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The Status of the Paddy and Rice Industry in Malaysia

Sarena Che Omar, Ashraf Shaharudin and Siti Aiysyah Tumin

Paddy Harvesting in Kedah, Malaysia

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The full report, the infographics booklet and the **Appendix** may be downloaded from our website at www.krinstitute.org

CONTENTS

"Singkirkan segala banjir besar yang
boleh melimpahi padiku.
Singkirkan kemarau panjang yang
mengeringkan tanah bendangku.
Jauhkanlah segala malapetaka yang
menghalang kami.
Jauhkan segala ketam-ketam putih yang
mematahkan anak padi kami selama ini.
Jauhkan segala ribut dan taufan."

Ranjau Sepanjang Jalan (1966)
Shahnon Ahmad

EXECUTIVE SUMMARY

Rice is a staple food for Malaysia and a defining feature of our culture. Malaysians consume the grain daily either as cooked rice or indirectly in the form of rice flour. *Nasi lemak, bihun goreng, laksa, kuih apam* and *lepat pisang,* are some of the many rice-based foods we consume. During festive occasions, we see *pulut kuning* at Malay weddings and red tortoise cakes during Chinese New Year. Therefore, it is not surprising that in 2016, we consumed **80kg of rice per person,** which is about **26%** of the total caloric intake per day, costing an average of **RM44/month per household**[1]. Among the states, households in **Sabah** spent the most on rice at **RM73/month** while households in **Perlis** spent the least at just **RM13/month**. This means that in the same year, **2.7m MT**[2] of rice was consumed, whereby **67%** was produced locally, and the rest imported primarily from Thailand, Vietnam and Pakistan[3].

It is now less than a year until the end of the National Agro-Food Policy (2011-2020). Knowing this and given the importance of rice, Khazanah Research Institute (KRI) conducted a review of the paddy and rice industry. The objectives of the report are to look into the history of the industry, meet key stakeholders, study statistical trends, identify challenges and finally, provide suggestions in charting a way forward for the industry.

Production has increased over the decades. Historically, Malaysia has always had production-driven agricultural targets. Measures were introduced since the 1940s to help increase national rice production and protect farmers' welfare. Indeed, over 30 years, the total production has increased, allowing the self-sufficiency level (SSL) to hover between 60 – 70%.

Paddy farmers remain in the B40. In 2016, the household income of farmers in MADA[4] was RM2,527/month, while the national mean was at RM6,958/month.

Without subsidies, the cost of production (COP) is high. The net profit from paddy cultivation in MADA in 2014 stood at RM2,892/Ha/season and this is affected by the COP at RM3,766/Ha/season[5]. The largest contributions to the COP are land rental and machinery, at 42% and 30% respectively, while input and labour costs contributed less.

1 Chapter 6 Supply Chain: Rice Consumption
2 Chapter 6 Supply Chain: Rice Consumption
3 67% = [Domestic production (1.8m MT)/ Domestic consumption (2.7m MT)] ×100%
4 Refer to the Abbreviation section for a list of abbreviation and acronyms used in this report
5 Chapter 4 Supply Chain: Paddy Production (Farming)

With input subsidies, MADA farmers are as competitive as key rice growing regions in Thailand, the Philippines, China and Indonesia. However, the removal of subsidies would result in the net profit of MADA to be lower than the key rice growing regions in the countries mentioned. These shortcomings may be attributed to issues within and between segments of the supply chain.

These issues include the slow release of new paddy varieties, weak farm extension programmes and poor farm management practices. There is also the tendency to focus on protecting the largest stakeholders: consumers (31 million) and farmers (~200,000), neglecting the interests of the other stakeholders in the industry.

The matter is compounded by distrust amongst stakeholders, resulting in disconnections within the supply chain. There are also **data transparency, reliability and frequency issues,** leading to delayed policy and private sector responses to changes in the industry.

The following are some suggestions for the industry:

Shift away from production-centric, self-sufficiency targets[6]**.** At 60 – 70% SSL, we have attained a certain level of production capacity. Thus, it is timely to review our agricultural strategies. It is also not sufficient to use rice SSL as a proxy for food security because food security is multidimensional. In fact, when other factors of food security were considered, **Malaysia performed better compared to rice exporting countries in Southeast Asia**. This suggests that the country's ability to produce rice (and other food), does not equate to being food secure as other factors (quality, safety and sustainable practices) should also be considered. Apart from increasing production measured in volumes, a suggestion is to include other indicators such as the adoption of **Good Agricultural Practices (MyGap), Good Manufacturing Practices and transparency** when evaluating the industry's performance.

Strengthen the supply chain with traceable, accessible and real-time data[7]**.** Such can be achieved through Information and Communication Technology (ICT) applications such as **Blockchain**, established by a team comprising representatives from each segment of the supply chain and technical specialists.

6 Chapter 2 Rice Policy and Regulations
7 Chapter 2 Rice Policy and Regulations

Increase private sector participation in the breeding segment[8]. MARDI has established and led the plant breeding work since the early 1970s with recognised achievements. Having said this, Malaysia is still **slow in the release of new varieties**. Over 50 years, India produced >1,900 varieties, the Philippines >200 and Thailand >80. Malaysia released less than 50 varieties. The segment may benefit from encouraging private sector participation, which can be achieved by: 1) **improving transparency and accessibility (especially web-based)** to the breeding and seed production standards and processes; and 2) review the **membership of the *Jawatankuasa Teknikal Bantuan Kerajaan kepada Industri Padi dan Beras* (JKTBKKIPB)** to avoid conflicts of interests.

Strengthen the linkage between the production (farm) and midstream players through contract farming[9]. Leveraging on the resources of the midstream players and the production capacity of the farmers, a shared-risk approach may help improve farm management, extension programmes and trust. Achieve a win-win outcome: in return for providing capacity building to the farmers, the buyers attain a steady supply of grains at the desired quality. With higher yield, improved grain quality and a secured buyer, farmers' net profit (income) may be improved.

Malaysia may continue to be a net importer of rice, and this should not be viewed as a failure of the industry[10]. Statistical trends, geography and consumer preferences for premium rice means that Malaysia is likely to continue being a net importer. Considering this, the nation may be in a better position not to target 100% SSL, but with domestic rice produced sustainably, responsibly, safely and where farmers earn a sustainable income.

***Invisible* consumption**[11]. Migrants living in Malaysia are an important source of labour and contribute towards the nation's economic growth. It is not possible for the country to meet the United Nation's 2030 Agenda for Sustainable Development Goal (SDG) of **'leaving no one behind'** if the basic needs of the migrants such as their staple food, are not met. Unfortunately, **their rice consumption pattern is not fully understood**. Based on KRI's calculations, around **228,899 MT** of rice was consumed by 2.1 million documented workers. The actual consumption that includes undocumented migrants can be more. Meaning that the actual portion of rice consumed by migrants is not known. The issue with *invisible* consumption should be addressed if we hope to protect vulnerable communities.

8 Chapter 3 Supply Chain: Farm Input
9 Chapter 4 Supply Chain: Paddy Production (Farming)
10 Chapter 5 Supply Chain: Midstream & Import
11 Chapter 6 Supply Chain: Rice Consumption

RESEARCH BACKGROUND

To reach the rice production targets, improve farmers' income and protect consumers from rice price volatilities, historically the government allocated a large number of resources and market interventions in the form of input subsidies, price controls, import monopolies and stockpiling since the 1950s. These measures were meant to be short-term solutions; however, they persisted, and periodic increases in subsidies and incentives came to be the norm.

After decades of government interventions, there has been an increase in production quantity, farm yield and the alleviation of hardcore poverty. However, albeit significant public resources allocated to the industry:

a) Paddy farming is perceived to be uneconomical;
b) Farmers are still associated with poverty; and
c) Malaysia is still a net importer of rice with the SSL hovering between 60 – 70%.

The objectives of this report are therefore to review the performance of the paddy and rice industry, identify challenges and through the observations made, provide policy recommendations where appropriate.

The study involves a combination of qualitative and quantitative analyses using publicly available data. Through key informant surveys, the team met a total of 86 stakeholders across the paddy supply chain, engagements with subject matter experts in the region and internationally including the International Rice Research Institute (IRRI) in the Philippines and the National Institute of Agricultural Botany (NIAB) in Cambridge, United Kingdom. Quantitative analyses involved the use of data from the Ministry of Agriculture & Argo-Based Industry (MOA), Department of Agriculture (DOA), Department of Statistics (DOS) Malaysia, the Organisation for Economic Co-operation and Development (OECD), Food and Agriculture Organization (FAO), World Bank and European Satellite Agency (ESA) satellite imagery data.

The report found that:

a) Paddy farming is perceived to be uneconomical – on the contrary, paddy farming in MADA is competitive compared to other rice growing areas, provided input subsidies remain;
b) Farmers are still associated with poverty – recent data shows that this is still true; and
c) Malaysia is still a net importer of rice with the SSL hovering between 60 – 70% – While we are still a net importer, it should not be seen as a failure of the industry.

Report limitations

Due to some constraints, there are interrelated factors not covered but are acknowledged in this report. Some of the limitations are:

a) Improving a farmer's household income should be addressed holistically to include non-paddy and off-farm activities;
b) While contract farming has many advantages, it should not be seen as the only answer towards improving the industry; and
c) This report only focuses on matters related to paddy cultivation in Peninsular Malaysia for the production of cheap to medium quality rice. The report did not cover matters related to speciality rice nor explore paddy cultivation in East Malaysia. This is briefly discussed elsewhere in the "Monograph of Paddy Smallholders in Bario" by KRI.

CHAPTER

01

INDUSTRY OVERVIEW

CHAPTER 1

INDUSTRY OVERVIEW

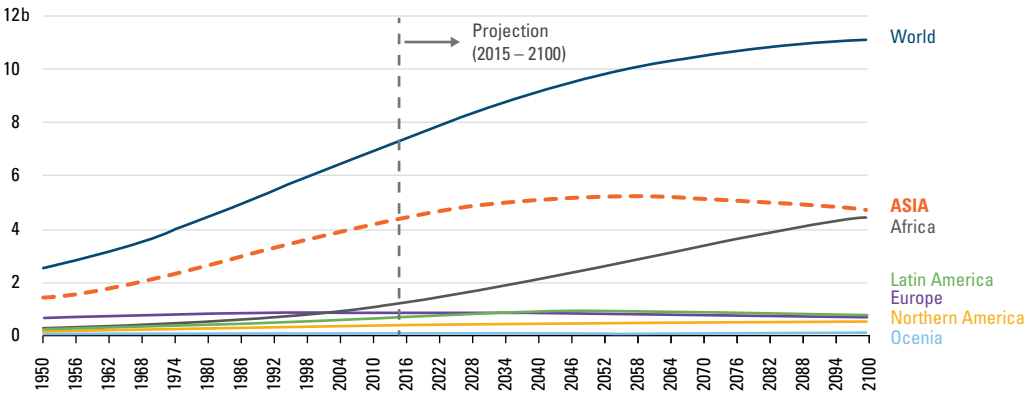
This chapter provides an industry overview of historical and future trends of the paddy and rice industry at the world, regional and national level.

The World Rice Situation

In 2017, the United Nations estimated the global population to reach 7.5 billion, with the biggest proportion in Asia (Figure 1.1). As rice is the staple food for most countries in Asia, the region consumes more than 80% of the world's rice (Figure 1.2). In fact, the world's five largest rice producers are also the world's five largest rice consumers, namely China, India, Indonesia, Bangladesh and Vietnam. Future demand for rice is expected to rise from the already high level of rice consumption as the population continues to grow. As such, countries in Asia have always been concerned with acquiring an adequate supply of rice at the back of this increasing demand. This is further motivated by concerns of spikes in rice prices which were shown to be correlated with social unrest[12] (Figure 1.3).

Regionally, Asia has the largest population in the world

Figure 1.1. Total population estimates, by region, 1950 – 2100 (billion)

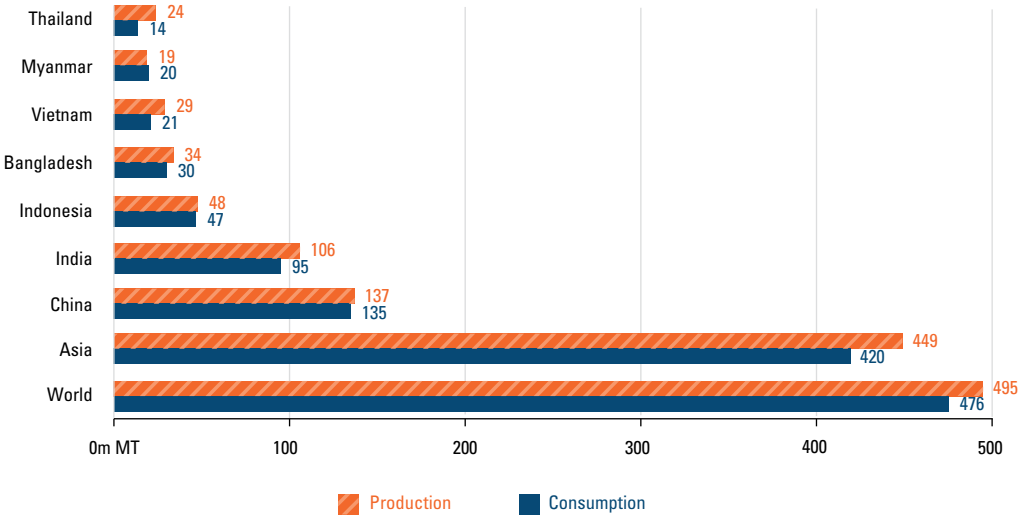


Source:
Special Aggregates: Geographical groups: Total population – Both sexes, World Population Prospects 2017, UN Desa/ Population Division (Accessed 19 Oct 2018)
Chart by KRI

12 Bellemare (2015)

Most of the world's rice production and consumption is concentrated in Asia

Figure 1.2. World's top producers and consumers of rice, by country and region, 2013 (m MT)



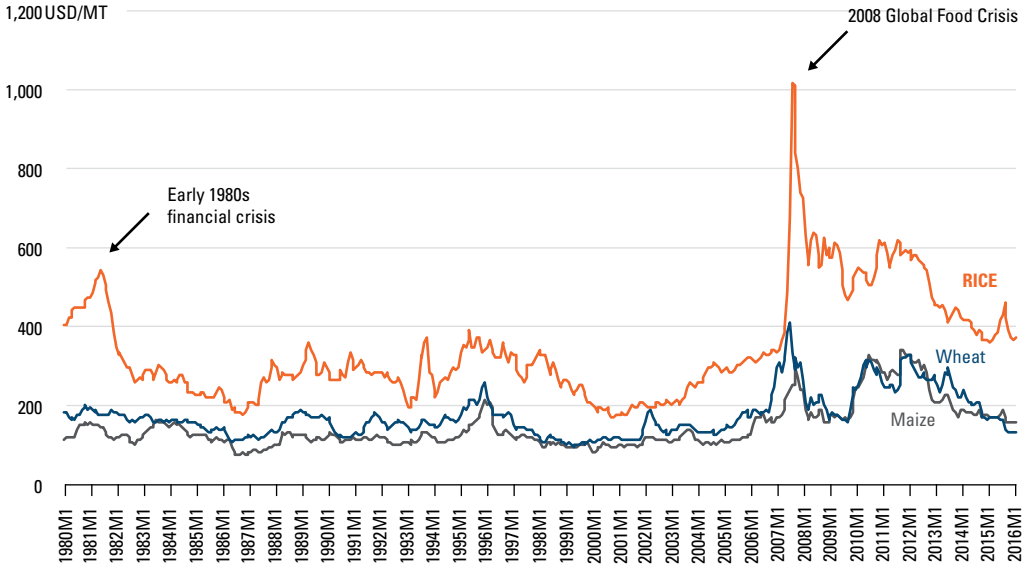
Note:

1. *The most recent data on production and consumption in FAOSTAT are up to the year 2013. OECD-FAO Agricultural Outlook 2018-2027, although provides data up to 2018 (and projection up to 2027), is limited in the number of countries covered.*
2. *Based on OECD-FAO Agricultural Outlook 2018-2027, the world's and Asia's rice production in 2016 is 502m MT and 453m MT respectively, whereas rice consumption is 498m MT and 434m MT, respectively.*

Source:
Food balance sheets: Production quantity & Domestic supply quantity, FAOSTAT (Accessed 2 Oct 2018)
Chart by KRI

World rice prices experienced the largest price hikes compared to wheat and maize

Figure 1.3. World monthly cereal prices, by commodity, 1980 – 2016 (USD/MT)



Notes:

1. *Rice: Rice, 5 per cent broken milled white rice, Thailand nominal price quote (USD/MT)*
2. *Maize: Maize (corn), U.S. No.2 Yellow, FOB Gulf of Mexico, U.S. price (USD/MT)*
3. *Wheat: Wheat, No.1 Hard Red Winter, ordinary protein, Kansas City (USD/MT)*

Source:

World: Prices & Forecasts: Monthly Data, IMF Primary Commodity Prices (Accessed 9 Nov 2018)

Chart by KRI

Regional Rice Situation

For the past century, the Southeast Asia (SEA) region has been the centre of the world's rice economy[13]. In 2016, this region contributed 16m MT (39.9%) of the world's rice exports[14], with Thailand and Vietnam being the region's top exporters. Thailand contributed up to 24.5% of the world's total export of rice, while Vietnam and Cambodia contributed 12.9% and 1.3% respectively (Figure 1.4).

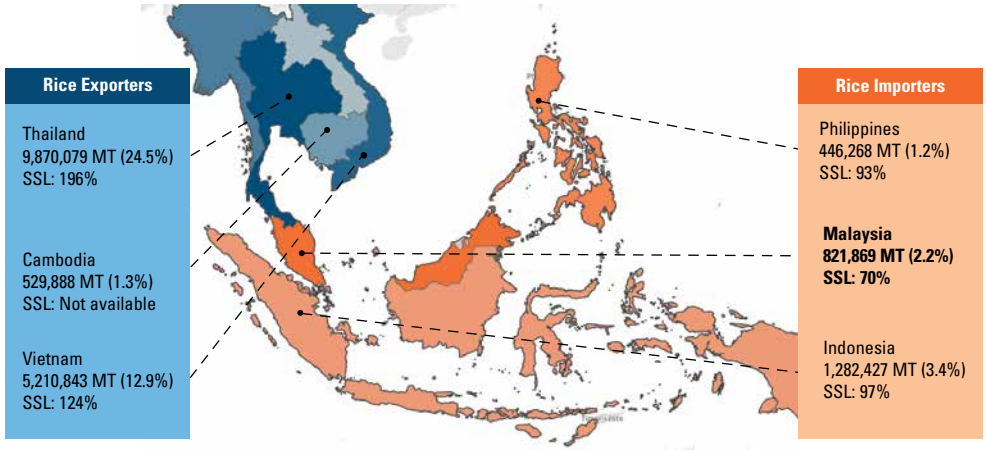
Despite the high exports of rice recorded by the SEA region, not all SEA countries are rice exporters. Countries such as Indonesia, Malaysia and the Philippines are net importers (Figure 1.5). In 2016, Indonesia imported 3.4% of the world's total rice import while Malaysia and the Philippines' share of imports stood at 2.2% and 1.2% respectively (Figure 1.4).

"The Southeast Asia (SEA) region has been the centre of the world's rice economy"

13 Baldwin et al. (2012)

14 Refers to semi-milled or wholly milled rice. Source: FAOSTAT (n.d.)

Figure 1.4. Quantity and share of the world's rice export/import and country's self-sufficiency level (SSL) of the top rice exporters and importers in Southeast Asia, 2016



Notes:

1. *'Rice' refers to rice (milled equivalent) of which the import and export of paddy rice are converted into the weight it would be as milled rice (FAOSTAT)*
2. *Import and export data are from FAOSTAT since it covers a larger number of countries compared to other sources*
3. *Percentages in brackets are the shares of rice export or import over the world's total rice export or import*
4. *Rice SSL calculation: production, import and export data are taken from OECD-FAO Agricultural Outlook 2018-2027. This is because the most recent available data for rice production from FAOSTAT is only up to the year 2013. FAO's SSL formula is used (refer Box Article 2). Data to calculate rice SSL for Cambodia is not available*

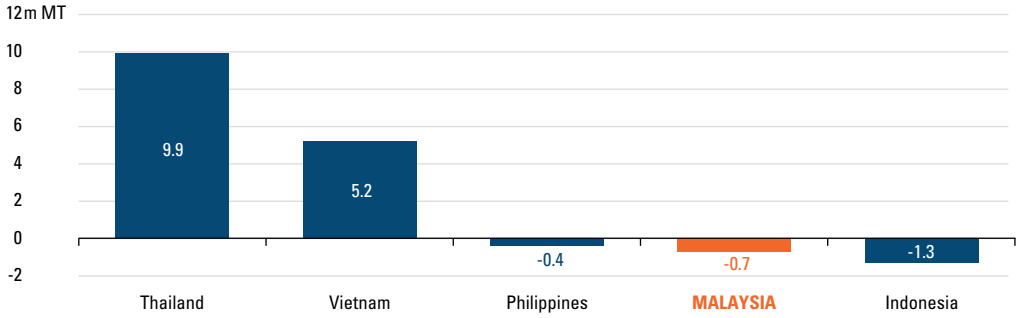
Sources:

1. *FAOSTAT (Accessed 28 Aug 2018)*
2. *OECD-FAO Agricultural Outlook 2018-2027 (Accessed 16 Aug 2018)*

Figure and calculations by KRI

Thailand and Vietnam are big players in world export of rice, while Indonesia, Malaysia and the Philippines rely on imports to meet their national requirement

Figure 1.5. Rice trade balance in Southeast Asia, 2016 (m MT)



Note:
Trade balance = total export – total import
Source:
KRI calculations based on Crops and livestock products: Import quantity & Export quantity: Rice – total (Rice milled equivalent), FAOSTAT (Accessed on 16 Aug 2018)
Chart by KRI

In the SEA region, countries showed varying trends in the paddy industry data (Table 1.1, Figure 1.6 to 1.9)[15].

Indonesia is the largest producer and consumer of rice. The country has the biggest rice harvested area which is 19.8 times larger than Malaysia and is close to being 100% self-sufficient. The country also has the highest producer price, which increased drastically following the world rice crisis in 2007/2008.

Although Thailand is still one of the main exporters of rice, over the last five years the country has seen a decline in production and total rice harvested area. Malaysia, relative to the other SEA countries, has shown an almost constant trend for rice production, harvested area and even rice SSL, but has the second highest average annual growth of rice yield at 1.6% after Vietnam at 1.8%, from 2000 to 2016. Vietnam has been an exceptional case, whereby it has shown the highest growth in rice production and SSL at the back of a relatively slower increase in paddy land area. For the Philippines, since the 1990s, it has shown a gradual increase in production and harvested area with SSL hovering below 100%.

15 OECD-FAO Agricultural Outlook 2018-2027 only includes SEA country data for Indonesia, Thailand, the Philippines, Vietnam and Malaysia. Source: OECD & FAO (2017)

The amount and percentage growth of Malaysia's rice production, consumption and area harvested are relatively small compared to its neighbouring countries

Table 1.1. Rice production, consumption, area harvested and yield for the Southeast Asia region, 2000 – 2016

Country	Population	Production		Consumption		Area Harvested		Rice Yield[c]	
	Thousand	Million MT[a]	Average Annual Growth (%)[b]	Million MT[a]	Average Annual Growth (%)[b]	Thousand Ha[a]	Average Annual Growth (%)[b]	MT/Ha[a]	Average Annual Growth (%)[b]
World	7,466,964	501.5	1.46	497.5	1.36	162,510	0.36	3.1	1.09
Asia	4,462,677	453.2	1.43	434.4	1.20	143,072	0.25	3.2	1.16
Indonesia	261,115	45.6	2.11	46.7	1.88	13,870	1.04	3.3	1.06
MALAYSIA	31,187	1.8	1.62	2.7	1.75	700	0.03	2.5	1.60
Philippines	103,320	12.1	2.61	13.5	2.82	4,722	1.03	2.6	1.53
Thailand	68,864	21.6	1.80	13.6	2.03	10,780	0.69	2.0	0.99
Vietnam	94,569	28.1	1.83	22.1	1.21	7,743	0.07	3.6	1.75

Notes:

[a] *Year 2016*

[b] *Average annual growth rate (AAGR), year 2000 – 2016*

[c] *Note that the yield reported in Table 1.1 is rice yield, which is different from paddy yield (in Figure 1.14, Figure 2.2 and Figure 4.6). KRI calculation based on rice production and harvested area data from Agrofood Statistics 2016, MOA gives 2.57 MT/Ha of rice yield for Malaysia in 2016 which is similar to the figure reported by OECD-FAO Agricultural Outlook*

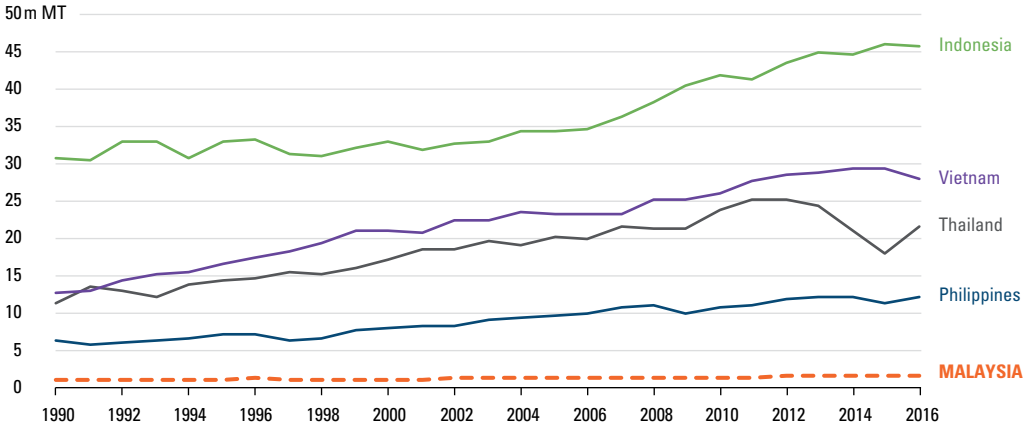
Sources:

1. *Population data from Special Aggregates: Geographical groups: Total population – Both sexes, World Population Prospects 2017, UN Desa/Population Division (Accessed on 19 Oct 2018)*
2. *Production, consumption, area harvested, and yield data from OECD-FAO Agricultural Outlook 2018-2027 (Accessed on 25 Oct 2018)*

Calculations by KRI

Malaysia's rice production remained relatively constant compared to other countries, which have shown an increasing trend since 1990

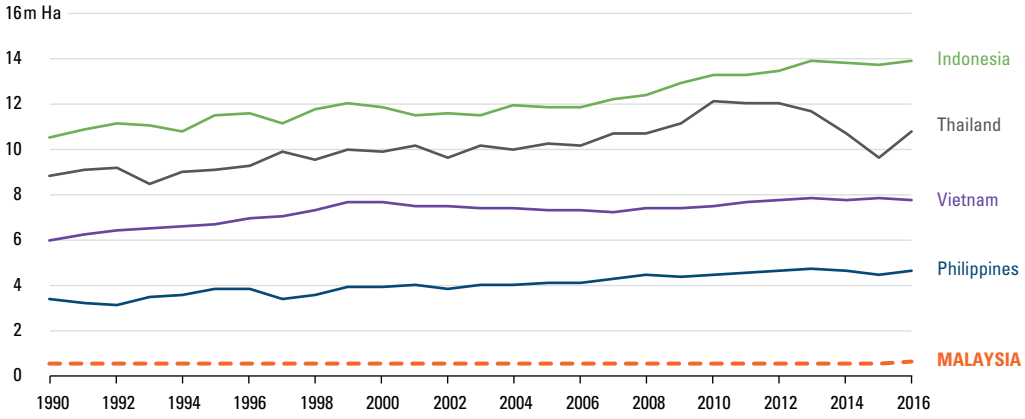
Figure 1.6. Total rice production in the Southeast Asia region, 1990 – 2016 (m MT)



Source:
Data from OECD-FAO Agricultural Outlook 2018-2027 (Accessed on 17 Aug 2018)
Chart by KRI

Malaysia's rice harvested area remained relatively constant compared to countries such as Indonesia, which have shown an increasing trend since 1990

