net buyers of rice in rural and urban areas would benefit from the increased supplies and improved quality of rice, potentially at lower prices.

Upgrading rice mills requires access to long term credit, technical and managerial capacity and reliable electricity supply at a reasonable price. Myanmar's electricity rates have long been subsidized, which has led to inadequate investment in new power sources and maintenance of existing plants and transmission lines. Therefore, planned investments in electricity generation over the next five years indicate supply increases of less than 5 % per year (Dapice 2012), while ADB forecasts that demand will increase by 13 % per annum from 2012 to 2018 (ADB 2012). In the absence of reliable electricity, rice millers were unwilling to invest to upgrade rice mills. The rice milling industry could take advantage of foreign direct investment (FDI) for modernization to overcome the limitation of domestic capital investment.

Improving the efficiency and quality of postharvest operations to reduce losses and improve the quality of rice will result in increased profitability of rice production. The critical interventions of the rice value chain are to improve productivity and efficiency of value chain segments and exporting high-quality rice and value added products. Economic liberalization, sector policy reforms, and better openness to innovation and international cooperation present promising signals for the Myanmar rice industry.

CONCLUSION

In Myanmar's rice industry, currently, mechanization, communications, and investments in new milling facilities are happening very rapidly. However, the seed system, extension serviceS, finance, land and water management are slowly scaled up. To fulfill the target of rice export requires providing public services and a favorable investment macroclimate to improve farm productivity, efficiency of milling and trade logistics in internal then foreign direct investment from international. A value chain modernization approach will be critically required with institutional innovations through strengthening public private coordination for the future Myanmar rice industry. It should contribute to upgraded rice value chain with the ultimate objective of improving the well-being of present and future generations of rice farmers and consumers, particularly those with low incomes in Myanmar.

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Profiles of Speakers

Dr. Apichart Pongsrihadulchai currently holds various positions. He is the Chairman of the Thai Organic Agriculture Foundation (TOAF), Chairman of the Dr. Sannuk Sriplung (The First S-G of the Office of Agricultural Economics) Foundation, Secretary-General of the Agricultural Economics Societies under the Patronage, Thailand, among others. Dr. Pongsrihadulchai obtained his B.S. in Agronomy from the Kasetsart University. He holds two Masters degrees MS Agricultural Economics, University of Kentucky, USA and M.S. Statistics, Iowa State University. It is also from the Iowa State University where he got his Ph.D. in Economics in 1981.

Dr. Min-Hsieng Yang is a Professor from the Department of International Trade, Feng Chia University in Taichung, Taiwan. He teaches graduate and undergraduate courses on international economics, micro and macro-economics, etc. and his research interests are in the fields of agricultural policy, agricultural economics, international trade theory, etc. From 2016-2017, Professor Yang is also President of the Rural Economics Society of Taiwan and was once an independent Director of the Agricultural Credit Guaranteed Fund of Taiwan. He took his BA in Agricultural Marketing and his MA in Agricultural Economics at the National Chung Hsing University and in 1993, received his Ph.D. in agricultural economics at the National Taiwan University.

Dr. Katsumi Arahata obtained his Ph.D. in Agricultural Economics in 1995 at the Faculty of Agriculture, University of Tokyo in Japan. Today, he is a professor at Japan's Gifu University. His career started in the late `70s where he worked at the Upland-Crop Production Division, Production Bureau, Ministry of Agriculture, Forestry and Fisheries. From there he rose from the ranks and became the Director of the Ministry's Crop Production Division, Agricultural Policy Bureau, Tokai District in 1996, after which he started teaching at the Gifu University.

Professor Muhammad Firdaus, Ph.D. is the Vice Dean of the Faculty of Economics and Management (FEM), Bogor Agricultural University, Bogor Indonesia. His fields of specialization are in agricultural economics and econometrics. He is also the Vice Chairman of Renumeration Board in Bogor and a member of the Policy Research Team, Ministry of Labor in Indonesia. Topics of his current research areas are agricultural economics, economics of horticulture and labor policy.