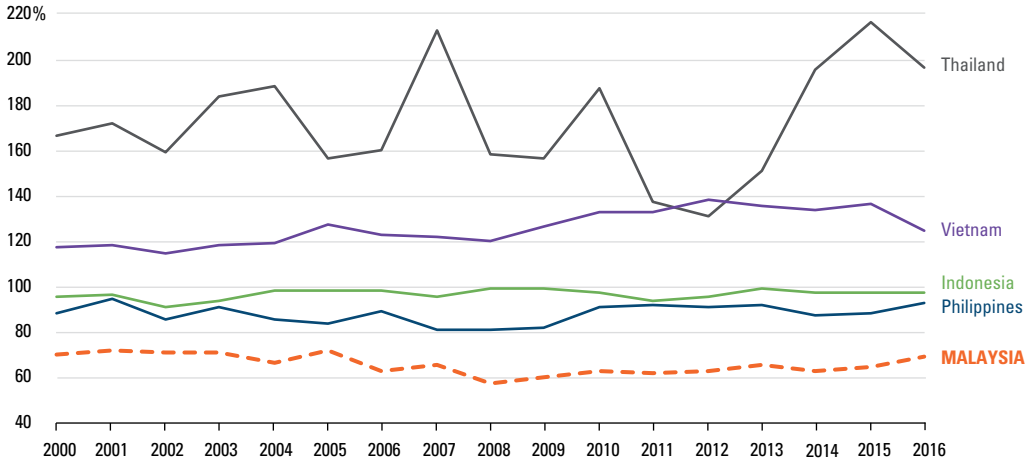
Figure 1.7. Total rice harvested area in the Southeast Asia region, 1990 – 2016 (m Ha)



Source:
Data from OECD-FAO Agricultural Outlook 2018-2027 (Accessed on 17 Aug 2018)
Chart by KRI

The rice self-sufficiency level for Malaysia remained the lowest compared to Thailand, Vietnam, Indonesia and the Philippines

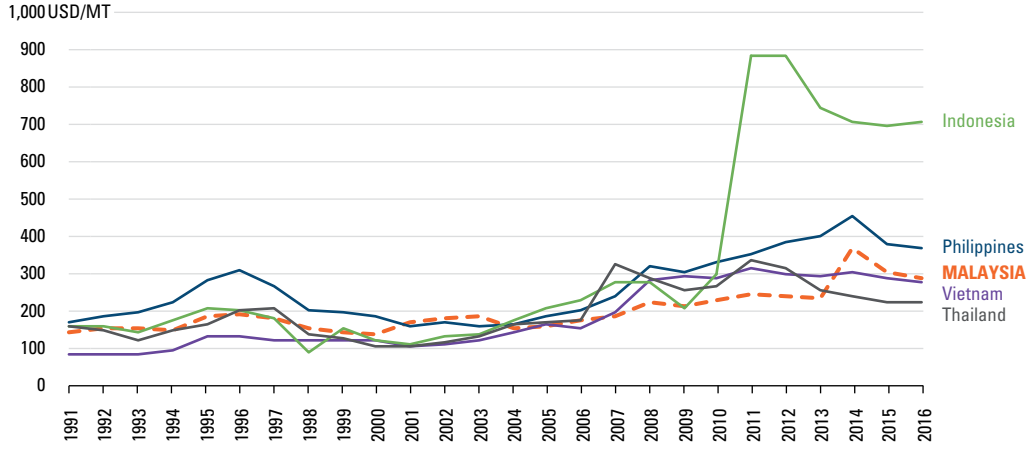
Figure 1.8. Self-sufficiency level (SSL) in the Southeast Asia region, 2000 – 2016 (percentage)



Source:
SSL calculations by KRI based on production, import, and export data from OECD-FAO Agricultural Outlook 2018-2027 (Accessed 17 Aug 2018) and FAO's SSL formula (Refer to Box Article 2)
Chart by KRI

Since 2004, Malaysia's producer price for rice is relatively low compared to other countries but spiked in 2014 due to Guaranteed Minimum Price (GMP) standardisation

Figure 1.9. Producer price for rice across different countries, 1991 – 2016 (USD/MT)



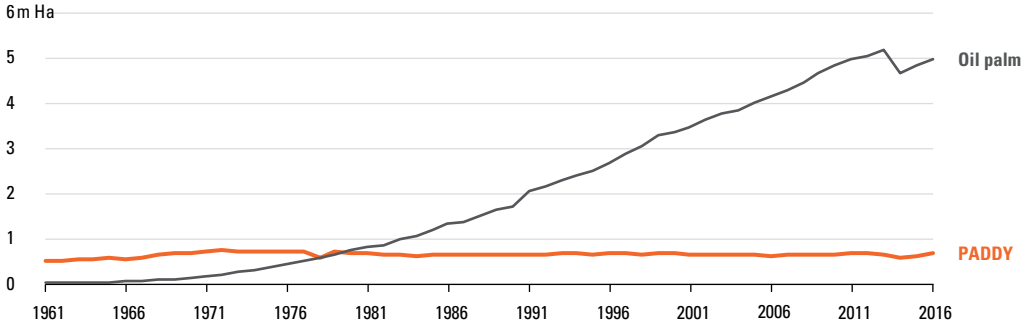
Source:
Producer prices – Annual: Rice, paddy, FAOSTAT (Accessed 17 Aug 2018)
Chart by KRI

Rice in Malaysia – Statistics

In 2016, Malaysia's Gross Domestic Product (GDP) was RM1,196.4b, whereby the agriculture, forestry and fisheries sectors contributed only RM106.5b (8.9%)[16]. Within agriculture, palm oil was the biggest contributor at RM41.9b (40.2%), while paddy contributed only RM2.4b (2.3%). Indeed, palm oil has always been a bigger contributor to the national GDP and this can be seen over time, as the oil palm harvested area has increased tremendously while the paddy harvested area remained relatively constant (Figure 1.10).

While the oil palm harvested area has increased over the years, paddy harvested area remained relatively stagnant

Figure 1.10. Total area harvested for oil palm and paddy in Malaysia, 1961 – 2016 (m Ha)



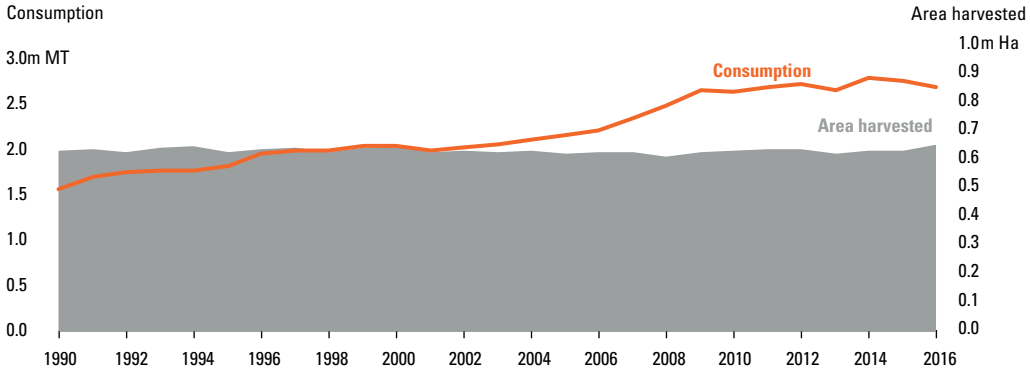
Source:
Crops: Area harvested: Oil palm fruit & Rice, paddy, FAOSTAT (Accessed 17 Aug 2018)
Chart by KRI

Despite the paddy and rice industry having a small contribution towards the nation's GDP, it has garnered much interest from policymakers given its complex relationship with food security, culture and socio-economic factors. This is motivated by the increasing national demand for rice (Figure 1.11) at the back of a constant size of the harvested area. In fact, the OECD-FAO Agricultural Outlook report projected a widening gap between Malaysia's production and consumption of rice (Figure 1.12).

16 National Accounts from Time Series Data: Malaysia Economic Statistics – Time Series 2016, DOSM website (Accessed 9 Nov 2018)

Rice consumption continues to rise while the total harvested area remained constant

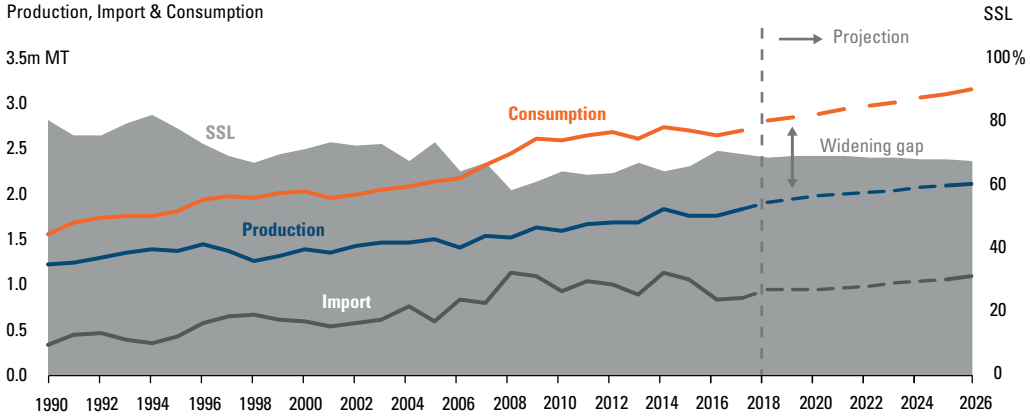
Figure 1.11. Rice consumption and total harvested area in Malaysia, 1990 – 2016 (m MT & m Ha)



Source:
OECD-FAO Agricultural Outlook 2018-2027 (Accessed 24 Aug 2018)
Chart by KRI

The gap between rice consumption and production is projected to widen

Figure 1.12. Malaysia's rice production, consumption, import (m MT) and self-sufficiency level (SSL, percentage), 1990 – 2026



Source:
Production, consumption, import and export data from OECD-FAO Agricultural Outlook 2018-2027 (Accessed 24 Aug 2018). SSL calculations by KRI using the FAO formula (refer to Box Article 2)
Chart by KRI

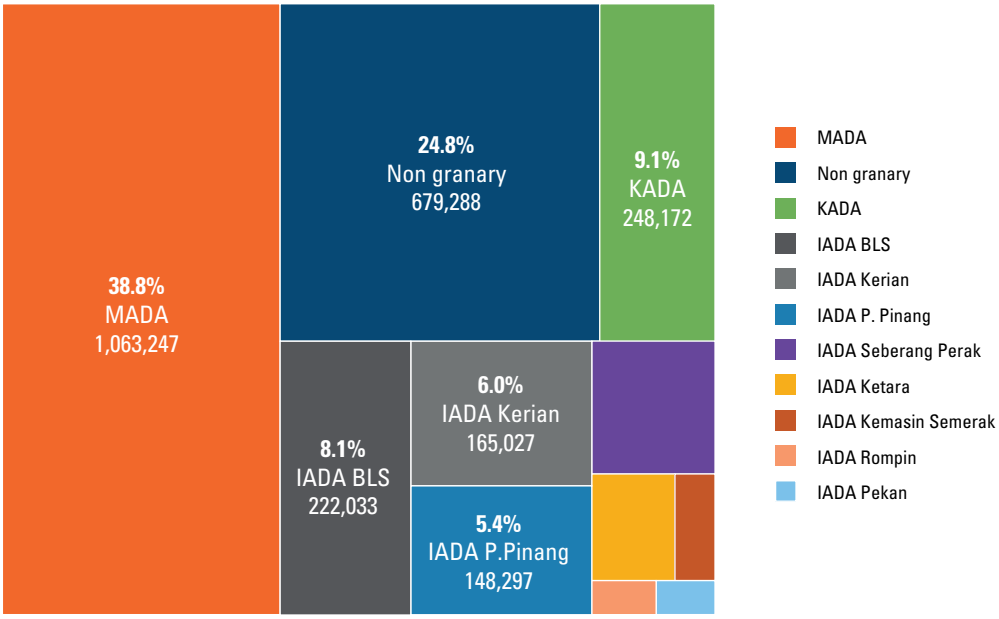
For domestic paddy production, Malaysia relies primarily on ten key granary areas for its supply of paddy. In 2016, the nation produced a total of 2.7m MT of paddy[17]. Out of this, 2.0m MT or 74.1% of the total paddy produced was from the granary areas (Figure 1.13). Muda Argricultural Development Authority (MADA), in the Northern Peninsular of Malaysia, produced about 38.8% of the total national paddy production and is known as the 'Rice Bowl' of the nation, followed by Kemubu Agricultural Development Authority (KADA) at 9.1% and Integrated Agricultural Development Area (IADA) Barat Laut Selangor (BLS) at 8.1% (Figure 1.13)[18]. Given the differences in their locations (different environmental conditions), farm practices and various other factors, these granary areas have different levels of farm yield (Figure 1.14). The national average yield is around 4.0 MT/Ha with high performing areas such as IADA Barat Laut Selangor, IADA Pulau Pinang, IADA Ketara and MADA, having yields above 5.0 MT/Ha. On the contrary, granaries such as IADA Pekan and Rompin are among the low yield producers, with yields below 3.0 MT/Ha[19].

In the future, should the nation opt to increase paddy production at the back of a constant size of the total harvested area, improving the yield by addressing each granary area's unique concerns is recommended (Box Article 1). This should be done without compromising other farm factors such as good agricultural practices and reducing the cost of production, which is discussed in subsequent chapters.

17 Statistik Tanaman (Sub-Sektor Tanaman Makanan), DOA (2017)
18 Refer to Abbreviations for the list of granary areas and their names
19 Agrofood Statistics 2016, MOA (2016a)

MADA granary area is the largest contributor to the nation's paddy production

Figure 1.13. Paddy production by granary area, 2016 (MT and percentage of total domestic production)



Notes:

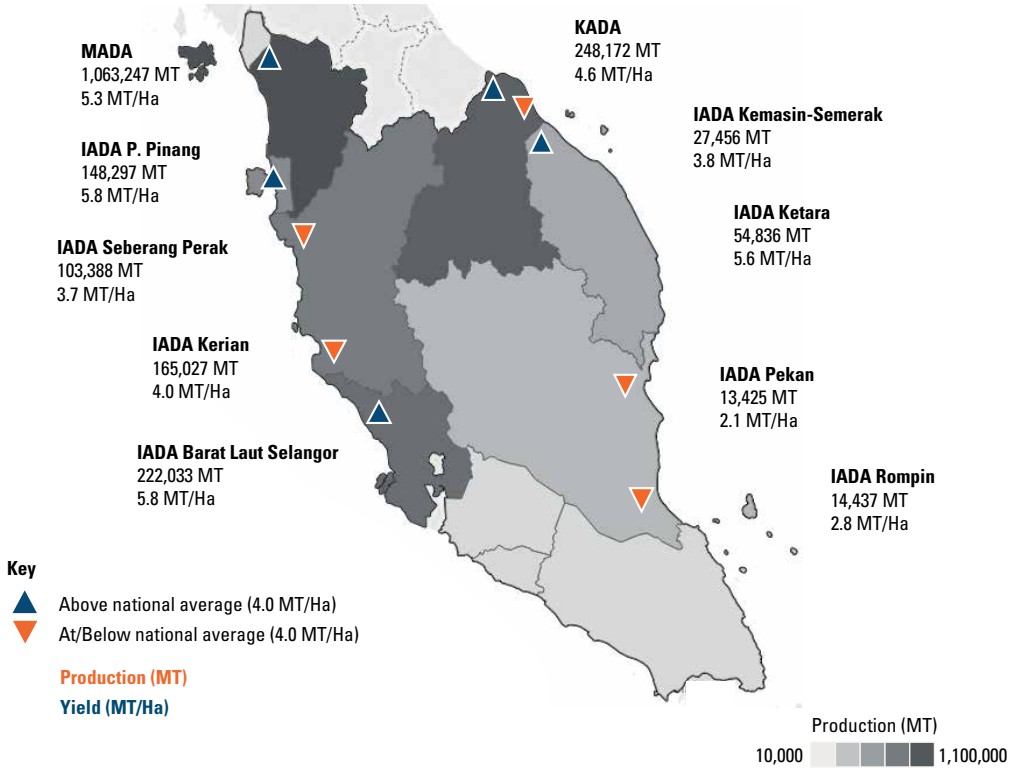
1. *IADA Seberang Perak: 103,388 MT (3.8%)*
2. *IADA Ketara: 54,836 MT (2.0%)*
3. *IADA Kemasin Semarak: 27,456 (1.0%)*
4. *IADA Pekan: 13,425 (0.5%)*
5. *IADA Rompin: 14,437 (0.5%)*

Source:

Table 3.1.10: Production of paddy of granary area, 2011-2016, Agrofood Statistics 2016, MOA
Chart by KRI

The average yield per hectare varies across the different areas with IADA Pulau Pinang, IADA Barat Laut Selangor, IADA Ketara and MADA having average yields above 5 MT/Ha

Figure 1.14. Paddy production (MT) and yield (MT/Ha) in the granary areas, 2016



Source:
Table 3.1.4: Production of paddy and rice, 2011-2016, Table 3.1.9: Average yield of paddy, 2011-2016, & Table 3.1.10: Production of paddy of granary area, 2011-2016, Agrofood Statistics 2016, MOA
Chart by KRI

BOX ARTICLE 1: How Much Land is Used for Paddy Cultivation?

In the paddy and rice industry, it is important to know the actual total area planted with paddy and the growth stage for each paddy plot. This helps to provide accurate measurement of yield, land use prediction, farm monitoring, and to predict the expected harvest. In addition, accurate and up-to-date paddy data are especially important during events such as natural disasters to allow the authorities to predict yield loss and end-of-season harvest. Furthermore, it helps avoide leakages in the input subsidies; whereby *ghost* lands can be prevented[20]. This, in turn, allows prompt and effective policy and management decisions as well as appropriate downstream market responses.

According to the *Rancangan Fizikal Negara ke-3*, the allocation of land for paddy cultivation was designated as *kawasan jelapang padi* or granary areas. Initially, there were eight granary areas, which have now been expanded to 10. The largest granary area is MADA. Recent data made available is on 2016[21] whereby a total parcel of 100,603 Ha in MADA was planted with paddy, producing a total of 1.1m MT of paddy at a yield of 5.3 MT/Ha. The data needed to generate this information involves on-site checks and individual information from the farmers which can be laborious, costly, prone to error and time-consuming.

KRI explored the use of satellite technology to enable quick, accurate and transparent determination of the total planted area.

Publicly-available satellite images covering the MADA area from ESA Sentinel-1A satellite were analysed[22]. The captured images were taken between March and August for the years 2015 and 2016. This corresponds to the paddy planting season (*Musim 1*) in the MADA area.

20 KRI's stakeholder engagements revealed that leakages can happen in the input subsidy programme. A person may claim to have a larger land area planted with paddy than is actually the case. The extra chemicals may be sold on the black market for profit or used on other crops.

21 *Laporan Tahunan 2016*, MADA (2016) and Agrofood Statistics 2016, MOA (2016a)

22 This work was done with Satellite Imagery Sdn. Bhd.

The paddy plant is a unique short-term crop with a maturity period of 90 – 140 days post germination. Within this period, it undergoes physically distinct life-stages (Figure 1.15) that can be seen in two-week intervals.

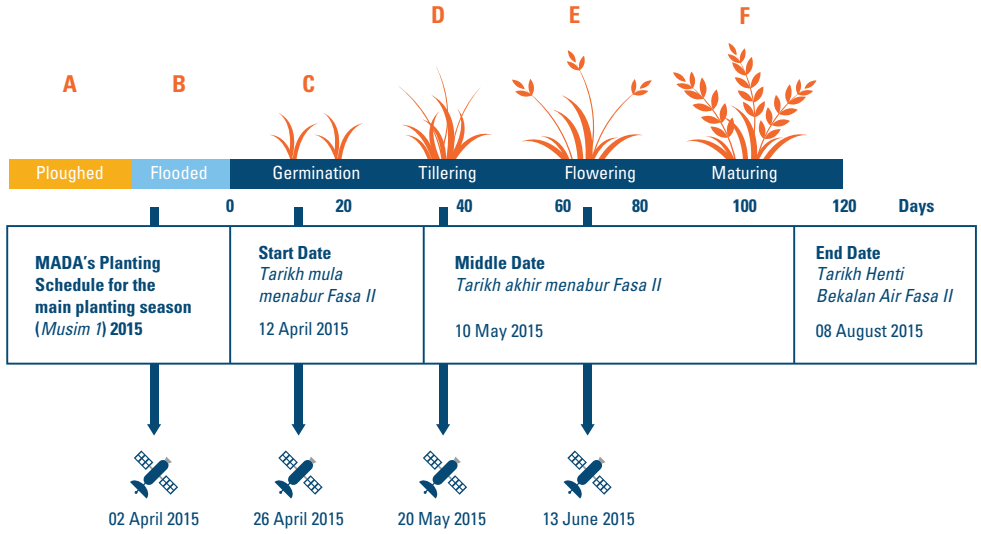
On the contrary, the physical characteristics of a permanent water body, such as a lake, a road, an oil palm estate, a forest, a home or a football field stay the same over the same two-week intervals. Therefore, theoretically, a satellite image shooting a light beam (of a certain wavelength) over a cultivated paddy plot should be able to detect the physical changes of a paddy plant over time and have it differentiated from a non-paddy surface. The use of this technology in paddy cultivation is demonstrated through the use of Sentinel-1A by researchers in IRRI[23].

KRI researchers stacked several Sentinel 1-A satellite images of the same MADA area that are about 2 weeks apart for each planting season. In the stacked image, colours indicate changes in the land surface area over time, while white-grey areas are surfaces that did not change over the same period (Picture 1.1).

This work is currently being written for a technical publication. In due course, it is hoped that the public can access the data from the KRI website and expand the use of satellite imagery for live updates of paddy cultivation.

23 Setiyono et al. (2018)

Figure 1.15. Temporal Sentinel-1A backscatter data for different structures, 2015

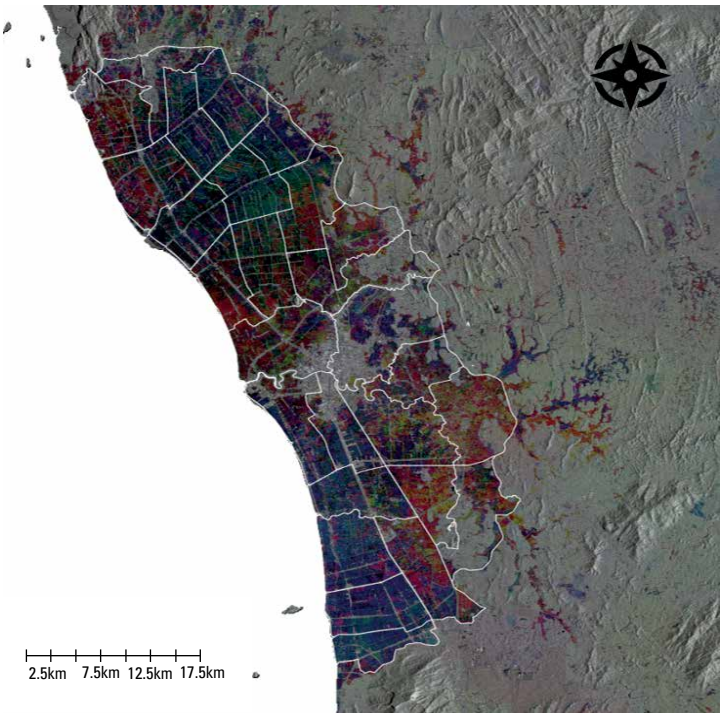


The cycle starts with the paddy plot having exposed soil (A) that is then flooded with water (B) which will soon have paddy seedlings growing through the water (C). This is followed by the gradual reduction of visible water surfaces as the height of the darker green paddy plants grows (D-E). As the plants continue to mature, they produce grains, giving a golden-yellow colour to the paddy plots (F) and, soon after, the field is harvested before it reverts to being a plot of exposed soil.

Illustration by KRI

Four satellite images of the MADA area taken over 2-weeks intervals were stacked. The coloured images indicate areas planted with paddy. On the contrary, areas in grey-white indicate the absence of changes in ground conditions, suggesting a non-planted area

Picture 1.1. Four stacked Sentinel-1A images for the MADA area from 2 April 2015 to 13 June 2015



Stacked Dates:

- 02 April 2015
- 26 April 2015
- 20 May 2015
- 13 June 2015

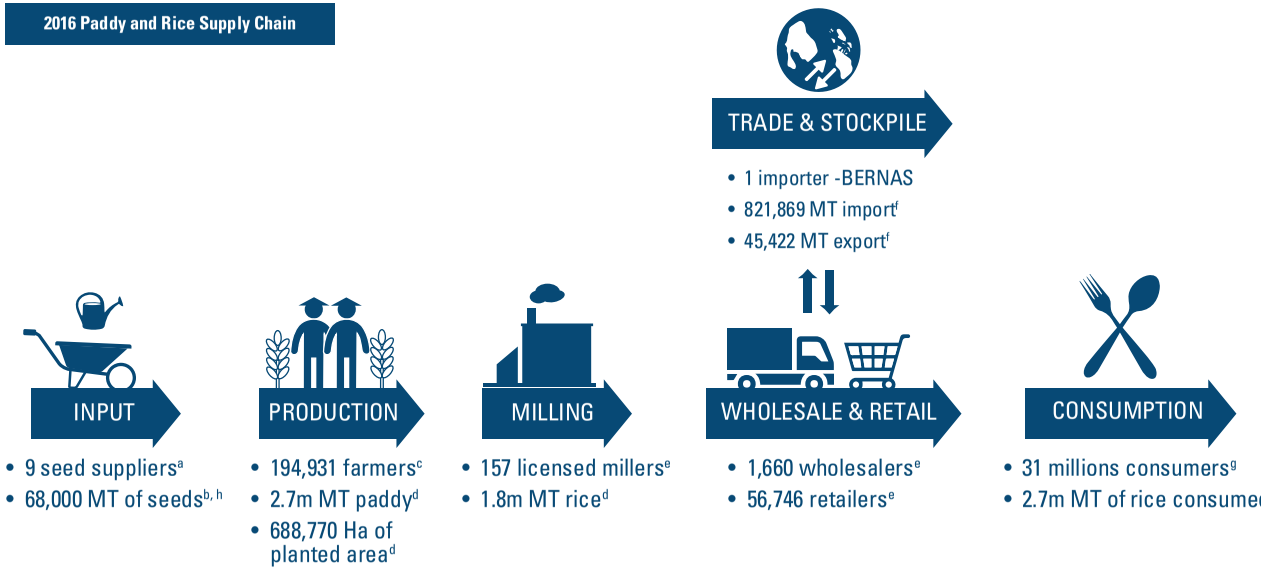
Source:
Raw data from Sentinel 1A
Image by KRI

Rice in Malaysia – Paddy and Rice Supply Chain

The production of paddy and the supply of rice to the consumers should not be viewed as separate segments but as a series of linked segments within a supply chain model.

Based on 2016 data, the paddy and rice supply chain takes an hourglass shape whereby there is a large number of farmers and consumers with a small number of midstream players. The typical flow in the production of paddy can be described as follows (Figure 1.16): 194,931 farmers in Malaysia produced a total 2.7m MT of paddy from around 68,000 MT of seeds. Once harvested, the paddy grains were sold to 157 millers at a Guaranteed Minimum Price (GMP) of RM1,200/MT, where they were processed into 1.8m MT of rice and subsequently distributed through retail stores via 1,660 active wholesalers. At 56,746 retail stores, rice was then sold to 31 million consumers with a total of 2.7m MT of rice consumed in 2016. This is more than the national domestic rice produced. The remaining 821,869 MT of demand for rice was fulfilled by importing rice, primarily from Thailand and Vietnam.

Figure 1.16. Domestic paddy and rice supply chain



Sources:

- [a] *Arkib Keputusan Tender Pembekalan Benih Padi Sah Kepada Petani di Bawah Program Benih Padi Sah, Kementerian Pertanian Dan Industri Asas Tani Bagi Tempoh Dua(2) Tahun (2015 - 2016)*
- [b] *MOA Media Statement – Benih Padi Tidak Sah Ancam Bekalan Beras*
- [c] *Booklet Statistik Tanaman (Sub-sektor Tanaman Makanan) 2017, DOA*
- [d] *Agrofood Statistics 2016, MOA*
- [e] *As of July 2016. Data from Maklumat Seksyen Kawalselia Padi dan Beras*
- [f] *FAOSTAT*
- [g] *Malaysia's population from Special Aggregates: Geographical groups: Total population – Both sexes, World Population Prospects 2017, UN Desa/ Population Division*

Note:

- [b] *Under the Paddy Seed Certification Scheme, the government sets the total quota level for seed production at 80,000MT each year, however, only 85% of the quota set are produced*

Illustration by KRI

CHAPTER KEY TAKEAWAYS

The World Rice Situation

- Rice is synonymous with Asia. In 2017, countries in Asia consumed more than 80% of the world's rice and demand is expected to continue to rise.

Regional Rice Situation

- SEA is a key player in the world rice market as both exporter and importer.
- In 2016, this region contributed 39.9% of the world's rice exports, with Thailand and Vietnam being the world's largest exporters.
- On the other hand, countries such as Malaysia, Indonesia and the Philippines are net importers.

Rice in Malaysia: Statistics

- In 2016, Malaysia's GDP was RM1,196.4b, whereby agriculture, forestry and fisheries sectors contributed only RM106.5b (8.9%). Within the sector, paddy was a small contributor valued at RM2.4b (2.3%).
- Despite the paddy industry having a small contribution towards the nation's GDP, it has garnered much interest from policymakers given its complex relationship with food security, culture and socio-economic factors.
- For domestic paddy production, Malaysia relies primarily on key granary areas. Approximately 70% of the domestic supply is from the granary areas.
- Therefore, the performance of the national paddy production is often a reflection of the performance of the granary areas in Malaysia.
- With regard to the industry, the production of paddy and the supply of rice to the consumers should not be viewed as separate entities but as a series of linked segments within a supply chain model. This will be explored in detail in the subsequent chapters.

CHAPTER

02

RICE POLICY AND REGULATIONS

CHAPTER 2

RICE POLICY AND REGULATIONS

Agricultural Policies – History

Malaysia's agricultural policies can be divided into two phases: pre-independence and post-independence (Figure 2.1). Before 1957, agricultural policies were implemented to serve the interests of the British colonial government. Consequently, commercial export commodities such as rubber, oil palm and cocoa received particular attention with policies designed to make improvements in infrastructure (road systems and rail tracks) and attract foreign labour and investments. Meanwhile, food crops intended for domestic consumption such as paddy were only cultivated by small-scale Malay farmers[24]. During this period, the rice SSL was below 50%[25].

Post-independence, the agricultural policies were formulated to steer the sector's growth in two main areas: agriculture for domestic interests as well as export crops. As a result, the development of paddy cultivation received special attention from the government, especially through the launch of the Green Book Plan (1979) by the late Prime Minister Tun Abdul Razak during the First Malaysia Plan (1966 – 1970).

The 1960s and 1970s were a turning point for the paddy and the rice industry. Among the initiatives made were the establishment of a dedicated agricultural research institution and the formation of key granary areas. In 1969, the Malaysian Agricultural Research and Development Institute (MARDI) was established to spearhead research in agriculture and has been the leading entity for research on paddy and rice. A few years later, in 1971, *Lembaga Padi dan Beras Negara* (LPN) was formed to oversee the adequate supply of rice and improve farmers' income, followed by the establishment of the development authority of the largest granary area, MADA, and the consolidation of farmers' organisations through the National Farmers Organization (NAFAS) in 1972. This was a turning point in the history of Malaysia's paddy cultivation as it resulted in the ability to have two harvests per year (as opposed to the reliance on an annual monsoon season) and a significant improvement in farming practices.

"The 1960s and 1970s were a turning point for the padi and the rice industry"

24 Dardak (2015)
25 Ariffin (2004)

Figure 2.1. A timeline of Malaysia's agricultural policies and action plans

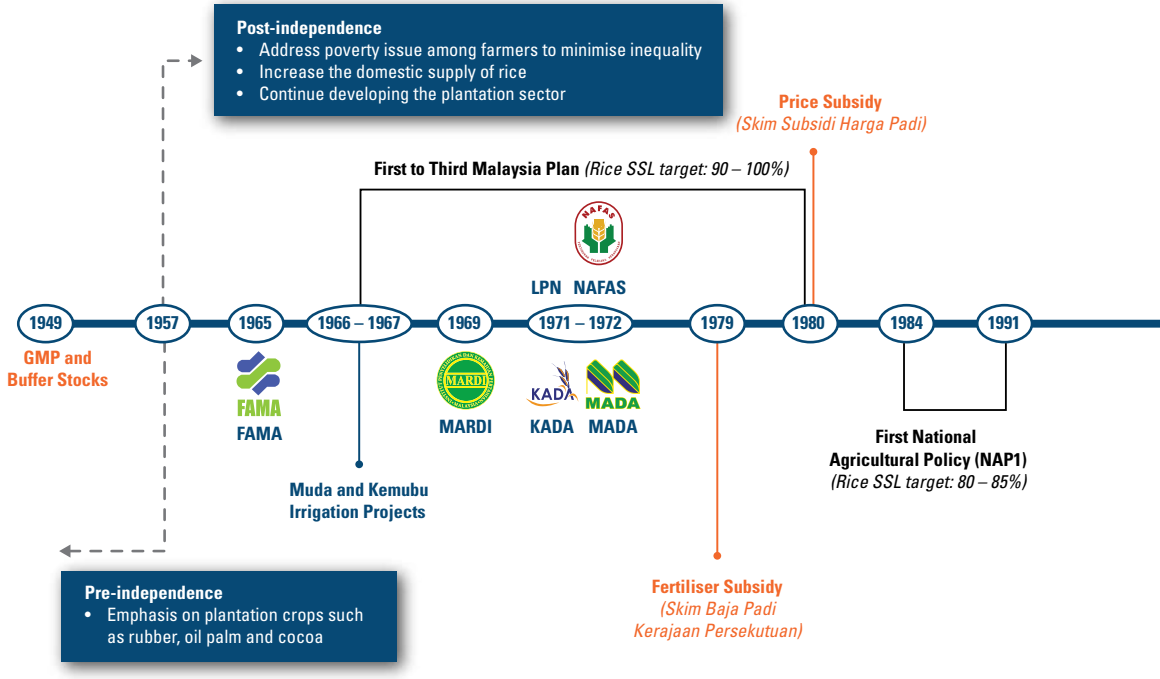
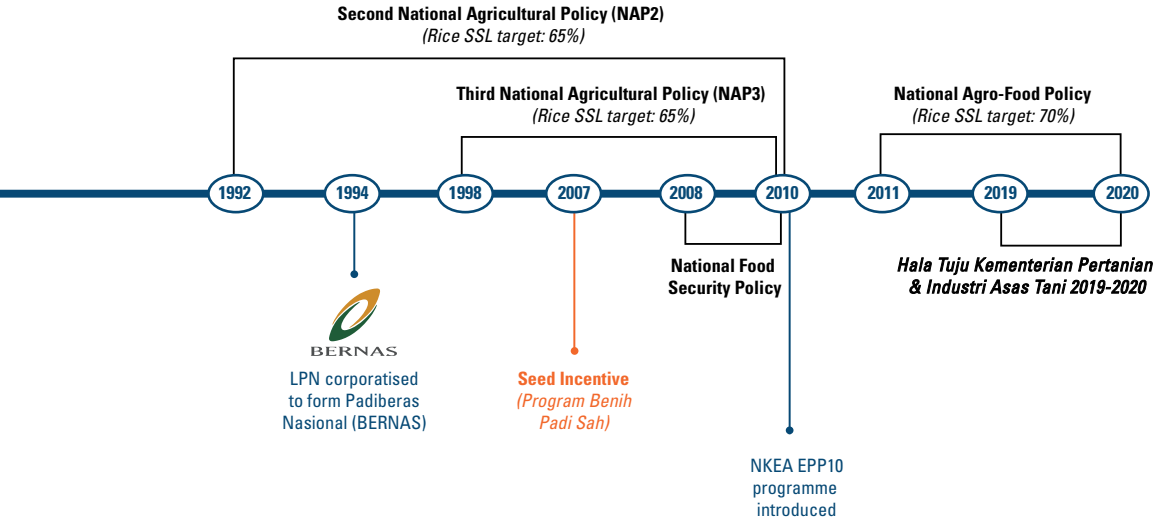


Illustration by KRI


Second National Agricultural Policy (NAP2)
(Rice SSL target: 65%)
Third National Agricultural Policy (NAP3)
(Rice SSL target: 65%)
National Agro-Food Policy
(Rice SSL target: 70%)
1992
1994
1998
2007
2008
2010
2011
2019
2020
National Food Security Policy
Hala Tuju Kementerian Pertanian & Industri Asas Tani 2019-2020
BERNAS
LPN corporatised to form Padiberas Nasional (BERNAS)
Seed Incentive
(Program Benih Padi Sah)
NKEA EPP10 programme introduced

Policy Objectives – Rice Self-Sufficiency and Food Security

The National Agro-Food Policy 2011-2020 was formulated with a special focus on improving the food production sector, including rice, and has the following objectives:

a) To address food security and safety to ensure availability, affordability and accessibility;
b) To ensure the competitiveness and sustainability of the agro-food industry; and
c) To increase the income level of agropreneurs.

Chapter 3 of the National Agro-Food Policy 2011-2020 for the rice sector mentions a need to increase the domestic production of rice to ensure sufficient supply to the country. The objective was to strengthen the paddy industry through:

a) An increase in productivity and rice quality;
b) An increase in automation and mechanisation;
c) An intensification of the use of rice by-products;
d) An improvement in the management of the national rice stockpile;
e) Restructuring of the rice subsidies and incentives; and
f) Strengthening of the institutional management of paddy and rice.

It is observed that the objectives of the National Agro-Food Policy 2011-2020 and previous agricultural policies have always been driven by the end goal of increasing production, measured in volumes (in MT) and to subsequently meet SSL targets (Figure 2.1). Indeed, targeting high SSL has always been the primary goal of Malaysia's rice policy since pre-independence. The Great Depression in the 1930s and the Japanese occupation in 1941 initiated the self-sufficiency approach to agriculture that persists until today.

As a result, the performance of a farmer, local farming authorities or government agencies is measured by their ability to constantly increase rice yield. Thus, historically, the overall performance of the industry is measured by its ability to increase rice production and SSL.

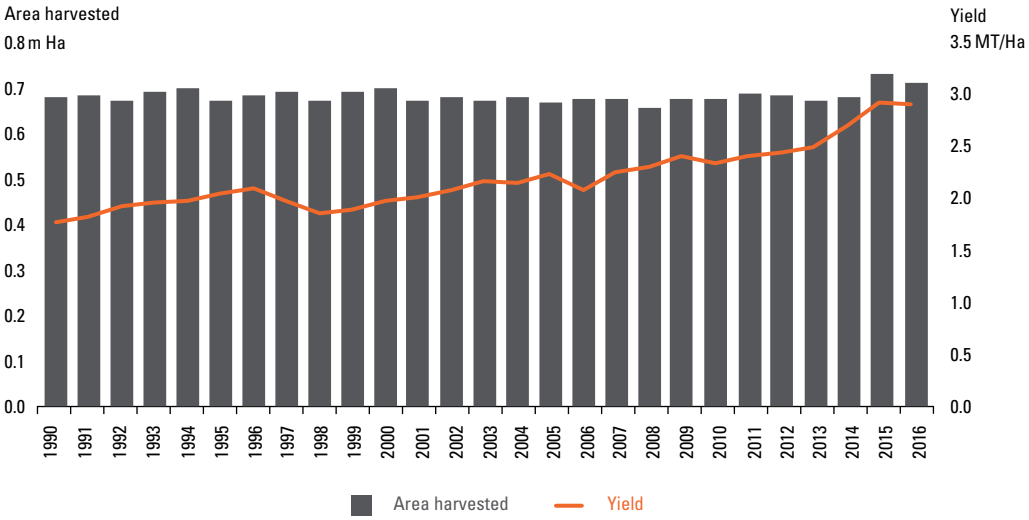
According to published data, the total domestic rice production has indeed been increasing at the back of constant land area as a result of increasing farm yield (Figure 2.2). The increasing national consumption offsets the increase in total rice production. Due to this, the nation's SSL (Box Article 2) fluctuated between 60 – 80% since the 2000s (Figure 2.10). Therefore, while the nation was not able to increase rice SSL towards 100%, various policy measures have helped in maintaining a relatively stable SSL.

Looking forward, now that the nation has established a certain level of rice production capacity, perhaps it is time to incorporate other aspects that are equally important into the production of rice for domestic consumption. This is because food security is not just a measure of production and self-sufficiency, but of other important factors such as environmental sustainability, food safety and affordability. It is possible that the nation may not need to target a high SSL if it comes at the expense of these other factors. A slightly lower SSL with a lower number of farmers but with higher yield and quality grains produced per farmer may, in fact, provide a higher income. This will be discussed in greater detail in the following subchapters and chapters.

"...historically, the overall performance of the industry is measured by its ability to increase rice production and SSL"

Despite a relatively constant total area harvested for paddy, national rice production has been increasing due to improvements in farm yield

Figure 2.2. Total area harvested (Ha) and paddy yield (MT/Ha), 1990 – 2016



Source:
Malaysia: Rice: Area harvested & Yield, OECD-FAO Agricultural Outlook 2018-2027 (Accessed on 29 October 2018)
Chart by KRI

BOX ARTICLE 2: Self-Sufficiency Level (SSL)

Self-sufficiency, from the word self-sufficient, is defined as "needing no outside help in satisfying one's basic needs, especially with regard to the production of food"[26].

The self-sufficiency status of a food item can be measured using the SSL, also known as the self-sufficiency ratio. The ratio is the total domestic production divided by total available supply, measured in percentage. However, there are variations in the way this ratio is calculated. Unless otherwise stated, this report will assume the formula as stated in the FAO Statistical Pocket Book 2015.

$$SSL = \frac{\text{Production}}{(\text{Production} + \text{Import} \pm \text{Stock} - \text{Export})} \times 100$$

Source: Agrofood Statistics 2014, MOA

$$SSL = \frac{\text{Production}}{(\text{Production} + \text{Import} - \text{Export})} \times 100$$

Source: FAO Statistical Pocket Book

"... self-sufficiency level (SSL) falls short of capturing other dimensions of food security including accessibility, stability, food safety and environmental sustainability for rice as well as other food items"

It is often for reasons of national security and a country's political interest that it is able to provide staple food for its citizens without relying on other countries. Given this reasoning, many countries in Asia use rice SSL as an indicator for food security and the basis for policy design. This is justifiable as shortages of rice or rice price hikes are usually followed by social unrest. However, while not contesting its importance, rice SSL alone may not be enough to fully achieve food security for a nation. This is because SSL falls short of capturing other dimensions of food security including accessibility, stability, food safety and environmental sustainability for rice as well as other food items.

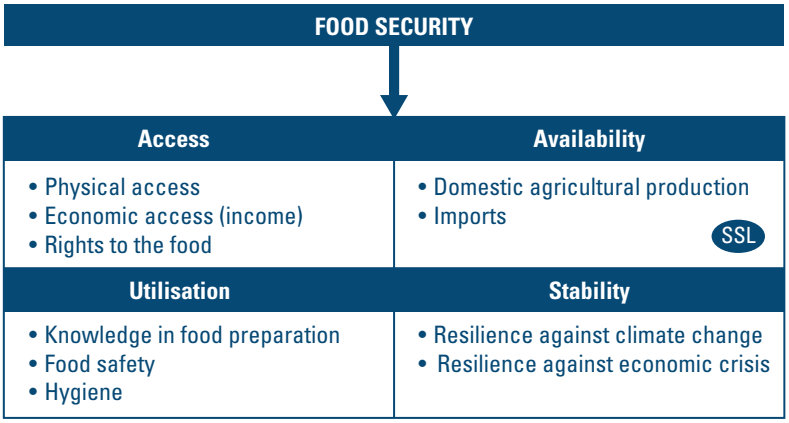
26 Oxford Dictionaries (2016)

Apart from calculating food SSL, there are other ways to capture the status of food security for Malaysia. The following sections discuss this in greater detail.

Measuring Food Security – How Does Malaysia Fare?

If indeed food security is the primary goal for agri-food policies, then the definition of food security made during the World Food Summit in 1996 should be holistically addressed. In 1996, due to the widespread malnutrition and increasing concerns over the ability of agriculture to meet future needs, the World Food Summit was organised in Rome. Here, the term food security was defined as the condition in which **"people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life"**[27].

Figure 2.3. Multidimensionality of food security food security



Source:
Food Security, Policy Brief June 2006 Issue 2, FAO
Figure by KRI

27 World Food Summit (1996)

The definition acknowledged the complexity of food security, which goes beyond food production. Using SSL to measure a nation's food security may not be sufficient as it only addresses the *availability* factor and thus, may not reflect the true status of the nation's food security. In doing so, other key factors may be overlooked such as environmental sustainability (long-term supply of limited natural resources), resilience against climate change, supply chain efficiency (minimising food loss), and welfare of the producers and consumers (food safety, quality and nutrition).

Considering this, Malaysia may want to include additional ways of measuring its status and robustness in food security beyond just the SSL of rice and other food items. Two tools to measure Malaysia's food security status are explored in this report, namely the Global Food Security Index (GFSI) and the Rice Bowl Index (RBI) (Table 2.1).

Table 2.1. Comparative table for measuring food security[28][29]

Detail	Self-sufficiency Level (SSL)	Global Food Security Index (GFSI)	Rice Bowl Index (RBI)
Developer & Sponsor	Non-applicable	Developed by the Economist Intelligence Unit Funded by DowDuPont Inc.	Governed by the advisory board comprising Professor Paul Teng (Nanyang Technology University), Bruce Blakeman (Cargill), Dr Ramon Clarete (University of the Philippines) and others Funded by Syngenta Asia Pacific
Function/ Objective	Predominantly used as a proxy for food security in Malaysia	Designed as a benchmarking model to compare and rank the level of food security across countries	Designed to measure a country's robustness in its ability to address food security issues
Number of countries	Non-applicable (it is country- and commodity-specific)	113 countries	15 countries (Asia Pacific)
Indicators	Commodity-specific domestic production, import, export and stockpile (if applicable)	Categories (49 indicators): 1. Affordability (6 indicators); 2. Availability (11 indicators); 3. Quality and safety (11 indicators); and 4. Natural resources and resilience (21 indicators).	Rubrics (33 indicators): 1. Farm-level; 2. Environmental; 3. Policy and trade; and 4. Demand and price.
Calculation	SSL = production x 100/ (production + imports – exports)[28]	Index and ranking calculated based on GFSI Excel Model[29]	Index based on qualitative and quantitative measures relative to other countries

Sources:
Statistical Pocketbook: World food and agriculture, FAO (2015); Global Food Security; and Rice Bowl Index
Table by KRI

28 FAO Statistical Pocket Book 2015: http://www.fao.org/3/a-i4691e.pdf
29 Download here: https://foodsecurityindex.eiu.com/Downloads

The Global Food Security Index (GFSI)

The yearly GFSI country ranking was first designed in 2012 by economists from the Economist Intelligence Unit and sponsored by DowDuPont Inc. The index uses a combination of qualitative and quantitative benchmarking models with 49 indicators representing 4 categories of food security (Table 2.2)[30].

Table 2.2. Global Food Security Index categories and indicators

Category	Indicator	
Affordability	• Food consumption as a share of household expenditure • The proportion of the population under the global poverty line • Gross domestic product per capita (US$ PPP)	• Agricultural import tariffs • Presence of food safety net programmes • Access to financing for farmers
Availability	• Average food supply • Dependency on chronic food aid • Public expenditure on agricultural R&D • The existence of adequate crop storage facilities • Road infrastructure	• Port infrastructure • The volatility of agricultural production • Political stability risk • Corruption • Urban absorption capacity • Food loss
Quality & Safety	• Diet diversification • National dietary guidelines • National nutrition plan or strategy • Nutrition monitoring and surveillance • Dietary availability of vitamin A • Dietary availability of animal iron • Dietary availability of vegetal iron	• Protein quality • Agency to ensure the safety and health of food • Percentage of population with access to potable water • Presence of formal grocery sector
Natural Resources & Resilience	• Temperature rise • Drought • Flooding • Storm severity (AAL) • Sea level rise • Commitment to managing exposure • Agricultural water risk—quantity • Agricultural water risk—quality • Soil erosion/organic matter • Grassland • Forest change • Eutrophication and hypoxia	• Marine biodiversity • Marine protected areas • Food import dependency • Dependence on natural capital • Disaster risk management • Early warning measures/ climate smart agriculture • National agricultural risk management system • Population growth (2015-20) • Urbanisation (2015-20)

Source:
Taken from Global Food Security Index
Table by KRI

30 Global Food Security Index (n.d.), https://foodsecurityindex.eiu.com/

According to the 2017 GFSI report, Malaysia performed relatively well compared to other countries in SEA with an overall score of 66.2/100. Malaysia was ranked 6th within the Asia Pacific region (Table 2.3) and ranked 41st compared to 112 other countries worldwide (overall average countries score at 57.3/100). Both Thailand and Vietnam, which are rice exporting countries, were ranked below Malaysia in their overall food security score. Other neighbouring island countries, except Singapore, were also ranked below Malaysia, namely the Philippines and Indonesia.

Malaysia scored well in nutritional standards, food safety and the proportion of a population under poverty with 97.1, 98.5 and 100.0 relative to the countries average of 73.0, 80.5 and 79.1 respectively. On the contrary, Malaysia scored poorly on public expenditure on research and development in food (12.5/100 versus 15.0/100 on average).

Compared to other countries in the Asia Pacific, Malaysia performed relatively well in the GFSI index

Table 2.3. Global Food Security Index Country ranking for the Asia Pacific, 2017

Overall		Affordability		Availability		Quality & Safety		Natural Resources & Resilience	
Rank		Rank		Rank		Rank		Rank	
1	Singapore	1	Singapore	1	Australia	1	Australia	1	New Zealand
2	Australia	2	Australia	2	New Zealand	2	South Korea	2	Japan
3	New Zealand	3	New Zealand	3	Singapore	3	Japan	3	Myanmar
4	Japan	4	Japan	4	Japan	4	New Zealand	4	Laos
5	South Korea	5	South Korea	5	South Korea	5	Singapore	5	Kazakhstan
6	Malaysia	6	Malaysia	6	Malaysia	6	Malaysia	6	Thailand
7	China	7	Kazakhstan	7	China	7	China	7	Cambodia
8	Thailand	8	Thailand	8	Azerbaijan	8	Kazakhstan	8	Pakistan
9	Azerbaijan	9	China	9	India	9	Thailand	=9	Australia
10	Kazakhstan	10	Azerbaijan	10	Indonesia	10	Vietnam	=9	China
11	Vietnam	11	Vietnam	11	Thailand	11	Philippines	11	Azerbaijan
12	Sri Lanka	12	Sri Lanka	12	Sri Lanka	12	Myanmar	12	Nepal
13	Indonesia	13	Indonesia	13	Vietnam	13	Sri Lanka	13	Sri Lanka
14	India	14	Uzbekistan	14	Pakistan	14	India	14	Vietnam
15	Pakistan	15	Pakistan	15	Myanmar	15	Nepal	15	Bangladesh
16	Uzbekistan	16	Cambodia	16	Bangladesh	16	Pakistan	16	Uzbekistan
17	Philippines	17	Philippines	17	Uzbekistan	17	Uzbekistan	17	South Korea

Overall		Affordability		Availability		Quality & Safety		Natural Resources & Resilience	
18	Myanmar	18	India	18	Philippines	18	Indonesia	=18	India
19	Nepal	19	Nepal	19	Nepal	19	Azerbaijan	=18	Tajikistan
20	Cambodia	20	Myanmar	=20	Cambodia	20	Tajikistan	20	Malaysia
21	Bangladesh	21	Bangladesh	=20	Kazakhstan	21	Cambodia	21	Philippines
22	Tajikistan	22	Tajikistan	22	Tajikistan	22	Bangladesh	22	Singapore
23	Laos	23	Laos	23	Laos	23	Laos	23	Indonesia

Source:
Global Food Security Index
Table by KRI

The Rice Bowl Index (RBI)[31]

The RBI is governed by an advisory board comprising Professor Paul Teng (Nanyang Technology University), Bruce Blakeman (Cargill Incorporated) and Dr Ramon Clarete (University of the Philippines) among others. The programme is funded by Syngenta Asia Pacific and attempts to measure the robustness of 15 countries in their ability to address food security issues. The index can be divided into four rubrics (Farm-level Factors, Environmental Factors, Policy and Trade, and Demand and Price) and utilises 33 indicators[32].

According to the RBI, Malaysia performed relatively well compared to 14 other countries in overall food security, with a score of 62 compared to the countries average of 50 (Table 2.4 and Figure 2.4). Similar to the GFSI report, Malaysia performed better compared to its neighbouring countries such as Thailand, Vietnam, Indonesia and the Philippines.

Table 2.4. Overall RBI score for Malaysia and according to each rubric compared to the average threshold, 2016

RBI Scores	Overall	Policy & Trade	Farm-level	Environmental	Demand & Price
Malaysia's Score (/100)	62	69	43	80	54
Average Threshold (/100)	50	60	40	60	55

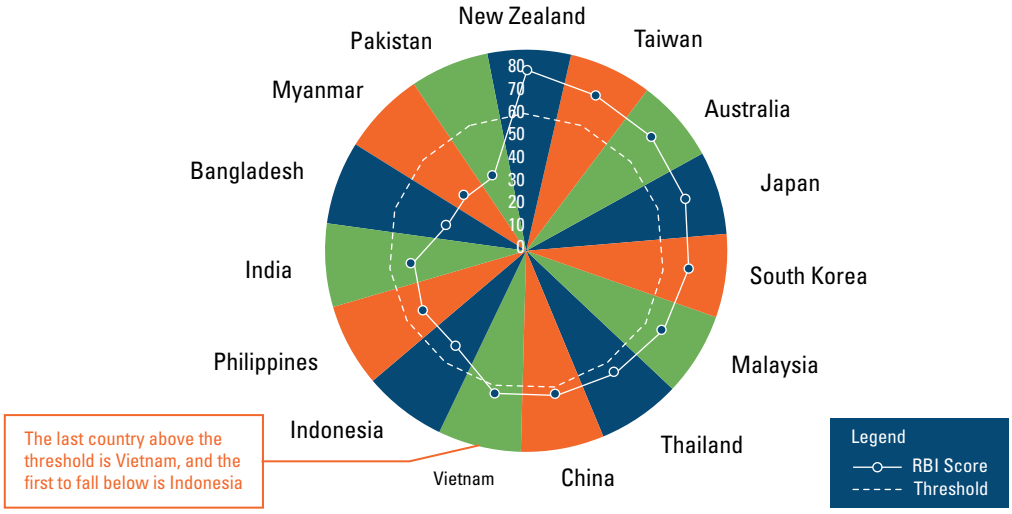
Source:
The Rice Bowl Index (2016)
Table by KRI

31 The Rice Bowl Index is no longer running. The last report publication was in 2016, which could be downloaded from Grow Asia's website: http://exchange.growasia.org/rice-bowl-index-2016-collective-responsibility

32 The Rice Bowl Index (2016)

Malaysia scored well compared to other countries in Southeast Asia including rice exporting countries such as Thailand and Vietnam

Figure 2.4. The RBI Composite Index for fourteen countries, 2016



Source:
Figure from The Rice Bowl Index (2016), pg. 28

In both the GFSI and RBI scores, Malaysia performed better compared to its neighbouring countries. Thailand and Vietnam, which are food exporting countries, were ranked below Malaysia in their overall food security scores. This suggests that the ability to produce food alone does not equate to being food secure. As such, using only food SSL as an indicator of food security may not be appropriate.

"Thailand and Vietnam, which are food exporting countries, were ranked below Malaysia in their overall food security scores"

On another scale of self-sufficiency, Singapore is an opposite example. Despite not producing rice or any other food crops, the country ranked high in terms of food security. However, this does not mean that Malaysia should fully emulate Singapore and discard its food production programmes as the income capabilities and food requirements of both countries are different. For instance, in the event of an emergency, Singapore only needs to purchase a smaller amount of food to feed its population of 5.6 million compared to 31.6 million in Malaysia[33].