Dr. Hoang Vu Quang is a Ph.D. holder in trade and international economic law at Laval University in Canada. Currently, he is a researcher at the Institute of Policy and Strategy for Agriculture and Rural Development under Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD) in Vietnam. His competence and experiences are in the fields of agriculture and rural development policy (analysis, evaluation, formulation), value chain and market analysis, institutional economics, poverty reduction, agrarian system, agricultural and rural services, to name a few.

Dr. Aldas Janaiah is a post-doctoral fellow, Social Sciences Division of the International Rice Research Institute (IRRI), the Philippines (2002); and Ph.D. (Agri Economics), Banaras Hindu University, Varansai India (1995). He has a total of 27 years of academic experiences; six years of international experience (IRRI, the Philippines (on deputation) and Asian Development Bank—ADB, Hanoi); 12 years of national experience as a senior economist in ICAR-institutions and nine years in the state Agricultural University as a Director of Agribusiness Management School, Dean/Principal and two terms as University Board/EC Member.

Mr. Surasak Sompadung is the Vice President of Bank for Agriculture and Agricultural Cooperatives (BAAC), having been with the bank since 2005. He holds a Master's degree in International Agriculture and Food Marketing at the University of Newcastle and a Bachelor's degree in Education Science at Prince of Songkla University.

Dr. Rosa Paula Cuevas is a scientist working at the Grain Quality and Nutrition Centre (GQNC), International Rice Research Institute (IRRI) in Los Baños, Laguna, Philippines. Part of her work include developing descriptive profiles of diverse collections of rice varieties through establishment of an in-house sensory evaluation panel, conducting instrumental measurements of sensory attributes and of viscoelastic properties via rheometry, among others. She has also contributed to the Philippine government's response to rice quality and safety issues. Dr. Cuevas obtained her Ph.D. in Agricultural Science at the University of Queensland, School of Land, Crop and Food Science.

Ms. Heng Sola is a Stakeholder Liaison Manager at Cardno Emerging Market Markets—Cambodian Agricultural Value Chain Program located in Phnom Penh. She has more than ten years of experiences in working with government agencies, NGOs and the private sector. Her experiences include market system development, market and business development/strengthening farmer groups, gender mainstreaming in agricultural and handicraft sector and agribusiness by working with Cardno Emerging Markets, International Trade Centre (ITC) and GIZ. Ms. Heng has a Master's degree in Rural Development Management from Khon Kaen University in Thailand.

Ms. Rosnani Binti Harun is a Senior Scientist at the Malaysian Agricultural Research and Development Institute (MARDI). She has a Master of Science degree in Resource and Environmental Economics at the Universiti Putra Malaysia. Some of her research experiences include the economic evaluation of hybrid and inbred rice, level of technology assessment on rice production, economic evaluation of specialty rice, aerobic rice, to name a few.

Dr. Tanapat Sangaroon is a Trade Officer at the Trade Policy and Strategy Office, Ministry of Commerce in Thailand. His work focuses on SME development in the trade and service sector. He is also a part-time lecturer at the School of Humanities and Tourism Management, Bangkok University and a researcher on the topics of international supply chains for agricultural products and tourism services. In 2011, Dr. Tanapat got his Ph.D. in international trade at the School of Management and Governance, University of Twente, The Netherlands.

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Ms. Reianne Quilloy is a Communication and Outreach Specialist at the International Rice Research Institute (IRRI), a position she has held since 2013. She is also an Officer, Administrative Coordination of IRRI who is in charge of some of the institute's key projects in Cambodia, Philippines and Vietnam. Part of her tasks include facilitating multi stakeholder learning processes on improving postharvest systems and inclusive rice value chain, developing communication materials relevant to specific cultures and end users and developing and implementing project communication and outreach strategies. Ms. Quilloy holds a Master of Science degree in Development Communication in 2009 and a BS in Agriculture major in plant pathology degree in 2002.

Dr. Theingi Myint is a professor whose areas of specialization are in teaching, research and policy consultancy. His main field of expertise is agricultural economics with agricultural marketing as his area of specialization. Dr. Theingi Myint obtained his Ph.D. at the Justus-Liebig University, Giessen, Germany and his Master in Agricultural Science at the Yezin Agricultural University in Myanmar.