33 Population figures from World Development Indicators, World Bank (n.d.)

Despite this, it does not mean that GFSI and RBI should be the only golden methods of gauging a country's food security as each method has its shortcomings. For example, these indices use national indicators that could either be limited or of poor quality, which is common in developing countries. Alternative methods include conducting household food security surveys such as the FAO's Food Insecurity Experience Scale (FIES) or the United States Agency for International Development (USAID)'s Household Food Insecurity Access model. It is worth noting, however, that such surveys will likely incur a significant amount of cost and labour.

Policy Recommendations

Future agricultural policies related to food should no longer be driven solely by production targets. Other important dimensions of food security should also be given equal consideration in a balanced manner. Malaysia may be in a better position to target moderate SSLs for key food items to reduce the budgetary burden while maintaining a certain level of domestic production. By doing so, public expenditure can be moved to other areas such as research and development (R&D), extension programmes, farm certifications and health and safety measures which address the other pillars of food security.

In policy implementation, the government may consider including other indicators when measuring the performance of the agriculture sector, the ministry, departments, agencies, farmers and even the private sector. Examples include:

1) Giving as much recognition to farmers and farm-related agencies for the adoption of Good Agricultural Practices (MyGAP), effective water usage and soil management, as given for the increase in paddy production; and
2) At the midstream segment, giving recognition to stakeholders who manage to minimise post-harvest loss, adhere to Good Manufacturing Practices, perform Hazard Analysis Critical Point (HACCP) and implement manufacturing and marketing transparency (example: the adoption of Blockchain technology).

By diversifying these indicators, there will be more incentives for the stakeholders to produce and manufacture products responsibly and to follow the health and safety guidelines of chemical use along the supply chain.

Recognising the complexity of food security and its importance to the nation, a research team in KRI led by Professor Jomo Kwame Sundaram is currently researching on food security. The researchers hope to explore the availability, affordability and accessibility of food in Malaysia and its changes through time, as well as its crucial role in affecting the nutritional status in the country.

Market Interventions

In a bid to increase rice production, improve farmers' income and protect consumers from rice price volatility, market interventions across the supply chain have been introduced. In fact, Malaysia's domestic rice industry is highly regulated relative to most countries[34]. These measures can be found in almost every part of the supply chain and the few measures not applied in Malaysia include those related to insurance. The high level of regulation within the Malaysia's rice industry is not a new matter as reflected in more than five decades of national economic plans and agricultural policies.

Paddy and Rice Policy Measures

Various intervention programmes have been introduced in the paddy and rice industry of which some have been implemented pre-independence and persist until today (Figure 2.6).

34 Abdullah (2007)

Table 2.5. Policy measures in the paddy and rice industry

Category of Policy	Intervention Programmes	Period	Details
Input Subsidy	*Skim Baja Padi Kerajaan Persekutuan* (SBPKP)	1979 to present	• Subsidised compound and urea fertilisers are distributed to farmers with maximum paddy area of 10 Ha • The amount and types of fertilisers are based on recommendations made by *Jawatankuasa Dasar Bantuan Kerajaan Kepada Industri Padi dan Beras*

	Skim Insentif Pengeluaran Padi (SIPP)	2007 to present	• The government introduced SIPP to alleviate the burden of paddy farmers due to the increases in diesel price and ploughing cost
			• Types of incentives include:
			  • Ploughing allowance
			  • Organic fertiliser
			  • Additional NS fertiliser
			  • Growth enhancer
			  • Foliar
			  • Pesticide (herbicide)

	Insentif Peningkatan Pengeluaran Beras Negara (IPPB)	2008 to 2015	• IPPB was introduced in 2008 in response to the food crisis as well as the hike in petroleum price that caused input price to increase tremendously
			• Types of incentives include:
			  • Liming
			  • Additional NPK fertiliser
			  • Pesticide

	Insentif Benih Padi Sah (IBPS)	2007 to present	• The objective of the incentive is to encourage paddy farmers to use high-quality seeds • Certified paddy seeds are purchased at a ceiling price of RM1.40/kg

	Skim Baja dan Racun Padi Bukit/ Huma	2015 to present	• Incentives for hill/upland paddy production, which includes:
			  • Compound fertiliser
			  • Urea fertiliser
			  • Pesticide

Output Subsidy	*Skim Subsidi Harga Padi* (SSHP)	1980 to present	• Farmers earn a pre-determined amount for each tonne of paddy harvested as an incentive to cultivate more paddy • In the 2016 budget announcement, the government increased the incentive to RM300/MT
Market & Trade	Guaranteed Minimum Price (GMP)	1949 to present	• Paddy prices are controlled through the GMP scheme • This is the minimum price millers must pay to farmers when purchasing the harvested paddy
	Stockpiling	1949 to present	• First introduced in 1949 by the British government, buffer stocks are used in Malaysia to stabilise domestic price fluctuations and as an emergency reserve • BERNAS manages the national stockpile; at any given moment, it must stock enough rice to feed the nation for 45 days
	Single rice importer	1974 to present	• *Lembaga Padi dan Beras Negara* (LPN) became the single rice importer in 1974 in response to the world rice crisis in 1973 – 1974 • After the corporatisation of LPN, BERNAS became the single importer of rice based on the corporatisation agreement

Category of Policy	Intervention Programmes	Period	Details
Others	Granary areas as permanent paddy areas	2010 to present	• In 2010, through *Rancangan Fizikal Negara ke-2*, the government made eight granary areas permanent paddy cultivating areas • In these areas, urbanisation and the planting of other crops will be limited and closely monitored

Source:
Zulkifli Jamil (n.d.), Abdullah (2007), Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia (2010), Vengedasalam (2013), Parlimen Malaysia (2014), & MOA (2016b)
Table by KRI

National Budgetary Burden

To safeguard the income of the farmers and to ensure that production continues to grow, subsidies and incentives were used as short-term[35] solutions to reduce input costs to farmers. These measures were introduced as early as 1949 (introduction of the GMP). Over the years, production has indeed increased. However, instead of phasing out these subsidies and incentives, Figure 2.5 shows that over the years, the expenditures on rice subsidies and incentives have had an increasing trend, with a gradual decline only in the last few years.

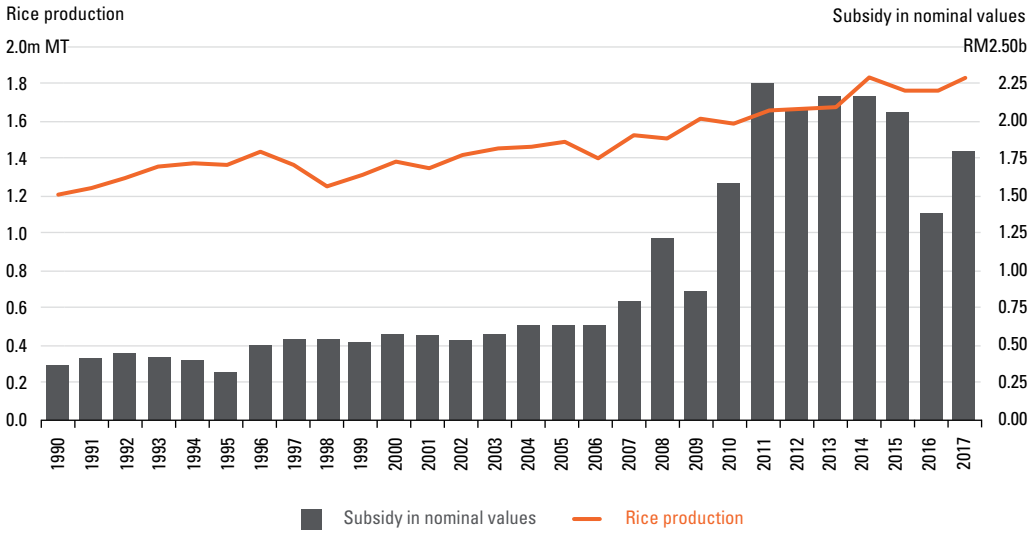
Between 2011 to 2015, more than RM2.0b was spent on paddy subsidies and incentives, which comprised between 40 – 50% of the total MOA's expenditure (Figure 2.5). This amount dropped in 2016 to RM1.4b (41% of the total MOA's expenditure) and increased in 2017 to RM1.8b (48% of the total MOA's expenditure). In 2018 and 2019, budget allocated for paddy subsidies and incentives were reduced to RM1.7b (33% of the budget to MOA) and RM1.1b (25% of the budget to MOA), respectively[36]. Albeit the declining trend, the paddy and rice industry still receive more budgetary assistance than any other crops.

35 According to Brooks and OECD Secretariat (2010) and Timmer (2010), rice policies can be loosely categorised into short-term and long-term policies. Short-term policies (1 – 2 years) include strategies and measures used to respond to price fluctuations and reduce poverty, while long-term policies (more than 5 years) involve strategies to increase yield and promote economic development.

36 Ministry of Finance (2018), ibid.

The amount spent on subsidies has been increasing over the years

Figure 2.5. Total public expenditure on paddy and rice subsidies (RM b) and domestic rice production (m MT), 1990 – 2017



Source:
Production data from OECD-FAO Agricultural Outlook 2018-2027 and public expenditure data from Accountant General of Malaysia (1990 – 2017)
Chart by KRI

According to Zorya and Santos (2015), higher agricultural spending per se does not guarantee higher productivity as it is the quality of expenditure that is more important[37]. A study showed that in ten Latin American and Caribbean countries, the reallocation of 10% of public agricultural expenditures from input subsidies to public goods led to a 2.3% increase in per capita agricultural income[38]. A similar result was observed in Indonesia when public expenditure was reallocated[39]. However, caution is needed when moving away from subsidies and incentives, as the removal of these short-term measures without careful transitional strategies could lead to a decline in production. Two modelling studies showed that the removal of the fertiliser subsidy for rice farming in Malaysia would lead to a sudden drop in rice productivity[40].

37 Zorya and Santos (2015)
38 López and Galinato (2007)
39 World Bank (2010)
40 Ramli et al. (2012) & Bala et al. (2014)

In summary, decades of input subsidies aimed at improving the income of farmers have become a significant budgetary burden to the country. However, the sudden removal of the subsidies and incentives would significantly affect the national rice productivity and SSL. It is thus imperative to re-evaluate current policies and develop strategies for the efficient re-allocation of financial resources to other areas for long-term growth without significantly affecting the short-term rice productivity.

As an interim measure towards the long-term growth of the industry without incurring a significant amount of government expenditure, this report suggests the strengthening of the paddy and rice supply chain through, but not limited to:

1) **Paddy and rice related policies** – Do away with a production-centric or SSL-centric policy targets. Incorporate other food security factors in the production of domestic rice (Chapter 2)
2) **Paddy and rice data** – Improve transparency and accessibility through digitalisation of data and information across the supply chain through the adoption of Blockchain technology (Chapter 2)
3) **New paddy varieties** – Facilitate the growth of the private sector breeders for the development of new paddy varieties (Chapter 3)
4) **Farmers and midstream players** – Develop a shared-risk approach through contract farming (Chapter 4 and Chapter 5)
5) **Consumption** – Improve the capture of consumption data among migrant workers

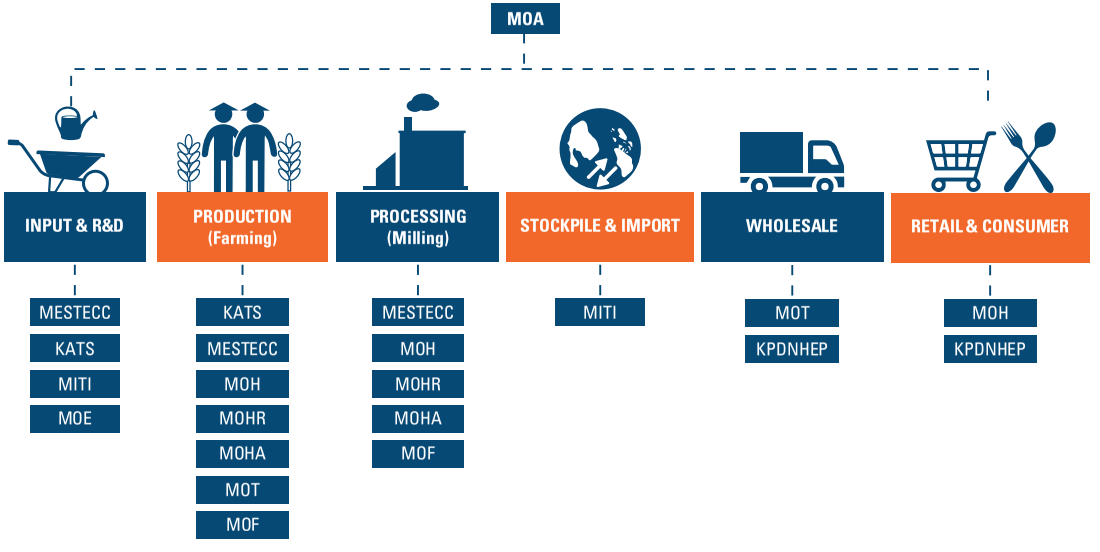
Governance & Data Reporting

Regulators and Regulations

The development of the paddy and rice industry primarily falls under the responsibility of the MOA. Having said this, the paddy and rice supply chain is dynamic, and upon closer inspection, the entire supply chain involves a complex interplay of various ministries and agencies (Figure 2.6).

These regulators oversee the implementation of various legislation and policies related to the industry (Figure 2.7). Most legislation and policies have a direct role and focus on the production, midstream and retail segments of the supply chain. The key policy is the National Agro-Food Policy 2011-2020, which charts the strategies of the growth of the paddy and rice industry by strengthening the supply chain. An example of a directly relevant Act is the Control of Padi and Rice Act 1994 (Act 522) which regulates the paddy and rice industry across the supply chain on matters related to pricing, licencing, processing and the grading of domestic rice.

Figure 2.6. Various ministries involved directly/indirectly across the paddy and rice supply chain

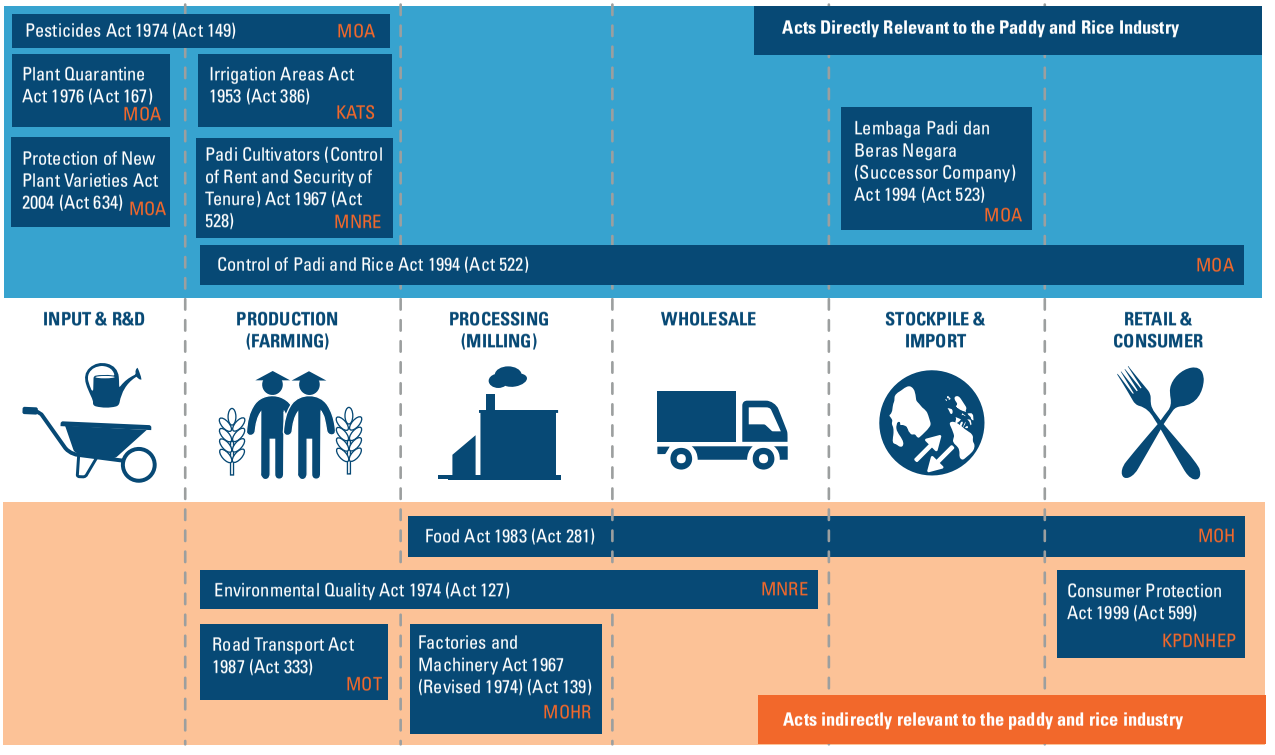


Key:

MITI	Ministry of International Trade and Industry	MOA	Ministry of Agriculture and Agro-Based Industry
KATS	Ministry of Water, Land and Natural Resources	MOF	Ministry of Finance
MESTECC	Ministry of Energy, Science, Technology, Environment and Climate Change	MOHA	Ministry of Home Affairs
		MOE	Ministry of Education
MOHR	Ministry of Human Resource	MOT	Ministry of Transport
MOH	Ministry of Health	KPDNHEP	Ministry of Domestic Trade and Consumer Affairs

Note:
Refer to Appendix for a full list of the ministries and agencies involved. This mapping exercise is non-exhaustive and may have excluded other ministries indirectly involved in the paddy and rice industry
Figure by KRI

Figure 2.7. Legislations at various stages of the paddy and rice supply chain



Note:
Acts may overlap with other segments of the supply chain and are non-exhaustive
Figure by KRI

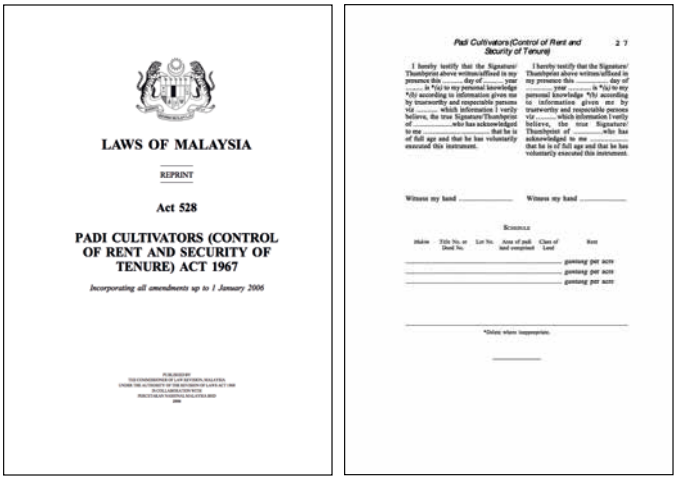
"... legislations ... may benefit from periodic reviews to ensure that it stays relevant"

Another piece of legislation designated to the industry is the Padi Cultivators (Control of Rent and Security of Tenure) Act 1967 (Act 528). It regulates the contract between the landowner and the tenant wanting to cultivate paddy. Unfortunately, KRI's stakeholder engagements revealed that most rental agreements are verbal, making this legislation almost irrelevant despite its lengthy description of protecting the interests of farmers. Also, the legislation is outdated in some areas, for example citing old measurement systems and imposing low penalties which may have been significant in the 1960s, but not today (Figure 2.8). An example is the use of "*gantang*" to measure paddy instead of in MT (Schedule 2, Section 11) and penalties of no more than RM2,000 or an equivalent of no more than 1-year jail term (Sections 34, 25 and 37)[41].

In addition, the rapid progress in technology, farm mechanisation, biotechnology and aerial monitoring means that legislations such as the Road Transport Act 1987 (Act 333), Factories and Machinery Act 1967 (Act 139), Civil Aviation Regulations 2016 and Biosafety Act 2007 (Act 678), may benefit from periodic reviews to ensure that it stays relevant. This is important given the recent emergence in precision paddy farming using aerial monitoring (drones and satellite), ground data sensors and the use of big data, which will involve legislation related to aviation and data protection.

41 Zahira Ishan (2016)

Figure 2.8. *Gantang* in Act 528, an old measurement system which is no longer used



LAWS OF MALAYSIA

REPRINT

Act 528

PADI CULTIVATORS (CONTROL OF RENT AND SECURITY OF TENURE) ACT 1967

Incorporating all amendments up to 1 January 2006

Padi Cultivators (Control of Rent and Security of Tenure) 2 7

I hereby testify that the Signature/ Thumbprint above written/affixed in my presence this ..... day of ..... year ..... is *(a) to my personal knowledge *(b) according to information given me by trustworthy and respectable persons viz ..... which information I verily believe, the true Signature/Thumbprint of ..... who has acknowledged to me ..... that he is of full age and that he has voluntarily executed this instrument.

I hereby testify that the Signature/ Thumbprint above written/affixed in my presence this ..... day of ..... year ..... is *(a) to my personal knowledge *(b) according to information given me by trustworthy and respectable persons viz ..... which information I verily believe, the true Signature/ Thumbprint of ..... who has acknowledged to me ..... that he is of full age and that he has voluntarily executed this instrument.

Witness my hand .....

Witness my hand .....

SCHEDULE

Mukim	Title No. or Deed No.	Lot No.	Area of padi land comprised	Class of Land	Rent
					..... gantang per acre
					..... gantang per acre
					..... gantang per acre

*Delete where inappropriate.

There is also a need to study the impact of shrinking agricultural land-size ownership due to Malaysia's *faraid* inheritance system under the *Shariah* Law for Muslims. A second or third generation farmer in Malaysia would own a very small piece of land, and for the farmer to continue farming, he would need to rent from other landowners. Often, a paddy plot is owned by multiple individuals who inherited land from a deceased farmer. These individuals usually have little farming interests and would rent the paddy plot to a farmer and share the rental profits. On the contrary, farmers in developed nations would traditionally inherit farmland through primogeniture[42] or written wills without many land subdivisions. For example, in Norway, *Åsetesrett* is an ancient Norwegian property law whereby the eldest child has inheritance rights to the whole agricultural property without the need for subdivisions[43]. Currently, there is an absence of detailed studies on changes in the pattern of land ownership and farm-size among Malaysian farmers and its impact, if any, towards the paddy and rice industry.

"There is also a need to study the impact of shrinking agricultural land size ownership ..."

42 Primogeniture – "The right of succession belonging to the firstborn child, especially the feudal rule by which the whole real estate of an intestate passed to the eldest son", Oxford Dictionaries (2016).

43 Modalsli (2017)

In addition to legislation with a direct role in the paddy and rice industry, there are indirect but equally important regulations. An example is the Food Act 1983 (Act 281) which is related to food safety, packaging and labelling of rice-based products. Another example is the Environmental Quality Act 1974 (Act 127), which is related to responsible land use and intended to prevent environmental pollution. There are also specific legislations involving the use of heavy machinery and automation such as the Road Transport Act 1987 (Act 333) and Factories and Machinery Act 1967 (Revised 1974) (Act 139).

Reporting and Transparency of Industrial Data

Given the public interest on matters related to the nation's staple food, data related to the domestic rice production and consumption are perhaps the most diligently collected information compared to other crops. According to the stakeholders engaged by KRI, data collection spans the whole rice supply chain from input to retail prices. These paddy and rice data are processed and made partially available to the public through different reports (Figure 2.9) and databases available for download, from various sources, either domestically such as via estatistik (DOS), data.gov.my and MAMPU or internationally through FAOSTAT and stats.oecd. The reports vary in the reporting frequency and in the calculation of key indicators such as SSL and rice consumption per capita (Table 2.6 and Figure 2.10). Remaining data unavailable to the public can only be acquired by submitting a formal request to the relevant departments.

Transparency is defined as "Easy to perceive or detect"[44]

44 Oxford Dictionaries (2016)

Due to the complexity in the acquisition of industrial data, the sector's response to the market, research findings and subsequent data-driven policy recommendations are often based on delayed data. This is a shortfall given the amount of time, labour and financial costs invested by the relevant authorities to collect such data.

It is recommended that the paddy and rice industry adopts data liberalisation and transparency. Live updates during the growing season and at each point in the supply chain can be made available to the public and managed by an independent entity.

Blockchain is a possible solution with regard to achieving transparency, traceability and in building trust between stakeholders across the paddy and rice supply chain. This is elaborated further in the next section and in Box Article 3.

Various types of reports related to the paddy and rice industry

Figure 2.9. List of published reports related to the paddy and rice industry 2012 – 2017

Paddy Statistics of Malaysia
Periodicity: Annual
Publisher: DOA

Publications Available					
2012	2013	2014	2015	2016	2017
29th	30th	31st	32nd	*	*

Paddy Production Survey Report Malaysia
Periodicity: By the planting season
Publisher: DOA

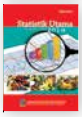
Publications Available					
2012	2013	2014	2015	2016	2017
*	*	68th & 69th	70th & 71st	*	*

Booklet Statistik Tanaman
Periodicity: Uncertain
Publisher: DOA

Publications Available					
2012	2013	2014	2015	2016	2017
*	*	*	1st	*	2nd

Agrofood Statistics
Periodicity: Annual
Publisher: MOA

Publications Available					
2012	2013	2014	2015	2016	2017
15th	16th	17th	18th	19th	*



Statistik Utama Pamasaran FAMA
Periodicity: Uncertain
Publisher: Federal Agricultural Marketing Authority (FAMA)

Publications Available					
2012	2013	2014	2015	2016	2017
*	*	1st	*	*	*

Note:
**Report not publicly available for online download or not yet published. This does not include hardcopies available at the respective Department or Ministry*
Table by KRI

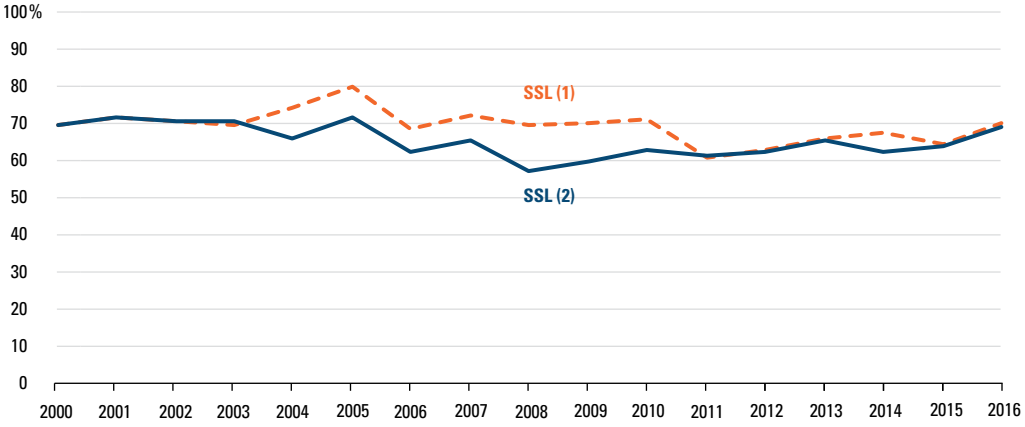
Inconsistencies in the calculation of rice consumption and SSL

Table 2.6. Malaysia's consumption per capita and self-sufficiency level based on various reports, 2012 – 2015

Source	Rice consumption (kg/person)			
	2012	2013	2014	2015
Supply and Utilization Accounts (SUA) 2016, DOS	90.8	84.9	90.1	93.2*
Paddy Statistics of Malaysia 2015, DOA	90.8	84.8	88.9	88.0
Agrofood Statistics 2016, MOA	90.1	83.8	87.9	87.5
OECD-FAO Agricultural Outlook 2018-2027	83.5*	82.3*	82.7*	82.5*
Source	**SSL (%)**			
	2012	**2013**	**2014**	**2015**
Agrofood Statistics 2016, MOA	63.0	66.3	68.0	64.8
OECD-FAO Agricultural Outlook data calculated using FAO formula	62.5	65.6	62.9*	64.3
Production and import data from MOA and export data from UN Comtrade calculated using FAO formula‡	63.0	66.6	68.9	66.5*

Notes:
** Denotes large data differences*
‡ Rice export data is not available in Agrofood Statistics, MOA
Table and calculations by KRI

Figure 2.10. Rice self-sufficiency level (SSL) for Malaysia, 2000 – 2016 (percentage)



Notes:
The calculation of SSL differs between MOA and FAO (Refer Box Article 2). SSL (1): Agrofood Statistics, MOA. SSL (2): Calculation based on OECD-FAO Agricultural Outlook 2018-2027 using FAO's formula
Sources:
1. *SSL (1) is from Agrofood Statistics, MOA*
2. *SSL (2) by KRI based on production, import, and export data from OECD-FAO Agricultural Outlook 2018-2027 (Accessed 17 Aug 2018) and FAO's SSL formula*

Chart by KRI

BOX ARTICLE 3: Digitalisation of the Supply Chain

What is Blockchain?

Blockchain has become a buzzword in recent years, commonly associated with cryptocurrency[45] such as Bitcoin, through which the technology made its public debut in 2008. Nevertheless, the concept of Blockchain and subsequently its application is not limited to cryptocurrency or the financial sector for that matter. Technically, all sectors can benefit from the Blockchain technology given the right platform, capital and motivation.

Don & Alex Tapscott, authors of Blockchain Revolution (2016) define Blockchain as a secure "digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value"[46]. In layman's term, Blockchain is a digital database that exists on multiple computers at the same time and it is deemed to be transparent and secure.

Conceptually, Blockchain is not a single technology, rather, it is a combination of advances in computer science including cryptographic technologies[47], database technologies, consensus algorithms[48] and decentralised processing[49]. Blockchain is seen as a powerful tool in the efficient management of transparent and trusted data due to three salient features[50]:

1) It is distributed – Blockchain works as a shared digital ledger among participants on a network, eliminating the need to reconcile disparate ledgers;
2) It is permissioned – Each member of the network has access rights and the information is shared on a need-to-know basis; and
3) It is secure – Consensus is required from all network members to conduct a transaction and all transactions are permanently recorded.

45 "A digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank." Definition by Oxford Dictionaries (2016)
46 Tapscott and Tapscott (2016)
47 Cryptographic technology refers to an information security technology that prevents third parties from accessing private information
48 Consensus algorithm refers to a process in computer science used to achieve agreement on a single data/ transaction among participants in the system
49 Decentralised processing refers to a technology that involves stand-alone data processing units in multiple locations
50 IBM (n.d.)

Figure 2.11. Blockchain: the combination of advances in computer science

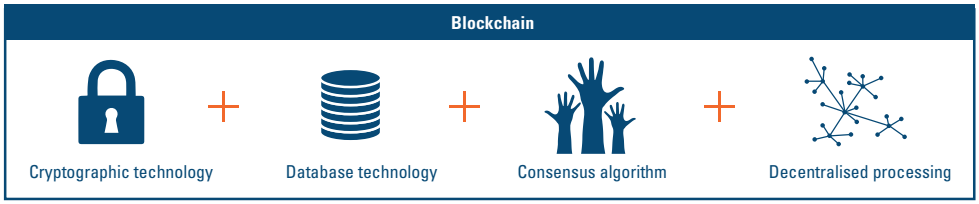


Illustration by KRI

Blockchain is a chain of blocks ordered in a network consisting of multiple non-trusting parties. A block is created when a transaction is initiated between parties (Figure 2.12). Each block contains data, its own hash[51] and the hash of the previous block. Changing something inside the block causes the hash to change.

Figure 2.12. A block is created when a transaction occurs

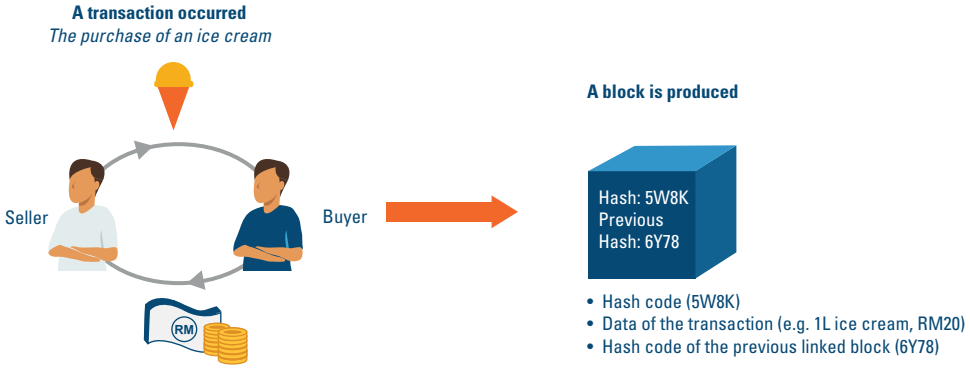


Illustration by KRI

51 Hash (or hash value) is a digital signature that represents large amounts of data as a much smaller numeric value. Think of hash as the barcode on your shopping item at the supermarket.

Figure 2.13. A Blockchain

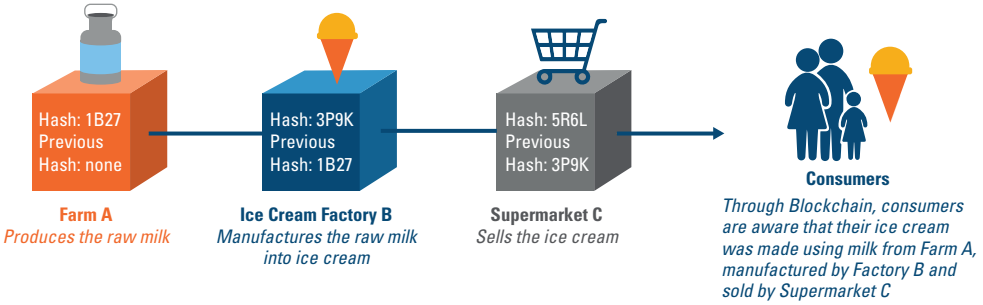


Illustration by KRI

Blockchain adheres to a rule that does not allow data to be altered without the consensus of all network members. Since every block contains the hash of the previous block, any tampering of the data would make the whole chain invalid.

Figure 2.14. A Blockchain is rendered invalid when tampering occurs

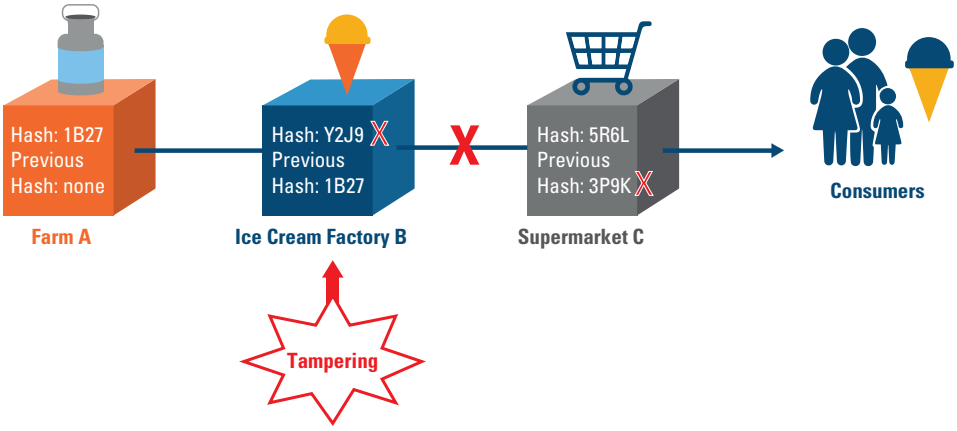


Illustration by KRI

Any node[52] in the network owns a full copy of the Blockchain that is automatically reconciled every time a transaction is conducted. Therefore, the Blockchain database is not stored in any single location. This decentralisation means that the data are transparent and less vulnerable to the risks linked to a centralised database such as a hacking attack. Cryptographic technologies in Blockchain based on the so-called "public" key and "private" key allow granting of access rights to information based on a need-to-know basis. Since no intermediary is involved in these transactions, transactional cost and time are greatly reduced.

Why is data important in the agri-food industry?

The agri-food supply chain especially in developing economies such as Malaysia can be characterised as the interaction of black boxes where each segment of the supply chain has limited information and control over the previous and/or subsequent segment. Globalisation brings about an additional set of challenges as the supply chain transcends national boundaries and jurisdictions.

Food fraud and mislabelling cause loss not only to consumers but also to the exporting industry as a whole. For example, in 2016, the United States (US) Food and Drug Administration (FDA) placed shrimps and prawns from Peninsular Malaysia on "import alert" over the alleged presence of nitrofurans and/or chloramphenicol residues in the seafood. The move implies that the FDA has the right to detain imports of shrimps and prawns from Peninsular Malaysia without inspection[53]. This is despite Malaysia banning the use of these drugs in aquaculture farming. Being one of the top ten exporters of prawns and shrimps to the US, the import alert caused anxiety among Malaysia's shrimp producers. From a different side of the story, according to Larry Olmsted, the author of "Real Food, Fake Food", because of the US ban on Chinese-farmed shrimps due to the presence of unapproved drugs, some suppliers have been shipping their drug-stained shrimps to Malaysia. These shrimps are then relabelled as Malaysian products for the US

52 A node is a participant's computer connected to the Blockchain.
53 Akil Yunus (2016)

market[54]. This claim is, however, difficult to substantiate without complete and transparent data of the shrimp supply chain right from the producer to the consumer.

A transparent supply chain data in Malaysia may also benefit the premium food sub-sector. In 2011, China's authorities blamed imports from Malaysia regarding the discovery of high nitrite levels found on red bird's nest. This allegation, however, baffled Malaysia's bird nest exporters since Malaysia had never been known to be a producer of red bird's nest[55]. According to How Ban (2011), what could have happened was that some players in the industry might have sold fake bird's nest claimed to be from Malaysia for a quick profit. Beside bird's nest, fake Musang King durians also captured the attention of the Ministry of Trade, Co-operatives and Consumerism (now the Ministry of Domestic Trade and Consumer Affairs). A few traders in the country have been found selling durians of a different variety from Musang King durians to foreign tourists as they are an easy target[56]. The availability of a complete and transparent food supply chain data updated in real-time could help prevent false labelling.

Aside from preventing fraud and the mislabelling of food, complete agri-food data are also necessary for effective policymaking and monitoring especially for regulated food such as rice. In the US, most grains and oilseeds produced are traceable from farm production to consumption[57]. This sort of data, however, is unavailable for Malaysia's rice industry, and other food industries for that matter. Thus, it is difficult to know, for instance, the productivity and profitability of a particular farm, profit margin across the supply chain, and the appropriate farmgate and consumer price level, let alone to determine the compliance with MyGAP, HACCP and Good Manufacturing Practice.

54 Olmsted (2014)
55 How Ban (2011)
56 The Star (2017)
57 Golan et al. (2004)

How can Blockchain solve issues in the agri-food sector?

Supply chain management involves not only the transfer of products from producers to consumers but also[58]:

- Payments, credit and working capital;
- Technology and advanced techniques;
- Ownership rights; and
- Information on consumer demand.

Blockchain technology has the potential to increase the efficiency of transactions of all the items above. The application of Blockchain technology offers complete, transparent, reliable and timely data that would elevate consumers' trust towards food products and allow data acquisition by the public and private sector without delay. The latter may help food industry players to effectively respond to market demand and the government to better formulate agricultural policy. Detailed examples of how Blockchain technology may improve the food supply chain are discussed below.

A. Food safety and traceability

Food safety and traceability is a major concern for consumers. The greater transparency that Blockchain provides facilitates prompt identification of contamination sources, thereby saving time, money and possibly lives, in the event of a foodborne disease outbreak. Besides, consumers would have greater knowledge of the sources of their food, the farmers and the processors. This could prevent issues related to false labelling and fraud. San Francisco-based Ripe.io is an example of a company that offers Blockchain-based solutions to map the food journey along the supply chain from farmers to distributors and consumers. London-based Provenance also offers similar solutions.

In Malaysia's paddy and rice industry, Blockchain technology could be applied to trace the authenticity of organic rice and artisanal rice such as the Bario rice. Even though geographical indication (GI)[59] is registered for Bario rice, consumers are not fully protected from false labelling. In the case

58 Cooper et al. (1997) as cited in Van Roekel et al. (2002)

59 Geographical indication (GI) is "a sign used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin". Definition by World Intellectual Property Organization (WIPO) (n.d.).

where GI has been falsely used to deceive the public, any aggrieved party would need to file an action at the High Court (Intellectual Property), which is costly. Besides, this traceability solution is also useful in ensuring the HACCP and Good Manufacturing Practice adherence in milling and product manufacturing.

B. Improving the transparency of payment transactions

For small farmers, securing fair prices as well as being paid on time are issues they face since they depend on intermediaries to market their products. Companies such as AgriLedger aim to help farmers retain a bigger share of their crop value by leveraging on Blockchain technology. The four key issues targeted by AgriLedger are: trust deficit among players in the agri-food market; lack of audit trail on transactions; paper-based systems that are error-prone; and lack of transparency regarding the market and price information. Australia-based Blockgrain runs on the same premise of increasing supply chain efficiency although their focus is not limited to small farmers.

As of late, growing dissatisfaction among paddy farmers and millers was reported in the media[60]. One of the grievances noted was the alleged unfair increase of deduction rates[61] that entails reduced compensation to farmers for their harvest, which is denied by buyers. Blockchain technology, in conjunction with other technologies such as the Internet of Things (IoT)[62], has the potential to bridge the gap in trust between farmers and millers such as in the case mentioned. This may ensure transparency on the deduction rate and other relevant information and ultimately ensure fair payment to everyone along the supply chain.

C. Encourage the adoption of good agricultural practices

Limited capital and incentives are some of the factors that inhibit the adoption of good agricultural practice among farmers. Indigo carries out an initiative to pay farmers a premium for an end-to-end production contract that is based on using certain products, following specific agricultural

60 The Edge (2017)

61 Deduction rate is the percentage of the product that is rejected due to impurities.

62 Internet of Things (IoT) is a system of interconnection of electronic devices via the Internet

practices, and providing traceability data on the production and movement of the grain. This initiative is built upon three objectives that are to increase farm profitability, to provide access to healthy food and the right information for consumers, and to preserve the environment. Demeter.life conducts a similar initiative through micro investment for farmland in which a community of investors defines the rules of production, hence ensuring quality farming.

In 2016, only 2.3% of the total number of farms in Malaysia were registered under MyGAP[63]. This low take-up rate may be explained by the limited incentives and awareness among the farmers to commit to MyGAP certification requirements and lack of consumer awareness regarding farm-level certifications. Having Blockchain to show that a food product uses raw material derived from responsible farming, can provide confidence to the consumers about the purchased product, as well as improve food safety and environmental responsibility.

D. Better market information

Farmers may benefit from greater market access. Companies such as AgriDigital offer seamless communication and connection with all players in the industry, which means farmers can directly connect with consumers to better understand their preferences. Another company, AgriLedger, aims to build the world's largest network of small farmers and cooperatives based on Blockchain's features that allow strangers across boundaries to establish trust and accountability without the need for intermediaries.

As an example to show that farmers are reactive to market information, a study investigated farmers' shift from white rice farming towards fragrant rice farming (of the MRQ74 variety). One of the factors motivating farmers to cultivate the new variety is the expected rise in demand for fragrant rice consumption as well as the high price of fragrant rice in the market[64]. With the application of Blockchain technology that provides faster and more accurate transmission of market information, farmers may likely respond more effectively. In this respect, Blockchain technology can be applied, for instance, to creating a system that provides information to industry players on the retail prices of different types of rice (including demand for organic rice). This would help farmers make better market decisions and give them greater access to the global market.

63 EU Directorate-General for Health and Food Safety (2016)
64 Jamal et al. (2013)

Adoption of Blockchain Technology in the Paddy Industry

Blockchain technology offers the potential to increase the efficiency of the agri-food supply chain. In developed economies such as the US and Australia, Blockchain technology has been gaining traction with industry players. Malaysia may want to capitalise on the advantages of the Blockchain technology to generate reliable and transparent data of the food supply chain, especially for the country's staple food, rice.

Figure 2.15 is a suggested illustration of how Blockchain technology can be used in the paddy and rice industry to help address matters related to data transparency, access and frequency.

Figure 2.15. Example of Blockchain application in paddy and rice industry

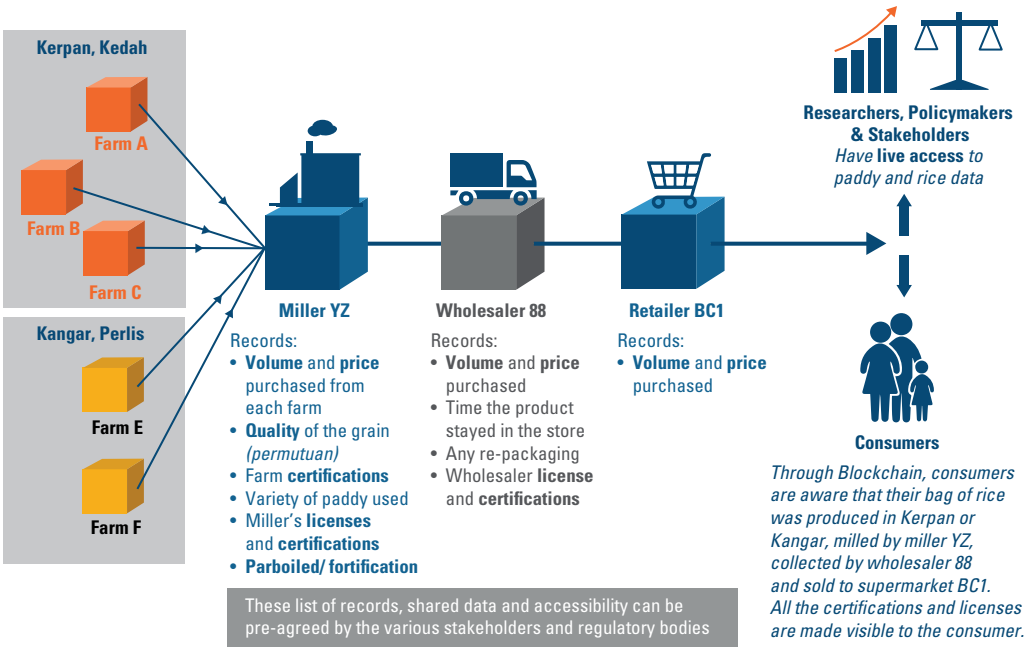


Illustration by KRI

Despite its strengths, there are, however, constraints that need to be considered in the adoption of Blockchain technology in Malaysia's agri-food industry. These include managing various stakeholders' interests to allow a fair balance between data privacy and public access to information. Besides, capital is also required for the entire supply chain's adoption of Blockchain technology. There may be disagreements on who should fund this initiative if it is meant to be a decentralised system. In addition, the adoption of Blockchain technology may result in high electricity consumption which may involve matters related to climate change and environmental sustainability. Having said all this, Blockchain technology still deserves some consideration.

CHAPTER KEY TAKEAWAYS

Policy Objectives – Rice Self-Sufficiency and Food Security

- The objectives of the National Agro-Food Policy 2011-2020 and previous agricultural policies have always been driven by the goal of increasing production measured in MT.
- Data indicated that over the years, Malaysia indeed experienced an increase in production. Due to the concurrent increase in national consumption, this resulted in a relatively stable SSL between 60 – 80% since 2000.
- **Recommendation:** Future agricultural policies should no longer be driven only by production targets.
- Now that we have established a certain level of production capacity for rice, it is timely to consider incorporating other food security factors such as **food safety, nutrition, traceability and environmental sustainability** in the policy targets.
- Food security is multidimensional but **rice SSL only captures the availability dimension**.
- **Recommendation:** To include the other dimensions, Malaysia may want to consider additional ways of measuring its robustness in food security such as the **Global Food Security Index (GFSI), the Rice Bowl Index (RBI), the Food Insecurity Experience Scale (FIES) or the US Agency for International Development Household Food Insecurity Access model**.
- **Recommendation:** The government may also consider incorporating other indicators when measuring the performance of the agriculture sector, ministry, departments, agencies, farmers and even the private sector.
- This can include giving recognition for the adoption of **Good Agricultural Practices (MyGAP)**, adherence to **Good Manufacturing Practices** and giving credit for the adoption of manufacturing and marketing transparency measures (e.g. Blockchain technology) by stakeholders.

National Budgetary Burden

- To safeguard the income of the farmers and ensure continued supply in domestic rice production, subsidies and incentives have been used as short-term solutions since the 1970s.
- While production has increased over the years, these subsidies and incentives continue to persist and increase.
- In **2016, RM1.4b** was spent on subsidies and incentives, which comprised **41.0%** of the total expenditure by MOA and about **0.7%** of the total public expenditure.
- In summary, decades of subsidies have become a resource burden for the country. Moreover, this report suggests that focusing on SSL and production alone should not be the direction of the nation's future agricultural policies.
- Having said this, the sudden removal of the subsidies and incentives may negatively affect the farmers and national rice production in the short-term.
- It is therefore imperative to carefully strategise the re-allocation of financial resources to other areas for long-term growth, with minimal short-term impact.
- **Recommendation:** As part of a mid-term interim strategy towards the long-term growth of the industry and less reliance on subsidies and incentives, this report suggests the strengthening of the paddy and rice supply chain by taking the following into consideration:
    1) **Paddy and rice policies** – Do away with a production-centric or SSL-centric policy targets. Incorporate other food security factors in the production of domestic rice (Chapter 2)
    2) **Paddy and rice data** – Improve transparency and accessibility through digitalisation of data and information across the supply chain through the adoption of Blockchain technology (Chapter 2)
    3) **New paddy varieties** – Facilitate the growth of the private sector breeders for the development of new paddy varieties (Chapter 3)
    4) **Farmers and midstream players** – Develop a shared-risk approach through contract farming (Chapter 4 and Chapter 5)
    5) **Consumption** – Improve the capture of consumption data among migrant workers (Chapter 6)

Legislation

- The rapid progress in technology, farm mechanisation, biotechnology and aerial monitoring means that certain Acts might benefit from periodic reviews to ensure that they stay relevant.
- **Recommendation:** There is a need to study the **impact of shrinking agricultural land-size** per farmer, land inheritance in the agriculture sector in Malaysia and the regulations governing these matters.

Reporting and Transparency of Industrial Data

- Data related to rice production and consumption are diligently collected compared to other domestically grown food crops.
- However, challenges in data acquisition and data consistencies mean that there is scepticism of the national data from the private sector, and its response to the market may be delayed as a consequence. For researchers, findings and subsequent data-driven policy recommendations may be outdated.
- **Recommendation:** For the paddy and rice industry to adopt data liberalisation and transparency.
- **Blockchain** is a possible solution to improve transparency, traceability and in building trust between stakeholders across the supply chain.

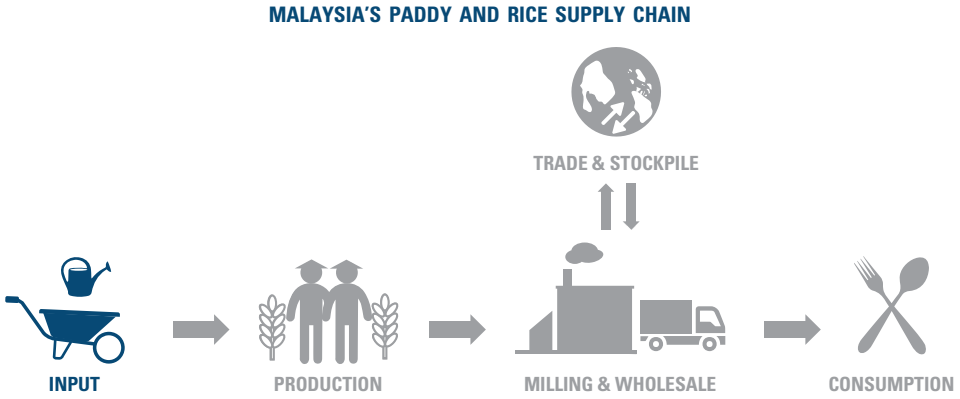
CHAPTER

03

SUPPLY CHAIN: FARM INPUT

CHAPTER 3

SUPPLY CHAIN: FARM INPUT



The input segment of the paddy and rice supply chain is an upstream segment that provides all the raw inputs needed to cultivate paddy. It includes but is not limited to the supply of seeds, fertilisers, pesticides, machinery and water. The supply of seeds will be discussed in greater detail due to the various achievements and challenges in seed production which has had relatively little research focus. This is so, despite the importance of plant breeding and R&D in helping to develop new rice varieties and improve farm yield. Water and irrigation, while important, are omitted due to limitations in the scope of this report. Additionally, matters related to the supply and subsidy of chemicals (both fertilisers and pesticides) have had significant interest and are being researched elsewhere.

Seed Production and Supply

The Journey of the Paddy Seeds – from Breeding to Farm

A key farm input for the cultivation of paddy is its seeds. In brief, paddy plant breeding R&D takes place to produce new paddy varieties that are commercially viable and with features desired by the industry. Upon laboratory, field tests and having the varieties approved and recognised, these new varieties are then mass cultivated to produce seeds. These seeds are then sold to the farmers for paddy cultivation.

As early as the 1970s, the Green Book Policy, which focuses on improving local agriculture production has emphasised the importance of high-quality seeds[65]. The local paddy seed segment has received a special focus from the authorities and as a result, the production of new paddy varieties and subsequently the seeds for cultivation have been domestically-driven (Figure 3.1).

Through the National Key Economic Area (NKEA) Entry Point Project 14 Seed Industry Development, the National Seed Council (NSC) was established in 2011 under the MOA and convenes twice a year[66]. The NSC comprises the Chief Secretaries and Director Generals of the MOA, MOSTI (now known as MESTECC), DOA, Department of Fisheries (DOF), Department of Veterinary Services (DVS), MARDI, FAMA and representatives from the National Seed Association Malaysia[67]. The functions of NSC are to determine the direction and policies for the seed industry, monitor the implementation of key action plans and oversee the quality of seeds in the market, among others.

65 Ginibun and Ugap (2012)
66 Fact Sheet: *Penubuhan Majlis Benih Negara* (National Seed Council (NSC)), MOA (2011)
67 See Appendix for the list of abbreviations.

There are three separate processes relevant to the paddy seed industry:

1) The protection of new varieties[68] (Figure 3.2)

- To give proprietary rights to the breeder of a new variety
- This procedure is in accordance with the Protection of New Plant Varieties Act 2004 (Act 634) and is monitored by the Crop Quality Control (CQC) Division of DOA
- Based on the terms set by the breeder, any other party who wants to commercially breed and supply the new variety may need to pay royalties to the breeder
- The decision on the registration of new plant varieties and grant of breeder's right are made by a Board comprised of 12 government agencies and chaired by the Director General of DOA based on recommendations by the Technical Committee which consists of 15 governmental members who are technical experts

2) The recognition (*pengisytiharan*) of new varieties[69] (Figure 3.2)

- Recognised variety can be a protected variety or a non-protected variety
- Certified seeds must be of recognised varieties. It is therefore within the commercial interest of the breeders to have their seeds recognised
- The recognition of the new variety is made by the *Jawatankuasa Dasar Bantuan Kerajaan Kepada Industri Padi dan Beras* (chaired by the Secretary General of MOA) based on the recommendation made by the *Jawatankuasa Teknikal Bantuan Kerajaan Kepada Industri Padi dan Beras* (JTBKKIPB) which is chaired by the Director General of MARDI (subsequent segments will elaborate on this point)

3) The production of certified seeds[70] (Figure 3.3)

- Only farmers who use certified seeds are eligible for input subsidies
- The procedure of producing certified seeds falls under the Paddy Seed Certification Scheme following the standards set by the Malaysian Standard (MS469:2012)
- Certified seeds are only produced by approved seed producers[71]

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68 *Prosedur Pendaftaran Varieti Tanaman Bagi Daftar Varieti Tanaman Kebangsaan (Pindaan 2016),* DOA

69 *Manual Pelaksanaan Skim Baja Padi Kerajaan Persekutuan (SBPKP),* LPP (2008); and *Prosedur Pembangunan dan Perakuan Varieti Baru dari Sektor Swasta atau Institusi R&D Awam (Rujuk Minit JKT Bil 1/2009),* DOA (n.d.-b)

70 *Prosedur Skim Pengesahan Benih Padi Jabatan Pertanian Malaysia,* DOA; *Pengesahan Benih Padi oleh Jabatan Pertanian,* DOA; and Rice (*Oryza sativa* L.) inbred seed plating materials – Specification (Second revision), Department of Standards Malaysia; and KRI's engagement with MARDI and DOA

71 The list of government tenders and successful bidders can be checked through http://myprocurement.treasury.gov.my

Figure 3.1. A timeline of policies related to the seed industry in Malaysia

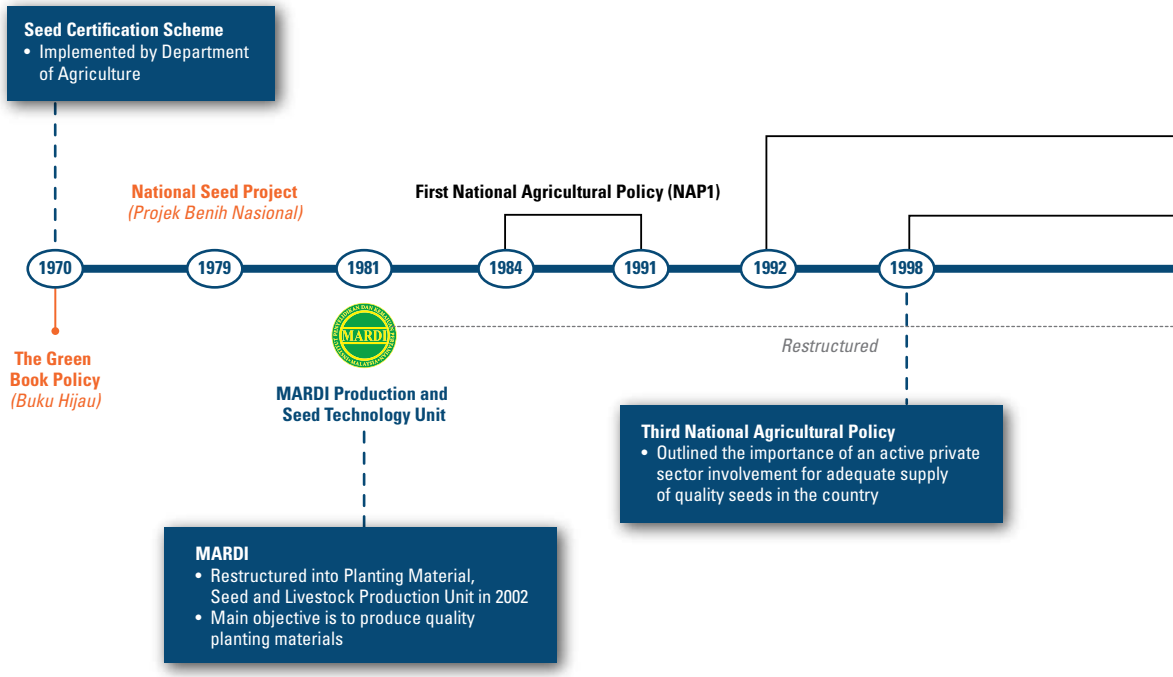


Illustration by KRI

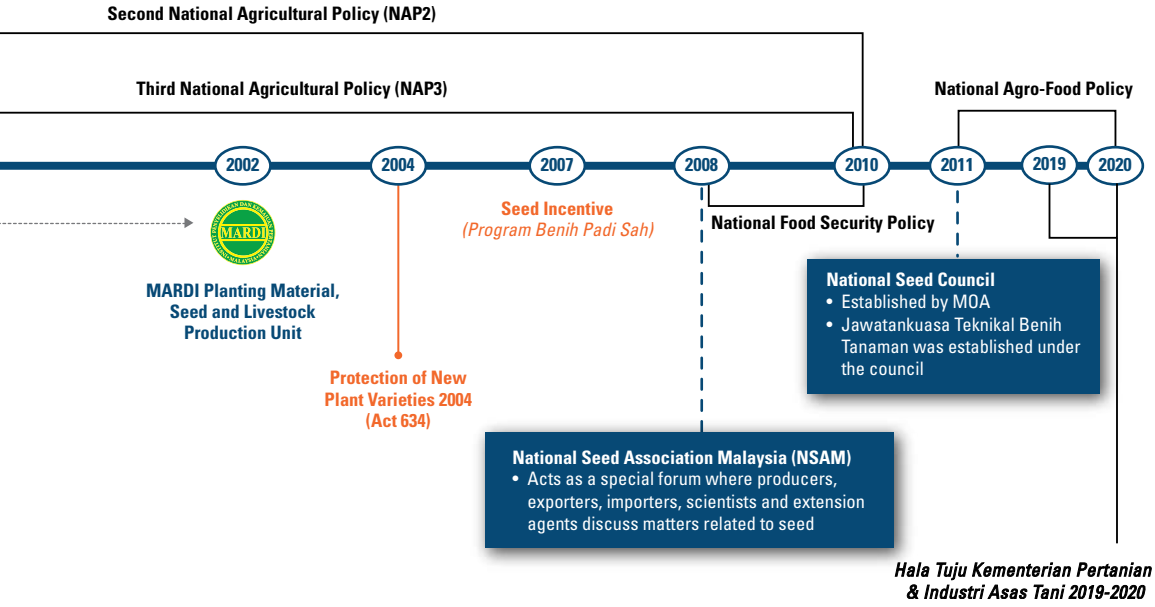
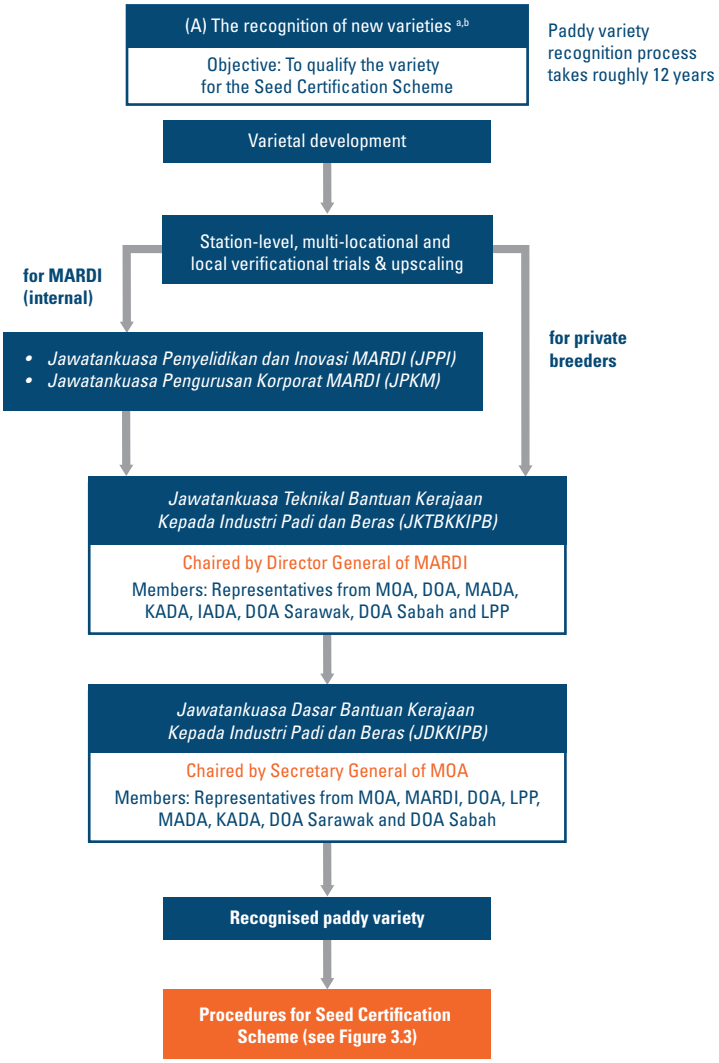

Second National Agricultural Policy (NAP2)
Third National Agricultural Policy (NAP3)
National Agro-Food Policy
2002
2004
2007
2008
2010
2011
2019
2020
MARDI
MARDI Planting Material, Seed and Livestock Production Unit
Protection of New Plant Varieties 2004 (Act 634)
Seed Incentive
(Program Benih Padi Sah)
National Food Security Policy
National Seed Council
• Established by MOA
• Jawatankuasa Teknikal Benih Tanaman was established under the council
National Seed Association Malaysia (NSAM)
• Acts as a special forum where producers, exporters, importers, scientists and extension agents discuss matters related to seed
Hala Tuju Kementerian Pertanian & Industri Asas Tani 2019-2020

Figure 3.2. The process flow for the (A) recognition and (B) protection of a new paddy variety



Sources:

[a] *Prosedur Pembangunan dan Perakuan Varieti Baru dari Sektor Swasta atau Institusi R&D Awam (Rujuk Minit JKT Bil 1/2009), MOA (n.d.)*

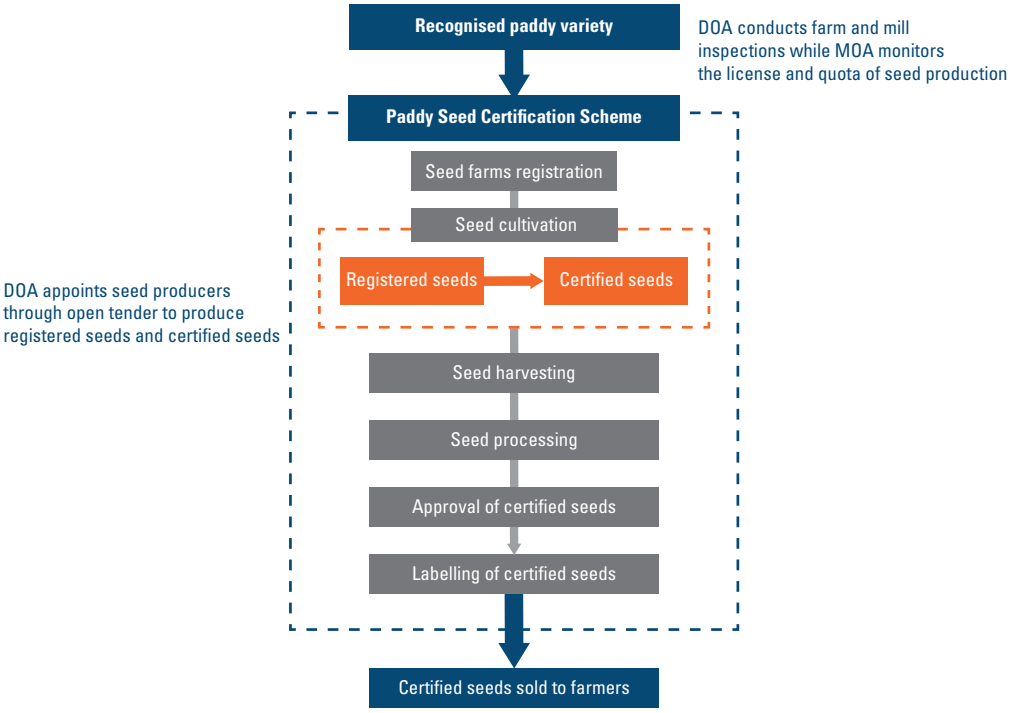
[b] *Manual Pelaksanaan Skim Baja Padi Kerajaan Persekutuan (SBPKP), LPP (2008)*

[c] *Prosedur Pendaftaran Varieti Tanaman Bagi Daftar Varieti Tanaman Kebangsaan (Pindaan 2016), DOA (2016c)*

[d] *Protection of New Plant Varieties System (Booklet), DOA (n.d.-c)*

Illustration by KRI

Figure 3.3. Procedure for Paddy Seed Certification Scheme



Sources:

1. *Prosedur Skim Pengesahan Benih Padi Jabatan Pertanian Malaysia, DOA (2011)*
2. *Pengesahan Benih Padi oleh Jabatan Pertanian, DOA (n.d.-a)*
3. *Rice (Oryza sativa L.) inbred seed plating materials – Specification (Second revision), Department of Standards Malaysia (2012)*

Illustration by KRI

Typically, farmers would order the volume of their preferred varieties between 3 – 6 months prior to the next planting season[72]. Popular local varieties include MR 220 CL2, MR 219 and MR 263. In Peninsular Malaysia, a farmer uses around 140kg/Ha of seeds that cost around RM270/Ha and can yield between 2,000 – 8,000 MT/Ha[73] depending on several interrelated factors such as soil condition, weather, pests and disease outbreaks, fertiliser, water and seed variety, and seed quality. The last two factors will be elaborated further in this chapter.

72 KRI's study visit to a seed production centre in the Northern Peninsular

73 Cross Cutting Survey (CSS) data from *Musim* 1 2015 (pers. comm. with MADA)

Paddy Seed Certification Scheme (*Skim Pengesahan Benih Padi Sah*)

"Only registered varieties approved by the Jawatankuasa Dasar Bantuan Kerajaan ke Industri Padi dan Beras can be used in the Seed Certification Scheme"

The Seed Certification Scheme was first introduced in 2007 to help boost domestic rice production. Certified seeds are paddy seeds produced according to the standards outlined in the Paddy Seed Certification Scheme (*Prosedur Skim Pengesahan Benih Padi Jabatan Pertanian Malaysia*) under the authority of the DOA and according to the seed testing guidelines prepared by the International Seed Testing Association[74]. Only registered varieties approved by the *Jawatankuasa Dasar Bantuan Kerajaan ke Industri Padi dan Beras* can be used in the Seed Certification Scheme.

The use of high-quality seeds is important for farm yield. Efforts to cultivate high-performing varieties cannot be fully maximised if the seeds are of poor quality. For instance, seeds could be contaminated with diseases, be mixed with genetically impure seeds or have a low germination rate[75]. All these contribute towards lowering farm yield. Therefore, the objective of the Seed Certification Scheme is to ensure the consistency of seed quality so that farmers have access to high-quality seeds produced from pre-approved registered varieties.

To be certified, among other requirements, seeds must meet the permitted level of germination rate, moisture content and contamination level (Table 3.1). Given the challenges of compliance with these high standards, only a handful of approved seed producers are allowed to sell seeds under the Paddy Seed Certification Scheme. There were only nine successful tender applications in 2015 and 2016 with a total seed quota of 80,000 MT per year (Table 3.2).

A possible solution is to introduce multi-grade certified seeds that enable new/small seed producers as well as larger producers to produce and sell seeds at various qualities and prices. This helps to reduce the use of non-certified seeds (*beg putih*) and enable lower quality seeds to be monitored by the DOA. At the same time, it may partially address the issue of insufficient/delayed supply

74 Prosedur Skim Pengesahan Benih Padi Jabatan Pertanian Malaysia, DOA (2011)
75 Wimalasekera (2015)

of certified seeds. However, this suggestion requires further evaluation and its implementation may require an increase in on-farm monitoring which may be an issue if human resource is limited.

Table 3.1. Standard requirements for certified seed under Paddy Seed Certification Scheme

Factor	Maximum permitted
1. Physical purity a) Pure seed (min.) b) Inert matter (max.) c) Other crop seed (max.)	 98.0 % 2.0 % None
2. Other seeds a) Noxious weed seed (max.) b) Weedy rice seed (max.)	 5 grains/kg 10 grains/kg
3. Germination rate (min.)	80.0 %
4. Moisture content (max.)	14.0 %

Source:
Department of Standards Malaysia (2012), Rice (Oryza sativa L.*) inbred seed planting materials – Specification (Second revision), pg. 3*

Table 3.2. List of certified paddy seed suppliers and total annual quota in 2015 and 2016

	Company	Percentage (%)	Annual Quota (MT)
1.	Kilang Beras Seri Merbok Sdn. Bhd.	24.3	19,422
2.	Haji Md Nor B Hj Abd Rahman (M) Sdn. Bhd.	16.8	13,461
3.	Syarikat Perniagaan Peladang (MADA) Sdn. Bhd.	16.7	13,352
4.	FELCRA Plantation Services Sdn. Bhd.	11.0	8,810
5.	PPK Lahar Bubu	8.9	7,125
6.	OBL Maju Sdn. Bhd.	8.5	6,765
7.	Kelang Beras Jelapang Selatan (Muar) Sdn. Bhd.	6.4	5,150
8.	Pertama Padi Sdn. Bhd.	4.0	3,175
9.	PPK Puteri Saadong	3.4	2,740
	TOTAL	**100**	**80,000**

Source:
Maklumat Perangkaan Industri Padi dan Beras 2016, MOA (2016b)

To help increase the use of certified seeds among farmers, several measures were employed. Firstly, the government introduced a seed incentive scheme for producers (RM1.03/kg) to ensure that the they can earn a profit despite a seed price cap at RM1.40/kg[76]. Additionally, farmers who use certified seeds qualify for other subsidies and incentives.

While the programme has succeeded in providing high-quality seeds, KRI's engagements with stakeholders revealed that there are several contemporary issues in the seed segment:

1. Supply and demand issues with made-to-order seeds; and
2. Few released varieties – limited choice for farmers.

Challenges – Supply Issues with Made-to-Order Seeds

According to KRI's study visits, registered seed producers in the Northern States of Peninsular Malaysia receive seed orders (by seed variety and volume) from the farmers and proceed to cultivate the seeds before the start of each planting season. Due to this, seed orders must arrive between 3 – 6 months in advance. Unfortunately, the length of time needed to prepare the seeds might limit the producers' ability to meet unexpected changes in the farmers' seed demand. This is a frequent problem especially during unexpected monsoon floods or disease outbreaks which require fast access to replacement seeds for replanting.

Having large and technically adequate seed storage facilities where seeds can be stored over multiple seasons can help improve responses to seed supply. An ideal medium-term storage facility can store seeds for up to 20 years provided that the temperature and humidity are kept at 5°C and 6% respectively[77] with pest-proof doors. These conditions will keep the seeds viable and with little outside contamination.

Currently, domestic seeds are temporarily stored in warehouses/rooms under ambient temperatures which can range between 26 – 28°C at near 100% humidity[78]. This shortens the seed shelf-life and is partly the reason that the producers resort to made-to-order seeds to minimise storage needs.

76 Based on KRI's engagements with seed producers and Laporan Jawatankuasa Kira-kira Wang Negara Parlimen Ketiga Belas – *Program Subsidi Benih Padi Sah*

77 KRI study visit to the International Rice Gene Bank in IRRI, Philippines

78 KRI study visit to seed producers' storage facility in Peninsular Malaysia

Improvement in storage facilities requires larger capital and maintenance costs. However, this is difficult to meet as most seed producers including those linked to the government have poor storage facilities due to financial constraints. Prior to providing any recommendations regarding storage facilities, it is worth exploring the profitability of storing seeds across multiple seasons and the impact of the recommendations on the industry as a whole.

It is worth noting that agricultural developments especially for the paddy and rice industry focus on farm-level technological advancement such as the adoption of farm machinery. Unfortunately, infrastructural and technological developments in other parts of the supply chain are given less attention. It is recommended that conversations are held with companies in the input segment to understand their infrastructural and technological needs.

Challenges – Few Released Varieties

Plant Breeding R&D

"Given the central and historical role of MARDI … the institute is the Chair for the Jawatankuasa Teknikal Bantuan Kerajaan kepada Industri Padi dan Beras, and therefore, is a key player in the process of developing and recognising new paddy varieties"

Unlike other inputs such as fertilisers and pesticides, R&D in breeding, production and supply of paddy seeds are domestically-driven. This is a unique situation as the supply of seeds for crops in many other countries is often dominated by large multinational corporations such as DuPont Pioneer and Syngenta[79].

MARDI is a leader in paddy plant breeding work, and has released 49 paddy varieties between the 1960s and 2000s[80] (Table 3.3). Given the central and historical role of MARDI as an R&D centre for rice, the institute is the Chair for the *Jawatankuasa Teknikal Bantuan Kerajaan kepada Industri Padi dan Beras*, and therefore, is a key player in the process of developing and recognising new paddy varieties.

79 The Access to Seeds Index (2016)

80 Paddy Production Survey Report Malaysia – Main Season 2013/2014, DOA (2015a) and KRI engagement

One of the varieties developed by MARDI is the MR 220 CL2 variety, developed in collaboration with BASF Ltd. in 2010. Weedy rice or *padi angin* is a type of paddy that is non-productive (does not produce grains) and grows like a weed. It is difficult to control weedy rice as any herbicide applied to it will inevitably kill productive paddy in its vicinity as well. Following intensive R&D, researchers in the US managed to breed a paddy variety that is productive and resistant to the herbicide Clearfield, which can kill weedy rice[81,82]. The MR 220 CL2 line was developed by MARDI and BASF Ltd. from this variety and is now the most popular variety in Malaysia. In 2014, more than half of MADA farmers used this variety[83]. The continued popularity, however, is of concern as the near mono-variety cultivation of MR 220 CL2 on thousands of hectares of continuous paddy plots exposes farmers to a higher risk: if a single disease epidemic occurs, it can cause significant losses to the industry.

The persistent use of this variety in subsequent seasons is also problematic. MR 220 CL2 was developed for short-term (two seasons) use but has been used by some farmers for ten consecutive seasons[84]. This behaviour encourages the incidence of Clearfield resistance in weedy rice (*padi angin*) through gene-flow[85] from MR 220 CL2[86]. Indeed, varieties such as the MR 220 CL2 were meant to be short-term varieties to limit the growth of weedy rice. However, for various reasons, farmers refuse to use other available varieties. A primary reason based on engagements with the farmers is the lack of alternative varieties that can compete in the maturity period and potential yield.

81 Sudianto et al. (2013)

82 Any other paddy varieties including *paddy angin* that do not have this resistance will die when exposed to Clearfield

83 Paddy Production Survey Report Malaysia – Main Season 2013/2014, DOA (2015a) & Paddy Production Survey Report Malaysia – Off Season 2014, DOA (2015b)

84 Yim Kong Ming (BASF Malaysia Sdn. Bhd.) (2017)

85 Gene-flow is the transfer of certain genetic material from one plant to another plant, usually of the same species

86 Sudianto et al. (2013) & Engku et al. (2016)

How do we fare compared to our neighbours?

Compared to other rice-producing countries, Malaysia has been relatively slow in its release[87] of new varieties. Since MR 220 CL2 was released in 2010, there have been a few other varieties such as MR 253, MR 263, MR 269 and MRQ 76 but these varieties have not been widely used[88].

On the contrary, India has been the most prolific variety producer with more than 1,900 varieties released since 1961, followed by South Korea at 277 varieties (Figure 3.4). Neighbouring countries in SEA such as the Philippines, Indonesia, Vietnam, Thailand and Myanmar performed better, having released more than double the number of Malaysia's new paddy varieties at 238, 183, 96 and 78 varieties respectively[89]. In comparison, Malaysia released only 35[90] varieties up to 2014. In an updated 2018 list, according to MARDI, 49 varieties were released (Table 3.3).

There are many factors influencing breeding work. One argument is that some countries have geographical variations requiring different varieties (such as India) while Peninsular Malaysia has mostly a homogenous environment. This may explain why some countries have higher number of varieties developed than others. Another factor is the nation's GDP per capita, assuming that a nation with a higher GDP per capita would have better research resources. However, despite having a lower GDP per capita and relatively homogenous geography, countries such as Cambodia, Bangladesh and Vietnam were still able to produce a larger number of varieties than Malaysia.

"… despite having a lower GDP per capita and relatively homogenous geography, countries such as Cambodia, Bangladesh and Vietnam were still able to produce a larger number of varieties than Malaysia"

87 Release of a new variety in this context refers to the development of a new paddy variety that is recognised by the *Jawatankuasa Teknikal Bantuan Kerajaan ke Industri Padi dan Beras* and can therefore qualify for the paddy seed certification programme

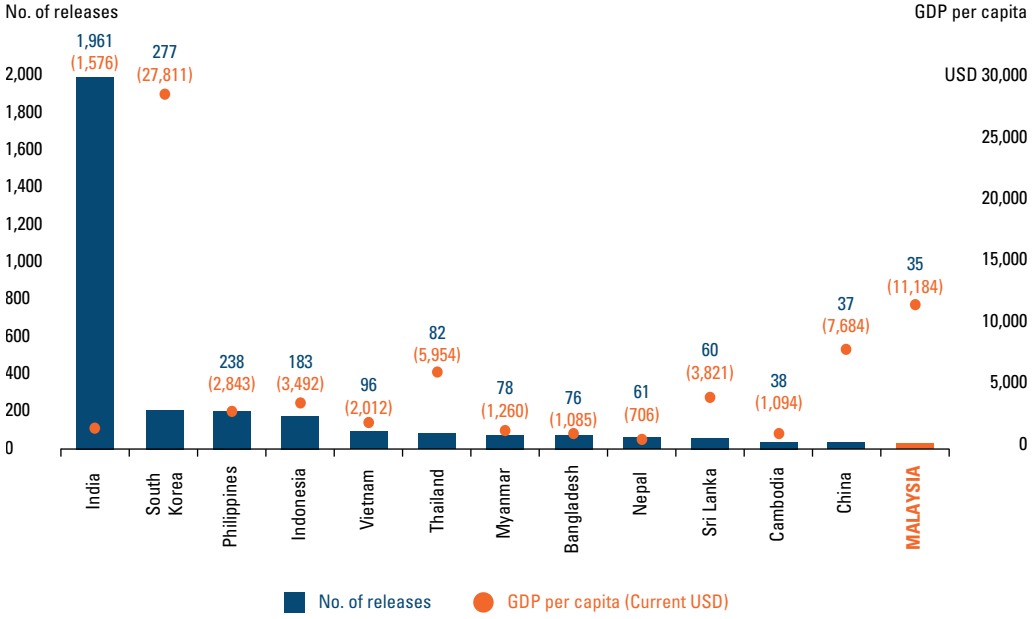
88 Paddy Production Survey Report Malaysia – Main Season 2013/2014, DOA (2015a)

89 Released varieties from 1961 – 2014. Data compiled from INGER (n.d.).

90 There is a slight discrepancy between the number of released varieties between INGER and MARDI (Table 3.3) – MARDI recorded 43 varieties released up to 2014 whereas INGER recorded 35 varieties.

Malaysia is behind other rice producing countries in the number of paddy varieties released, especially compared to India and other Southeast Asia countries

Figure 3.4. The number of paddy varieties released by country and GDP per capita (current USD), 1961 – 2014



Notes:

1. *Figures in the brackets are the GDP per capita in current USD*
2. *Data from IRRI may not be the latest update*

Sources:

1. *Number of paddy varieties released from Global Releases 2013 and 2014, Released Rice Varieties, IRRI (Accessed on 1 Nov 2018)*
2. *GDP per capita (current USD) from World Development Indicators, World Bank (Accessed on 13 Nov 2018)*

Chart by KRI

Table 3.3. List of released paddy varieties for Malaysia

	Variety	Year of Release
1.	Malinja	1964
2.	Mahsuri	1965
3.	Ria	1966
4.	Bahagia	1968
5.	Murni	1972
6.	Masria	1972
7.	Jaya	1973
8.	Sri Malaysia 1	1974
9.	Sri Malaysia 2	1974
10.	Pulut Malaysia 1	1974
11.	Setanjung/MR 1	1979
12.	Sekencang/ MR7	1979
13.	Sekembang	1979
14.	Kadaria/MR 27	1981
15.	Pulut Siding	1981
16.	Manik/MR 52	1984
17.	Muda/ MR 71	1984
18.	Seberang/ MR 77	1984
19.	Makmur/MR 73	1985
20.	MR 84	1986
21.	MR 81	1988
22.	MR 103	1990
23.	MR 106	1990
24.	Pulut Hitam 9	1990
25.	MR 123	1991

	Variety	Year of Release
26.	MR 127	1991
27.	MR 159	1995
28.	MR 167	1995
29.	MR 185	1997
30.	MR 211	1999
31.	MRQ 50	1999
32.	MR 219*	2001
33.	MR 220*	2003
34.	MRQ 74*	2005
35.	MR 232	2006
36.	MR 220 CL1*	2010
37.	MR 220 CL2*	2010
38.	MRM 16	2010
39.	MR 253	2010
40.	MR 263*	2010
41.	MRQ 76*	2010
42.	MR 269	2012
43.	MRIA	2013
44.	MARDI 284	2015
45.	MARDI SIRAJ 297	2016
46.	MARDI WANGI 88	2016
47.	MARDI WARNA 98	2018
48.	MARDI SEMPADAN 303	2018
49.	MARDI SEBERNAS 307	2018

Note:
** Denotes the varieties that were reported to be planted for cultivation in Peninsular Malaysia during Main Season 2014/2015 according to the Paddy Production Survey Report Malaysia Main Season 2014/2015. There were eight varieties in total*
Source:
Paddy Production Survey Report Malaysia – Main Season 2014/2015, DOA (2016a) & unpublished data from MARDI

Encouraging the Growth of Private Breeders

To spur the seed segment forward, particularly in plant breeding, the nation can no longer rely on one government agency to lead the breeding and R&D work. Private researchers and breeders are much needed in this segment. However, to encourage the involvement of the private sector, the processes for the development and recognition of new varieties for these stakeholders must be made clear and easily available.

As of 2017, all varieties qualifying for the certified seed programme are varieties produced only by MARDI[91] or in collaboration with MARDI. Prior to 2017, no varieties developed independently by the private sector or universities have been included in this list. This is because not all paddy varieties developed in Malaysia can meet the stringent and lengthy requirements needed to have the variety recognised and subsequently qualify for the Seed Certification Scheme.

To add, while seed producers can legally sell non-certified seeds, these seeds cannot compete with the cheaper, subsidised certified seeds and farmers who purchase non-certified seeds do not qualify for farm input subsidies. This, coupled with the complexity of the process involved in getting a new variety recognised, discourages private sector participation. The result is the release of fewer than 50 varieties over nearly five decades, while neighbouring countries have achieved more than double the number.

"As of 2017, all varieties qualifying for the certified seed programme are varieties produced only by MARDI or in collaboration with MARDI"

Historically, MARDI, DOA and MOA were responsible for developing, monitoring and approving the standard operating procedures (SOPs) related to the release of new paddy varieties and the inclusion of new varieties into the Certified Seed Programme. Current regulatory processes related to the local paddy varieties rest on the assumption that MARDI is the primary entity conducting paddy breeding research. Furthermore, any technical queries are referred to MARDI for advice and guidance.

91 *Soalan Lazim - Bahagian Padi, Tanaman Industri dan Florikultur*, DOA (2016d). http://www.doa.gov.my/index.php/pages/view/594?mid=263

"… JKTBKKIPB, which is currently chaired by the Director General of MARDI, has a role in recommending a new variety to MOA … with MARDI itself also producing its own breed"

This was true pre-2000s, with the seed segment benefitting significantly from the role played by MARDI. With the foundations put in place by MARDI, DOA and MOA, post-2000s, the landscape for R&D in paddy breeding research has changed with the emergence of private sector breeders and those from academia.

For the seed segment to continue to grow and be driven by the private sector, it is important for them to foresee the possibility of making a profit. They need assurance from the government that the processes and standards in plant breeding and seed production for independent private breeders are clear and achievable.

To reflect changes in the breeding landscape, it may be timely to review the Chair and membership of the JKTBKKIPB to avoid possible conflicts of interest. This is because the JKTBKKIPB, which is currently chaired by the Director General of MARDI, has a role in recommending a new variety to MOA for approval (Figure 3.2), with MARDI itself also producing its own varieties. Previously, there were no other breeders except for MARDI and having such a structure served it purpose well. While still recognising MARDI's significant contribution to the nation's plant breeding segment, given the recent increase in private and academic sector breeders, perhaps a review of the current committee structure may be appropriate.

In conclusion, an enabling regulatory and policy environment for breeding and seed production is needed to encourage the entry and success of new players to spur the seed segment as opposed to the reliance on a single R&D entity to drive paddy breeding in Malaysia.

BOX ARTICLE 4: The International Rice Gene Bank, an Untapped Potential[92]

At the International Rice Research Institute (IRRI), the International Network for Genetic Evaluation of Rice (INGER) is a 40-year-old initiative established as a global model for the exchange, evaluation, release and use of rice genetic resources. This programme was developed as part of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)[93]. Malaysia is one of the member countries of this treaty and one of the 50 INGER participating countries[94].

The INGER programme helps rice producing countries by continuously searching for potential rice varieties within the vast resources of the International Rice Genebank (IRG). The IRG currently holds approximately 130,000 types of rice accessions and 4,657 wild relatives[95]. The programme also conducts preliminary breeding and field tests before sharing these rice varieties with other countries. As such, it is deemed to be a fast-track route for countries to develop new varieties as they can follow up with further breeding domestically to meet the needs of the local environment (Figure 3.5).

In total, INGER has been responsible for the release of 667 rice varieties across 62 countries from 1975 to present[96]. However, Malaysia has been one of the least active countries relative to its Southeast Asian neighbours. Seed variety was requested only once over a five-year period (Table 3.4) compared to other member countries.

INGER is an open source and its vast genetic resources are accessible to any breeder. It is therefore recommended that private breeders and university researchers in Malaysia take advantage of INGER to hasten the development of new paddy varieties for the nation.

92 Data source: IRRI webpage and pers. comm. with Dr Shoba Venkatanagappa, Senior Scientist, INGER & MET Co-ordinator, Plant Breeding Division, IRRI

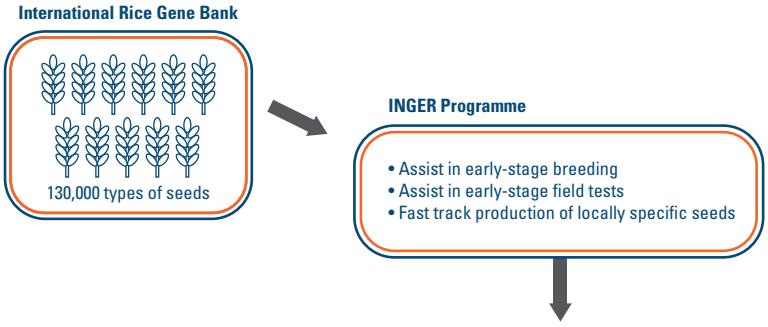
93 ITPGRFA, http://www.fao.org/plant-treaty/en/

94 INGER, http://inger.irri.org/

95 The International Rice Genebank, http://irri.org/our-work/research/genetic-diversity/international-rice-genebank

96 INGER (n.d.)

Figure 3.5. The function of the INGER Programme



Source:
IRRI (n.d.)
Illustration by KRI

Malaysia as a participating country to the INGER programme has been relatively inactive compared to other Southeast Asia countries

Table 3.4. List of countries that participated (requested rice variety) in the INGER Programme by year

Country	2011	2012	2013	2014	2015
Cambodia	Yes			Yes	
East Timor					
Indonesia	Yes	Yes	Yes	Yes	Yes
Lao PDR					Yes
MALAYSIA				Yes	
Myanmar	Yes	Yes	Yes	Yes	Yes
Philippines	Yes	Yes	Yes	Yes	Yes
Thailand	Yes	Yes		Yes	Yes
Vietnam	Yes	Yes	Yes	Yes	Yes

Source:
Pers. comm. with Dr Shoba Venkatanagappa, Senior Scientist, INGER & MET Co-ordinator, Plant Breeding Division, IRRI

Chemical Input

This segment includes the system of supplying chemicals for disease control and fertilisers to farmers to help increase farm yield. A primary topic of interest has always been the relevance and mode of providing subsidised fertilisers and chemicals under the *Subsidi Baja Padi Kerajaan Persekutuan* (SBPKP) and *Skim Insentif Pengeluaran Padi*. While recognising its importance, this will not be discussed in detail as it is currently being reviewed elsewhere.

Notwithstanding, of concern, are matters related to the health and safety of the chemical input users (Box Article 5). In a bid to focus on increasing yield and reducing costs, there has been widespread negligence in adherence to the safe use of the chemicals as recommended on the labels, and the widespread use of unregistered/illegal chemicals. During farm visits, workers were not wearing the appropriate Personal Protection Equipment (PPE). Instead, unprotected hands were used to prepare the chemical mixes, old clothes were used to cover mouth and nose from inhaling the water-chemical suspension, and eyes were left exposed. This observation was also made by Mohammed et al. (2016) in a survey conducted to study farmers sustainability practices in the granary areas.

The negligence can be seen as a combination of several factors including low self-awareness among farmers, lack of follow-up training by the chemical suppliers, distributors and farming authorities as well as lack of pressure from the consumers due to poor consumer awareness. This is symptomatic of an industry that only focuses on production (in MT) as the main performance indicator while failing to recognise that farms should also prioritise health and safety as well as environmental sustainability[97].

Further investigations and studies are needed to evaluate the extent of chemical usage negligence and the monitoring of food safety (biological and chemical) from farm to bin.

97 The impact of farming on the environment is not discussed in detail here as it requires a separate detailed report. In summary, a correctly used chemical applied in combination, in succession to or alternating with soil-fertility improvers such as microbial starters or organic fertilisers are good farming practice, but are often neglected.

BOX ARTICLE 5: The Use of Unregistered Pesticides

Since 2010, the 'Rice Bowl' region of the Northern States in Peninsular Malaysia has been hit by a pest from the genus Pomacea known as the Golden Apple Snail (GAS) or *siput gondang*[98]. Each snail reproduces rapidly by laying hundreds of pink eggs above water. It exerts most damage during the tillering stage, as the aquatic snail consumes the soft seedlings. Unfortunately, both farmers and the local authorities are unable to control the pest quickly and effectively. According to the farmers, none of the subsidised pesticides is able to prevent the damage done by the GAS. Desperate, farmers in the Northern States resort to purchasing from smugglers an unregistered product from China claimed to contain Fentin acetate. Fentin acetate is a compound commonly used in Asia to control GAS as it has molluscicidal properties[99]. The product is banned for use in agriculture in Europe and India[100].

It is important to emphasise here that efficacy does not equate to safety. While the product may be effective in controlling GAS, there is no assurance that it is free from contamination from other toxins as its environmental and health safety has yet to be ascertained. Further investigation is needed by disease control specialists to help develop a safe, effective and sustainable solution to this problem.

Right: GAS eggs in Kangar, Perlis by the side of a paddy plot
Left: mature GAS at the base of a rice plant
Photos by KRI

98 Salleh et al. (2012)
99 Heong et al. (1995), Cheng and Kao (2006) & Arfan et al. (2016)
100 United Nations (2005)

"Kami tak boleh baca bahasa asing di paket racun dan kami tiada pilihan. Walaupun tak mahu, kami terpaksa gadai nyawa guna racun haram sebab padi itulah periuk nasi kami"

by a paddy farmer interviewed in 2016

PESTICIDES ACT 1974 (Act 149)

Section 53A. Possession or use of unregistered pesticides and unapproved use of pesticides

(1) Except as provided in sections 14 and 14A, no person shall—
  (a) possess or use a pesticide that is not for the time being registered under this Act; or
  (b) use a pesticide otherwise than in accordance with the uses stipulated on the label, as approved by the Board.

(2) Any person who contravenes subsection (1) commits an offence and is liable on a first conviction, to imprisonment for one year or to a fine of ten thousand ringgit and, on a second or subsequent conviction, to imprisonment for three years or to a fine of twenty thousand ringgit or to both.

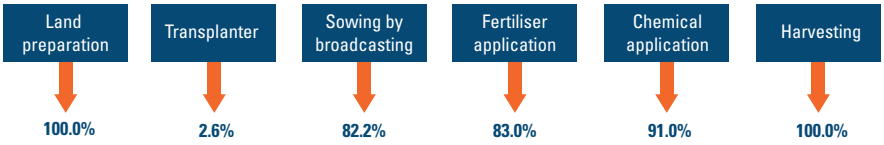
Mechanisation & Automation

"The adoption of farm mechanisation is good and can be attributed to the accommodating role of both public and private agencies as well as farmers"

On-farm mechanisation for paddy cultivation in Malaysia in the last decade has been well adopted, especially in land preparation and harvesting (Figure 3.6). Furthermore, based on the estimated cultivated land area and the size of hectare coverage per vehicle, Malaysia has enough heavy machinery to cover paddy cultivation in Peninsular Malaysia[101]. The adoption rate of farm mechanisation is good and can be attributed to the accommodating role of both public and private agencies as well as farmers (Figure 3.6 and Figure 3.7).

Apart from transplanting, farm machinery is widely used throughout the paddy planting process

Figure 3.6. Percentage of machinery usage according to farm activity in the granary areas, 2014

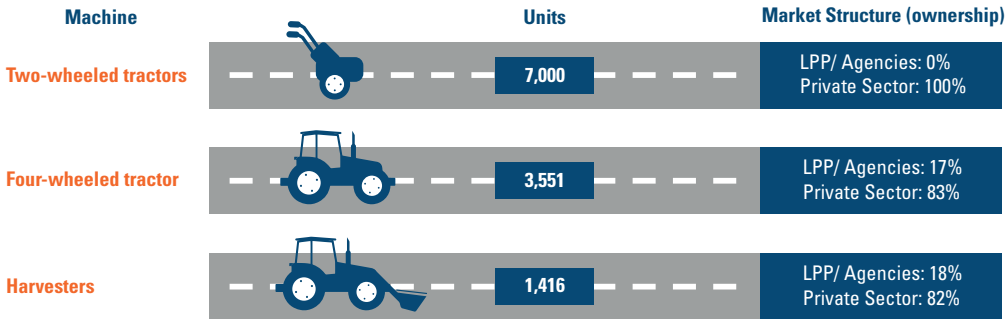


Source:
Data from Mr Abdul Aziz A Rahim from LPP at the Halatuju Industri Padi, 2016 Kedah
Illustration by KRI

101 Abdul Rahim (2016)

As service providers, the private sector dominates the heavy machinery market

Figure 3.7. Percentage of machine ownership in Malaysia for the paddy industry, 2014



Source:
Data from Mr Abdul Aziz A Rahim from LPP at the Halatuju Industri Padi, 2016 Kedah
Illustration by KRI

Despite the high adoption rate, KRI's stakeholder engagements revealed issues related to access to suitable machinery. The use of modified or unsuitable machines has led to yield loss as well as physical damage to farm roads and in the paddy fields. For example, farmers use large and heavy combine harvesters originally designed for wheat in a paddy field which causes land compaction, road damage and higher post-harvest lost (Picture 3.1 and 3.2). The machine suitability issue warrants further investigation by the relevant authorities to ensure that farmers have access to rent or purchase the appropriate machines for maximum yield and to minimise long-term damage to the land.

Picture 3.1. Three workers trying to dislodge a harvester stuck in the soft mud in Sarawak

Photo by KRI

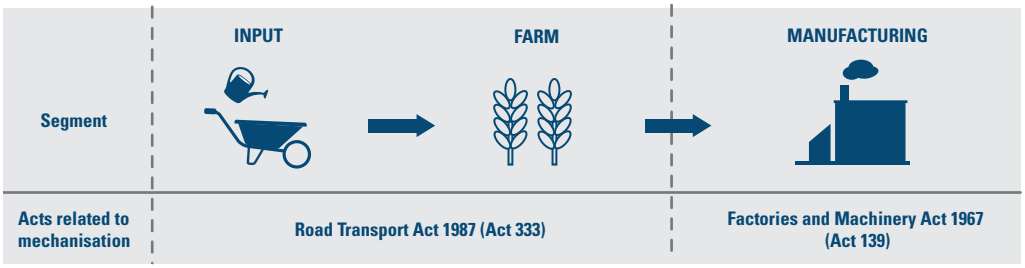
Picture 3.2. A combine harvester originally designed for wheat is used to harvest paddy in Kedah

Photo by KRI

For the machinery segment to continue developing, it is worth reviewing the role and relevance of the various Acts, regulations and monitoring bodies involved in this segment (Figure 3.8).

Given the recent advent of farm mechanisation, gaps remain in the regulatory framework, particularly on vehicle modification and on-farm suitability

Figure 3.8. Gaps in the farm mechanisation regulatory structure



Activity	Agency
Vehicle inspection	PUSPAKOM
Licensing and on-road regulator	JPJ
Machinery on-farm monitoring	None

Illustration by KRI

It is worth adding that often, mechanisation in the farming industry is associated with on-farm mechanisation and not elsewhere across the food supply chain. Interest and focus should also be given to upstream and downstream segments such as mechanisation and automation in seed production (including upgrading storage and logistics) and downstream milling, packaging and logistics.

CHAPTER KEY TAKEAWAYS

Seed Production and R&D

- **Malaysia is slow in the release of new rice varieties**.
- To spur the seed segment, Malaysia must encourage the proliferation of breeders from the private sector and public universities.
- **Recommendation:** It is important to make the process of recognising new paddy varieties clear and transparent for independent private breeders, especially those not associated with MARDI. An enabling regulatory environment for breeding and seed production is needed to encourage the entry and success of new players as opposed to a reliance on a single R&D entity to drive paddy breeding in Malaysia.
- **Recommendation:** It is suggested that the *Jawatankuasa Teknikal Bantuan Kerajaan ke Industri Padi dan Beras* (JKTBKKIPB) membership is reviewed to avoid any possible conflicts of interest and to assess the level of representation and influence of breeders within the JKTBKKIPB.
- **Recommendation:** Furthermore, breeders should take advantage of the services provided outside Malaysia such the INGER programme by IRRI.

Chemical Use

- In a bid to focus on increasing yield and reducing farm costs, there has been widespread negligence in adherence to the safe use of chemicals on the farms.
- **Recommendation:** Further investigations and studies are needed to evaluate the extent of negligence in chemical usage and to monitor food safety (both biological and chemical) from farm to bin.

Mechanisation

- The adoption of farm mechanisation in Malaysia is high, and there has been a growth of service providers for the rental of heavy machinery.
- The focus on the adoption of automation and machanisation should be further expanded to other segments of the paddy and rice supply chain.

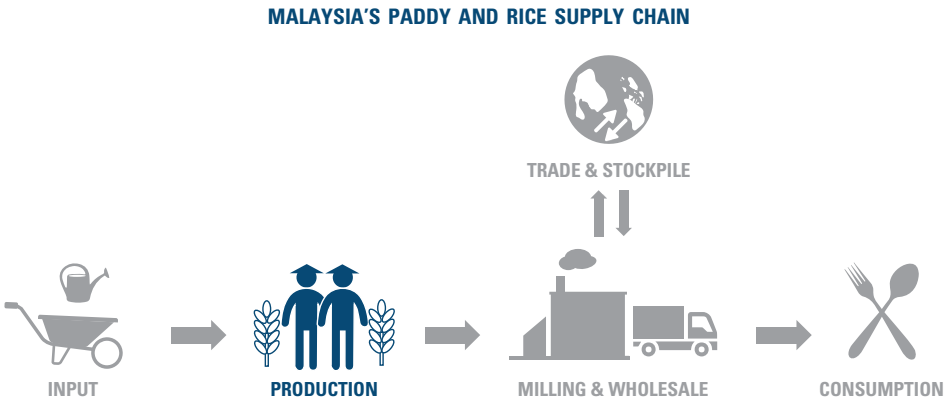
CHAPTER

04

SUPPLY CHAIN: PADDY PRODUCTION (FARMING)

CHAPTER 4

SUPPLY CHAIN: PADDY PRODUCTION (FARMING)



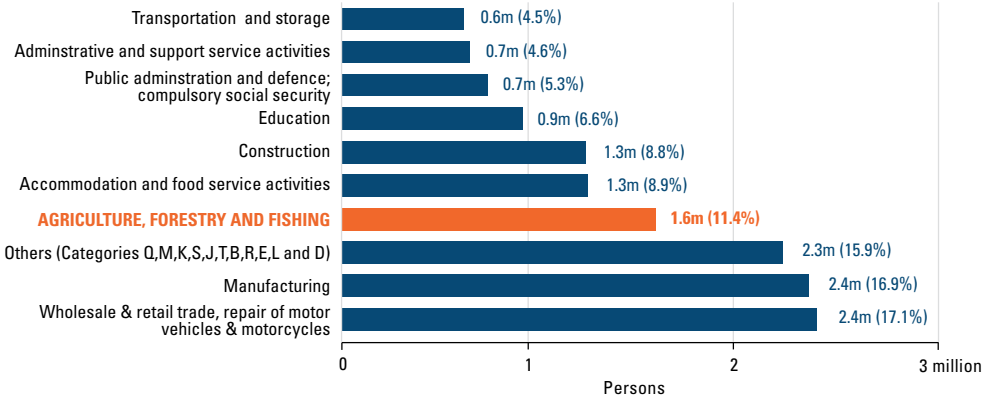
The following segment in the paddy and rice supply chain is the farm/production segment. Here, farmers purchase and utilise farm inputs to cultivate paddy plants over a period of 90 – 120 days. Once matured, the grain is harvested and sold to millers for profit. Given a large number of farmers and their association with the lower income group, this segment receives the most attention from the government and the public. Consequently, it is heavily protected by multiple intervention measures compared to other segments in the supply chain. This chapter will begin by describing the historical and current demographics of the farmers and their income level. It will then look into contributing factors that determine farm productivity[102] and farmer's income. This is followed by policy recommendations on improving the performance of this segment and strengthening its linkage to the next segment (midstream segment) which may have an impact on further improving farmer's income.

102 Farm/agricultural productivity is the ratio of agricultural output acquired to the agricultural input used or "... ratio of index of local agricultural output to the index of total input used in farm production". Shafi (1984) as cited in Dharmasiri (2012)

Farmers' Demographics

In 2016, there were 14 million employed persons in Malaysia. Out of this number, 1.6 million workers belonged to Category A (agriculture, forestry and fishing), which was 11.4% of the total labour force (Figure 4.1)[103]. This category had the third largest number of employed persons after Category G (wholesale and retail trade, repair of motor vehicles and motorcycles) and Category C (manufacturing)[104]. Given this large number of employees, policies related to agriculture, forestry and fishing are likely to have a large impact on the livelihood of many workers.

Figure 4.1. Number of employed persons by industry, 2016 (million persons)



Note:
Percentages are from the total number of employed persons in 2016
Source:
Table 12: Employed persons by industry, Malaysia/States, 1982 – 2017 (pg. 3), Labour Force Survey Time Series Statistics, DOS (2018) (Accessed 23 Oct 2018)
Chart by KRI

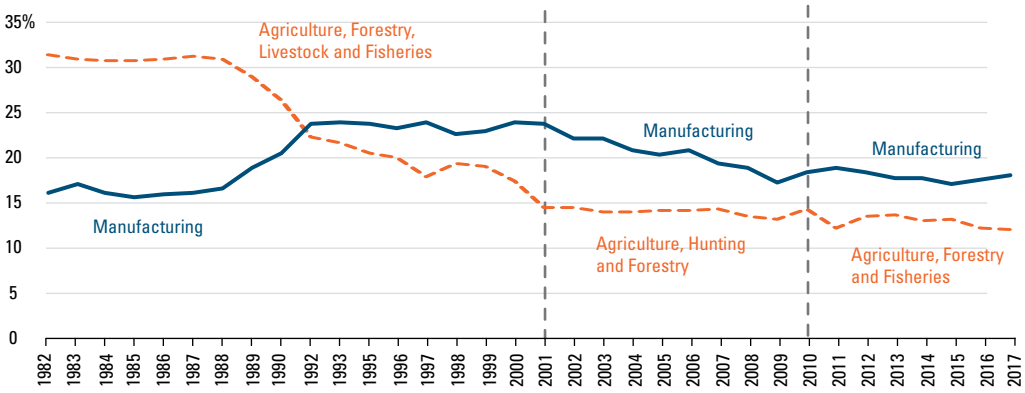
There has been a gradual decline in the share of employed persons in the agriculture sector out of the total employment over the years. The turning point was in 1992 when the total number of employed persons in the manufacturing sector became higher than in agriculture. In 1982, 1.6 million were employed in Category A from a total of 5.2 million employed workers (30.8%). In comparison, in 2016, the total number of workers employed in Category A was still 1.6 million people but out of 14 million employed workers (11.4%) (Figure 4.2).

103 DOS (2018)
104 'Others' is omitted here as it is a sum of multiple categories

This decline is not necessarily a negative phenomenon. The rise in farm mechanisation and improvements in farm management and R&D mean that presently, fewer farmers are needed to produce the same, if not a larger harvest. This is seen in the improvements in paddy farm yield and total national paddy production as highlighted in Chapter 2. This is especially so with the nation experiencing a shift from an agrarian-based economy to an industrial one.

There is a declining trend in the percentage of people employed in categories related to agriculture

Figure 4.2. Employed persons in agriculture-related industry, 1982 – 2017 (percentage over total employment)



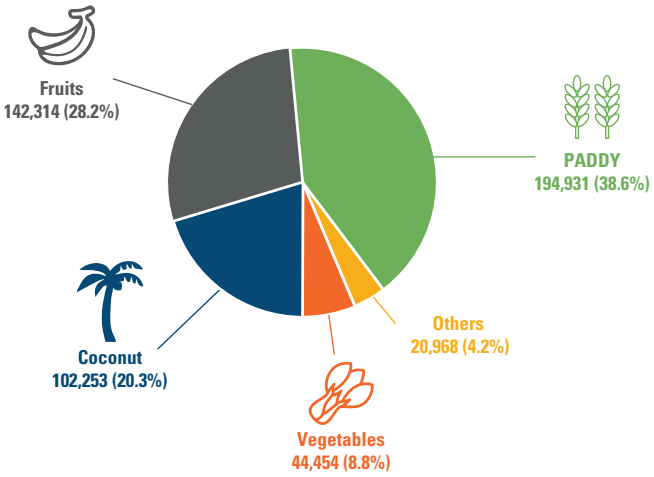
Note:
There were changes in the categorisation used, including the category related to agriculture in 2001 and 2010
Source:
Table 12: Employed persons by industry, Malaysia/states, 1982 – 2017 (pg. 3), Labour Force Survey Time Series Statistics, DOS (2018) (Accessed 18 Oct 2018)
Chart by KRI

Closer inspection of the agriculture sector revealed that approximately 500,000 farmers are from the food production sub-sector. Within this sub-sector, around 200,000 are paddy farmers (Figure 4.3), located mostly in the granary areas (164,068 in 2015)[105]. These figures indicate the considerable size of paddy farmers and potentially explain the level of attention given by the authorities to the well-being and socio-economic status of farmers in this country.

105 Agrofood Statistics 2015, MOA (2015). The number of farmers in granary areas is not available in the Agrofood Statistics 2016.

Paddy farmers make up the largest portion of farmers in the food sub-sector

Figure 4.3. Number of farmers according to crop type (food sub-sector), 2016 (persons)



Notes:

1. *Others include cash crops (maize, groundnut, tapioca, sweet potatoes, yam bean, sugarcane), spices, floriculture and herbs*
2. *The number of farmers are estimated based on the number of individuals cultivating each crop*
3. *A farmer may cultivate more than one crop*

Source:

Jadual 2: Anggaran bilangan petani mengikut negeri (pg. 3), Statistik Tanaman (Sub-sektor tanaman makanan) 2017, DOA (2017)
Chart by KRI

A common observation in the farmers' demography is the prevalence of an ageing population. This was identified as far back as 1985 by the then Deputy Minister of Agriculture[106]. Three decades later, the demography remains in paddy farming. A socio-economic survey in Pendang, Kedah conducted in 2013 involving 150 respondents showed that the largest percentile of the respondents was 50 years old and above, at 23%[107]. Consistently in 2016, MADA Annual Report revealed that the average age of farmers in the MADA area is 60 years old[108]. It is likely that the current economic insecurity associated with farming and better employment opportunities in urban areas had led to this ageing scenario in rural areas[109].

106 Goh C.T (1985)
107 Hussin and Mat (2013)
108 *Laporan Tahunan 2016*, MADA (2016)
109 Abdullah (2007)

According to Tauer (1995), it is commonly accepted that the productivity of a farmer improves through years of experience, and then, at a certain age, declines as physical limitations increase. The same author conducted a study of farmers across 10 US Department of Agriculture production regions and showed that farmer efficiency increases 5 to 10% every 10 years between the ages of 35 and 44, then drops at the same rate beyond 44 years old. The same scenario can be assumed in Malaysia whereby an ageing population of farmers with an average age above 50 may indicate a sub-optimal achievement in farm efficiency. The ideal scenario is that the ageing farmers' population will gradually shift towards fewer but more productive younger farmers.

With the adoption of farm machinery, technology and improvements in farm management, a smaller number of dynamic agropreneurs may produce the same output or better than the collective output of a group of ageing farmers. According to an agropreneur from Penang, older farmers tend to work on smaller land areas of less than 3 Ha for various reasons. On the contrary, the ideal farm size to achieve economies of scale is around 10 Ha. Over time, if there is a continued reduction in input subsidies, paddy farming in these smaller plots may no longer be economical for these ageing farmers. According to the interviewed agropreneur, it is predicted that the more productive farmers will take over and consolidate these lands and adopt new methods to ensure the best returns on investment for their paddy cultivation[110].

The challenge, therefore, is for the paddy and rice industry to attract younger farmers. Contract farming may be the first step towards this and is described in detail under the contract farming subchapter.

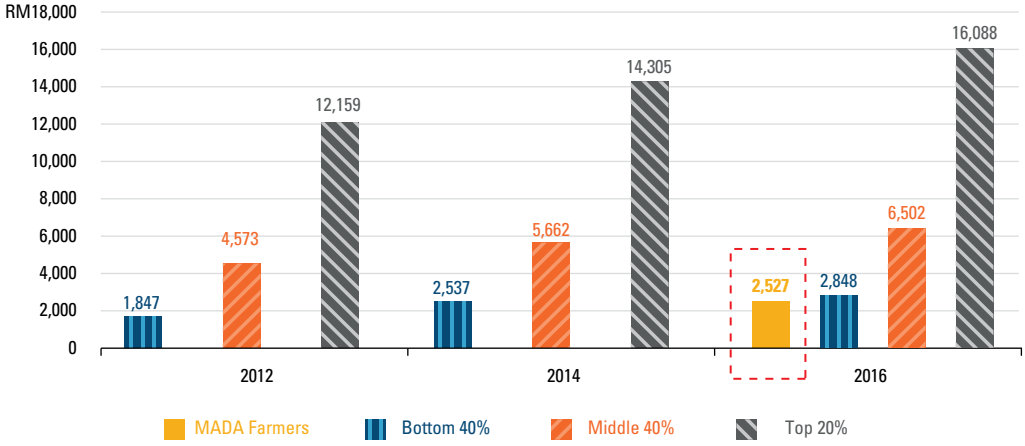
110 KRI engagement with an exemplary paddy farmer who is in his 30s from IADA Pulau Pinang

Farmers' Income

Previous agricultural policies were successful in the gradual eradication of hardcore poverty over the years, but farmers remain relatively poor compared to their contemporaries in other occupational groups. This is the case for paddy farmers in the MADA area. Based on the 2016 MADA Annual Report, the monthly household income for paddy farmers in the region was RM2,527. This includes income from both agricultural and non-agricultural related activities. This is below both the national median household income (RM5,228) and mean household income (RM6,958) in 2016[111], with paddy farmers falling within the B40 income group (Figure 4.4).

Paddy farmers remain in the bottom 40%

Figure 4.4. Mean monthly household income for Malaysians and MADA paddy farmers, 2012 – 2016 (RM)



Note:
Monthly household income for farmers is estimated from the reported annual net household income of MADA farmers in 2016
Sources:

1. *Household income data from various tables in Household Income and Basic Amenities Survey Reports (Table 1.3, Table 1.8, and Table 2.1 in 2012, 2014 and 2016 reports respectively), DOS (Various years) (Accessed 23 Oct 2018)*
2. *MADA farmers income data from Jadual 11: Pendapatan Peladang Tahun 2016 Berbanding Tahun 2015 Mengikut Purata Sampel (pg. 29), Laporan Tahunan 2016, MADA (2016) (Accessed on 23 Oct 2018)*

Chart by KRI

111 Household Income and Basic Amenities Survey Report 2016, DOS, pg. 26 & 28

Despite subsidies and incentives, in most cases, paddy cultivation alone is insufficient to support a household. As such, most paddy farmers have additional income from other sources. For example, a multinomial logistic regression study conducted in 2010 showed that part-time paddy farmers in the IADA in north-west Selangor had higher per capita monthly incomes if they had non-farm income (RM1,310) compared to full-time paddy farmers (RM656)[112].

In an ideal scenario, the issue related to the income of a paddy farmer should be viewed as part of a bigger picture and efforts should holistically consider the contribution of both paddy and non-paddy as well as farm and non-farm activities. However, due to the constraints of this report, the focus will be towards increasing a farmer's income through paddy cultivation with the assumption that it still comprises an important part of the household's source of income.

112 Nathan et al. (2014)

A farmer's income via the cultivation of paddy is essentially the net profit acquired at the end of the planting season upon selling the harvested paddy to the millers or brokers (Figure 4.5). The net profit is determined by the gross profit and the cost of production, with the following determining factors[113]:

a) **Total production** – Determined by yield and grain quality. It is the final volume of harvested paddy sold to the millers post-grading;
b) **Price of paddy** – Fixed at RM1,200/MT of harvested paddy; and
c) **Cost of production** – Influenced by farm management practices, prices of land, input and labour.

Since the government has standardised the GMP of paddy to RM1,200/MT, the following section will discuss issues related to the production volume and costs in paddy farming. There is ongoing research on the grading of paddy grains and the development of SOPs to ensure minimal post-harvest losses. However, this will not be discussed in this report.

Figure 4.5. Illustration on the sources of income for paddy farmers

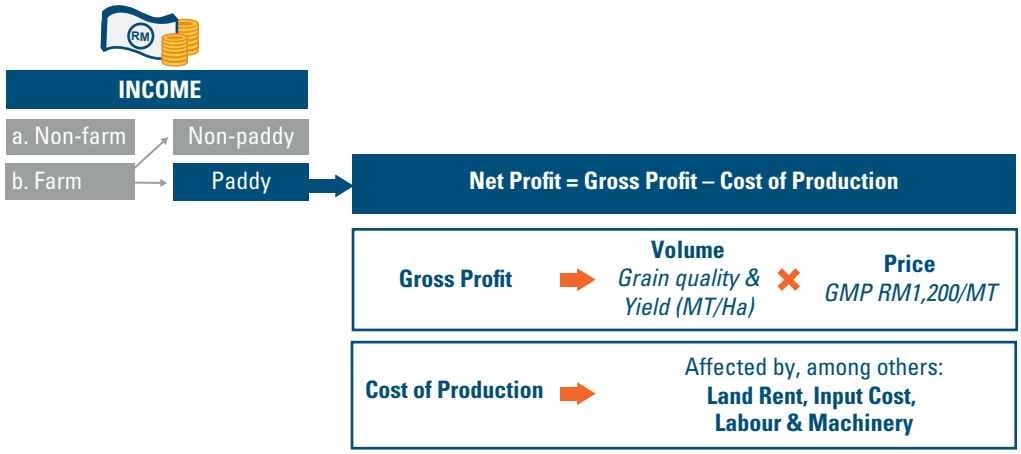


Illustration by KRI

113 Amin (1989)

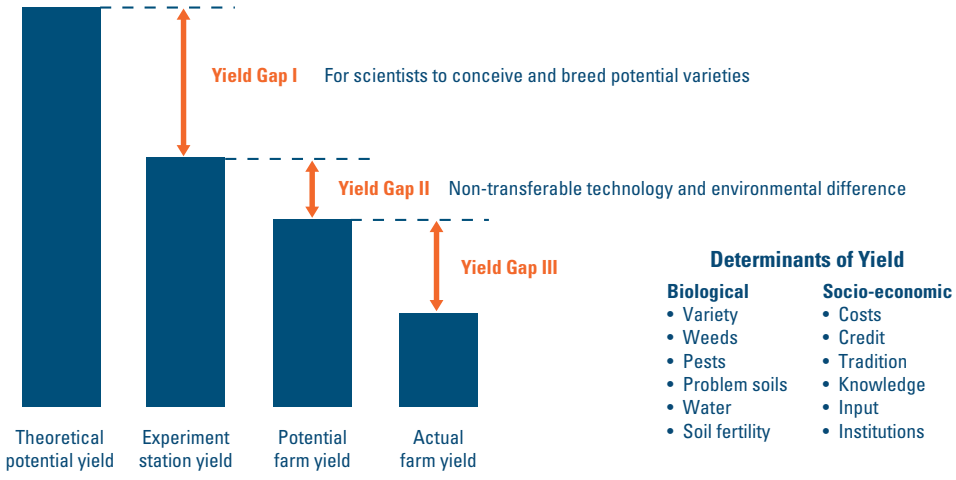
Farm Yield

A farmer's profit margin can be improved by increasing the total amount (in MT) of paddy harvested for each hectare of land. Furthermore, given that land, labour and resources are scarce and paddy farmers in Malaysia work on small land sizes, the national focus on increasing total national production has been on improving farm yield. In most cases, yield (MT/Ha) is used as a measure of farm productivity[114].

In agriculture, there are several types of yield gap, and the aim of a farmer is to reduce the gap between the potential farm yield and actual farm yield. According to FAO, this type of gap is termed Gap III (Figure 4.6) and can be reduced through effective farm management, optimal environmental conditions (soil fertility and climate), the variety of the paddy plant and the quality of the seed.

A farmer's aim is to reduce Gap III

Figure 4.6. Yield gap components for a given paddy variety



Source:
Figure adapted from the 'Rice and Narrowing the Gap' article, FAO (2004)

114 Fermont and Benson (2011)

A. Yield – Between Countries

Countries such as Australia and the US significantly out-rank Malaysia in average farm yield (Figure 4.7). It is recognised that farming practices in both countries are more advanced and better managed, which contribute to the higher yield. However, it is also worth highlighting that these countries grow paddy over the summer period (single-cropping) where there is an extended number of sunshine hours and higher solar radiation. Generally, the longer the photoperiod, the higher the yield. For example, the Riverina region in Australia has the world's highest yield in paddy cultivation due to a combination of higher solar radiation and longer daylight time (12 – 14 hours) during the growing season[115].

In terms of the average yield, countries in SEA performed less well compared to Australia or the US. In fact, despite being some of the world's largest rice producer and exporter, mainland SEA has lower farm yield compared to island SEA. Their high level of paddy production is attributed to having vast areas for paddy cultivation with a large supply of water from the Mekong River, coupled with relatively cheap labour[116]. In 2016, Thailand's paddy yield was 2.9 MT/Ha. On the contrary, countries in island SEA such as Malaysia, the Philippines and Indonesia performed better with a yield of 3.2 MT/Ha, 3.9 MT/Ha and 5.4 MT/Ha respectively, in the same year. The exception here is Vietnam whereby since the 1990s, the country's yield overtook Indonesia in 2001 and in 2016, its paddy yield was 5.6 MT/Ha[117].

The average annual growth rate in yield for other SEA countries in Figure 4.8 is higher than for Malaysia, ranging between 1.1%/year (Indonesia) to 2.4%/year (Vietnam) over a 30-year period. Malaysia, on the other hand, recorded an average annual growth rate of just 0.8%/year from 1986 to 2016.

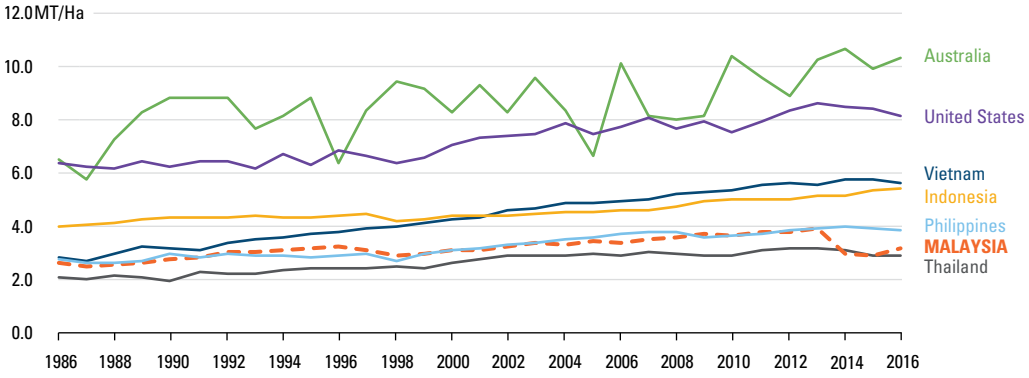
115 Farrell et al. (2003)
116 Elaborated further in the import subheading in Chapter 5
117 Paddy yield figures from FAOSTAT

To a certain extent, daylight hours and solar radiation could partly explain the higher average yield in both Australia and the US. However, the higher average annual growth rate in yield over three decades for Australia (2.9%/year), the US (0.9%/year) and other SEA countries (with lower GDP per capita) especially for Vietnam at 2.4%/year compared to Malaysia at just 0.8%/year, may be attributed to higher investments in R&D. This had led to regionally-unique varieties and improved farm management practices.

Considering the above observations, Malaysia may want to continue focusing on improving its average farm yield. Assuming a theoretical average yield of 6.0 MT/Ha, around 417,007 Ha[118] of planted area in the granary areas alone could produce an estimated 2.5m MT of paddy. Assuming a paddy to rice conversion rate of 65.0%, that equates to 1.6m MT of rice. This is about the amount produced in both granary and non-granary areas in 2016[119]. Increasing the national allocation towards R&D[120] to develop more varieties, better technologies, improved farm management and better extension programmes could help increase Malaysia's growth in farm yield.

Malaysia's growth in paddy yield over three decades is smaller compared to other rice producing countries

Figure 4.7. Paddy yield by country over three decades, 1986 – 2016 (MT/Ha)



Source:
Crops: Yield: Rice, paddy, FAOSTAT (Accessed 23 Oct 2018)
Chart by KRI

118 Table 3.1.3 Paddy Planted Area, Agrofood Statistics 2016, MOA (2016a)

119 Table 3.1.4, ibid.

120 This allocation of national resources to R&D should not be focused on a few agencies, but shared across other research entities. Refer to the Chapter 2 for further information.

B. Yield – Within the Country

Described in greater detail in Chapter 1, paddy cultivation in Malaysia comprises the designated granary areas and non-granary areas. Typically, the average yields in the granary areas are higher than in the non-granary areas (4.9 MT/Ha as compared to 4.0 MT/Ha in 2016[121]). The yield also varies between granary areas, with MADA, IADA Penang, IADA Ketara and IADA Barat Laut Selangor being the top performers with yields above 5.0 MT/Ha. These differences can be attributed to many combinatorial factors, including soil condition, weather, farm management, irrigation, pests and diseases and use of technology. In fact, in agriculture, acquiring optimal yield requires good farm management practices that have been modified to best suit the unique local conditions.

C. Yield – 27 PPKs in MADA

To show that even within the same region there can be differences, KRI conducted a statistical yield analysis within the MADA region comprising a total of 27 smaller areas called *Persatuan Peladang Kawasan* (PPK)[122]. Using Kruskal Wallis non-parametric testing and, subsequently, Dunn Bonferroni analysis (Table 4.1), the average yield for each PPK was compared against another. The results showed that there were significant ($P<0.05$) differences in yield between the different PPKs. For example, the yield in Kodiang is significantly lower than the yield in Jitra, Sungai Limau Dalam, Kerpan, Jerlun and Guar Chempedak.

This shows that even within the same MADA region, local factors are important determinants of farm yield. As the performance of the granary areas has a direct influence on the performance of the nation's paddy industry, it is important to further investigate at the PPK level the unique reasons for the different productivity levels and to identify potential factors of inefficiencies as opposed to comparing between granaries. This matter is discussed in the cost of production section.

121 Agrofood Statistics 2016, MOA (2016a)
122 Refer to Appendix for the methodology and full results

There is a significant difference in yield between PPKs in the MADA area

Table 4.1. Statistical comparison of the average yield between PPK Sungai Limau Dalam and other PPKs in MADA, 2016

PPK 1	26 other PPKs	PPK 1 (Yield MT/Ha)	PPKs (Yield MT/Ha)	Difference (MT)	P-value*
Sungai Limau Dalam	Alor Senibong	6.75	6.01	0.75	0.00
	Pengkalan Kundor	6.75	5.82	0.94	0.00
	Simpang Empat Kangkong	6.75	5.42	1.33	0.00
	Titi Hj. Idris	6.75	4.95	1.80	0.00
	Tajar	6.75	6.08	0.67	0.01
	Jitra	6.75	5.96	0.79	0.01
	Pendang	6.75	6.20	0.55	0.06
	Hutan Kampung	6.75	6.05	0.70	0.40
	Kangar	6.75	5.80	0.96	0.52
	Kubang Sepat	6.75	6.27	0.49	0.53
	Kobah	6.75	6.22	0.53	0.71
	Batas Paip	6.75	6.68	0.07	1.00
	Kayang	6.75	6.64	0.11	1.00
	Permatang Buluh	6.75	6.63	0.13	1.00
	Tambun Tulang	6.75	6.61	0.15	1.00
	Guar Chempedak	6.75	6.90	0.15	1.00
	Tunjang	6.75	6.52	0.23	1.00
	Simpang Empat	6.75	6.48	0.28	1.00
	Kodiang	6.75	6.47	0.29	1.00
	Jerlun	6.75	6.47	0.29	1.00
	Bukit Besar	6.75	6.46	0.30	1.00
	Arau	6.75	6.46	0.30	1.00
	Sanglang	6.75	6.43	0.33	1.00
	Kerpan	6.75	6.42	0.34	1.00
	Kepala Batas	6.75	6.37	0.39	1.00
	Kuala Sungai	6.75	6.12	0.63	1.00

Notes:

1. **Kruskal Wallis and Dunn Bonferroni non-parametric testing. A p-value of less than 0.05 is considered significant*
2. *The above is representative of the PPK Sungai Limau Dalam against all other PPKs. Refer to Appendix for the full results and sampling details*
3. *Green cells are PPKs that have significantly different yield compared to PPK Sungai Limau Dalam*

Source:
Cross Cutting Survey (CSS) data from Musim 1 2016 (pers. comm. with MADA)
Tables and analysis by KRI

Cost of Production

Efforts to increase grain production and yield may contribute to the total national supply but have little impact on farmers' income if the cost of production is still high. The best combination would be a farm that produces maximum yield by using high-performing plant varieties and effective management practices that can minimise farm costs. Unfortunately, barriers to achieving this combination are the demographics of paddy farming which comprise many ageing farmers working on fragmented land and/or small land sizes leading to higher costs of production.

A. Cost of Production – Between Countries

How does Malaysia fare in terms of the cost of cultivating paddy, compared to other rice producing countries? When comparing the cost of production between countries, a national average may not be an ideal representation given the large differences between regions within a country[123]. Noting this, instead of taking national averages, Bordey and colleagues (2016) selected six key paddy growing areas from six different countries (China, Indonesia, the Philippines, Thailand, Vietnam and India) in a comparative study on paddy cultivation in Asia. Among the criteria, these key growing areas must be irrigated and planted with paddy at least twice a year. The researchers obtained about 100 respondents within each area and tabulated the cost of production for the year 2014.

KRI then compared the data published by Bordey and colleagues (2016) against the cost of production data from MADA. This is because MADA is the nation's largest paddy producing area, it is irrigated and planted with paddy twice a year. Figure 4.8 showed that the cost of production for the MADA area in 2014 at USD1,151/Ha (with subsidy) is actually below the cost of production in key rice growing areas in other importing countries such as the Philippines, China and Indonesia, but is still higher than in exporting countries such as Vietnam, Thailand and India.

123 Bordey et al. (2016)

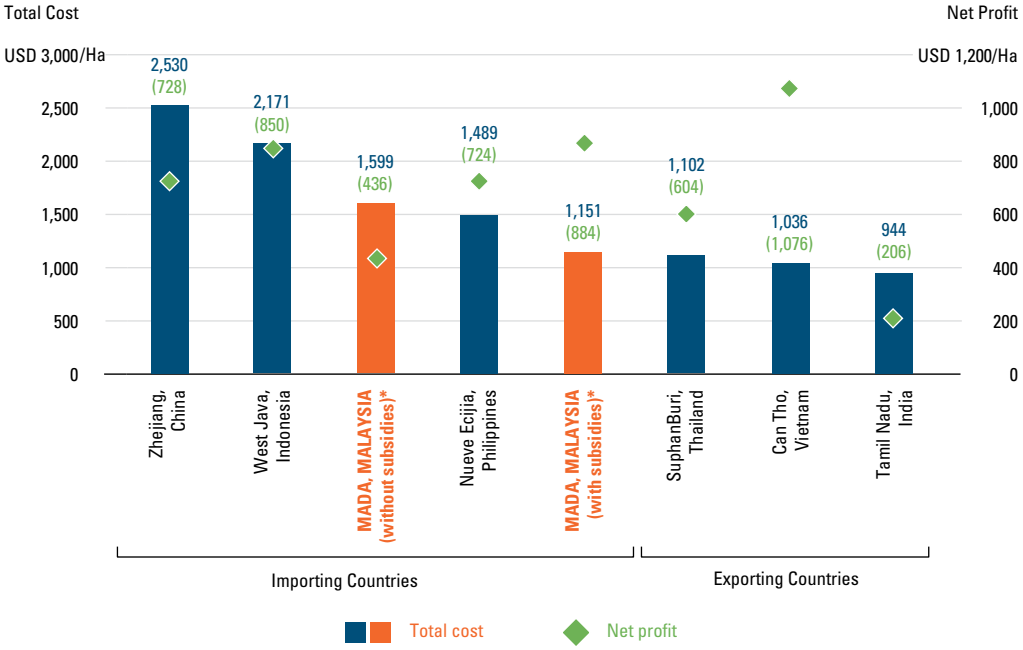
Contrary to popular belief that Malaysia's cost of producing paddy is high, with subsidies included[124], its cost of production is not that much higher than that of rice exporting countries and the net profit is in fact the second highest (USD884/Ha) after Can Tho (Vietnam). The net profit acquired by farmers in MADA surpasses those in the key rice growing regions of Thailand, Indonesia, the Philippines, China and India. However, the cost of production increases when the input subsidy is removed, rising to USD1,599/Ha and resulting in being the second lowest net profit at USD436/Ha.

"Contrary to popular belief that Malaysia's cost of producing paddy is high, with subsidies included, its cost of production is not that much higher than that of rice exporting countries"

124 Cost of production with subsidies: lower cost of production for farmers as some of the inputs are subsidised

Malaysia's cost of production is lower than other rice importing countries but higher than rice exporting countries

Figure 4.8. Cost of production in key rice growing areas in seven countries, 2014 (USD/Ha)



Notes:

1. *The total cost in RM/Ha is converted to USD/Ha using the mean value of the daily exchange rates data from IMF*
2. ** Cost of production (without subsidies): the cost of production under the scenario where farmers would need to bear the input cost should there be no government input subsidies*

Sources:

1. *Cost of production for Malaysia taken from Jadual 7.15 Kos pengeluaran padi sehektar mengikut musim di kawasan Muda, pg. 94, Buku Perangkaan MADA 2014, MADA (2014)*
2. *Total amount of subsidies: RM1,466.60 (449.39 USD) from pg. 85, Buku Perangkaan MADA 2014*
3. *The exchange rate from IMF Exchange Rates (Accessed 14 Nov 2018)*
4. *Cost of production for other countries from Appendix Table 10.1a (pg. 127) in Bordey et al. (2016)*

Chart by KRI

B. Cost of Production – Between Granary Areas

What is then the pattern in the cost of production across the different regions in Malaysia? Often, the performance of one granary area is compared to another, especially against IADA Barat Laut Selangor (Sekinchan). Historically, IADA Barat Laut Selangor has always had higher average yield and is seen as the exemplary granary area, while MADA is considered important due to its total size in hectarage, allowing it to be the highest contributor in terms of paddy volume (Figure 1.13). Recently, many of the granary areas have seen improvements in the average yield and the yield differences between the granary areas are narrowing and almost negligble. This is especially true for IADA Barat Laut Selangor, IADA Pulau Pinang, IADA Ketara and MADA all with an average yield ranging 5.3 to 5.8 MT/Ha (Figure 1.14).

In 2016, the difference in the net profit for farmers (owners) in the MADA area compared to IADA Barat Laut was less than RM500 (Table 4.2). The improved yield in MADA, the standardisation of the GMP across the nation, a higher cost of production in IADA Barat Laut Selangor and a negligible difference in the cut-off rate between the two granaries may have explained this outcome. In fact, when the cost of rent was included, the difference was large at almost RM3,000, given that land rental price in IADA Barat Laut Selangor is higher[125].

Having said this, it is important to emphasise that agriculture and farm-level performance is site-specific and different solutions are required for different locations. In this case, it is better to compare a top performing location to another location within the same region, as opposed to comparing different regions or granaries in Malaysia. Section C will provide an overview of the cost of production within MADA and a breakdown of the cost. In section D, KRI researchers conducted a statistical analysis to evaluate the performance of the 27 different PPK areas in MADA and will elaborate further on the results.

"Agriculture and farm-level performance is site-specific and different solutions are required for different locations"

125 Pers. comm. with *Bahagian Perancangan dan Pemantauan*, IADA BLS (2018).

Table 4.2. Farmer's cost of production and profit in MADA and IADA Barat Laut Selangor (BLS), 2014 and 2016

Granary	Yield (MT/ Ha)	GMP (RM/ MT)	Price subsidy (RM/MT)	Cut-off rate (%)[a]	Cost of production (Owner) (RM/Ha)	Net profit (Owner) (RM/Ha)[c]	Cost of production (Renter) (RM/Ha)[b]	Net profit (Renter) (RM/Ha)[c]	No. of farmers	Planted area (Ha)
2014										
MADA	5.54	1,200	248.10	17	2,174.28	4,484.37	3,766.26	2,892.39	57,635	190,127
2016										
MADA	5.28	1,200	300.00	20	2,208.50	4,127.50	3,825.59	2,510.41	55,130	201,239
IADA BLS	5.83	1,200	300.00	20	3,311.76	3,684.24	7,311.76*	-315.76	9,693	38,042

Notes:

[a] *Cut-off rates in this table is the prevalent cut-off rate in the respective year based on KRI's engagement with MADA and IADA*

[b] *Renter's cost of production includes land rental*

[c] *Net profit = [(100% - Cut-off Rate) × Yield × (GMP+ Price Subsidy)] – Cost of Production. The first term in the right-hand side of the equation, [(100% - Cut-off Rate) × Yield × (GMP+ Price Subsidy)], refers to farmer's revenue from selling paddy according to the cut-off rate*

** Based on an estimated land rent per hectare provided by IADA (pers. comm. November 2018)*

Sources:

1. *Yield and planted area data from Table 3.1.9 Average yield of paddy and Table 7.1 Basic information of Integrated Agriculture Development Area in Agrofood Statistics 2016, MOA (2016a)*
2. *MADA farmer's cost of production data is based on Jadual 7.15 Kos pengeluaran padi sehektar mengikut musim di kawasan Muda in Perangkaan MADA 2014, MADA (2014); and Cross-Cutting Survey data from Bahagian Strategi dan Teknologi Maklumat MADA via pers. com.*
3. *Number of farmers in 2014 data are from 3.1 Kawasan Kendalian in Maklumat Perangkaan Industri Padi dan Beras 2016, MOA (2016b)*
4. *Number of farmers in MADA in 2016 is from page 13 of Laporan Tahunan 2016, MADA (2016)*
5. *Number of farmers and cost of production in IADA BLS in 2016 is based on pers. comm. with Bahagian Perancangan dan Pemantauan, IADA BLS (2018)*

Table by KRI

C. Cost of Production – MADA

A closer inspection of the cost of production in MADA showed that land rental is the largest contributory factor and has been increasing over the years. The cost of land rental is more than 40% of the total cost of cultivating paddy in MADA (Figure 4.9). It has increased from below RM900/Ha in 1997 to almost RM1,600/Ha in 2014 (Figure 4.10). The same may be happening in other granary areas. However, there is limited data on land rental cost to confirm this. Similarly, machinery cost has been increasing and, in 2014, it comprised about 30% of the total cost of production. Labour cost and input cost, in this case are smaller.

A stronger bargaining power of farmers when negotiating with suppliers, service providers and landlords may help to control drastic increases in the cost of production. It is also worthwhile to better monitor the rental market within the region and formalise the rental process as rental agreements are mostly done verbally. It is also important to better understand the rental market and changes over time, landlord's motivations for renting and/or increasing rent and the number of farmers who are renters, owners, and those that are both renter and owner (25%, 38% and 34% respectively in 2014)[126]. Currently, there is little temporal information on this.

"A stronger bargaining power of farmers when negotiating with suppliers, service providers and landlords may help to control drastic increases in the cost of production"

126 Others is 3%. Based on data from *Jadual 3.1 Peladang dan Taraf Pemegangan Tanah Sawah* (pg. 31), MADA (2014)

Table 4.3. Cost of production breakdown and net profit for a renter in MADA, 2014 (RM/Ha)

Description	Unit (RM/Ha)	Formula
Gross Profit (per Ha)		
Yield (MT/Ha)	5.54	(A)
Cut-off rate (%)[1]	17%	(B)
Paddy price per MT[2]	1,448.10	(C)
Gross profit (per Ha)	6,658.65	(A) × [100% - (B)] × (C) = (D)
Production Cost (per Ha)		
Land rent	1,591.98	
Input cost[3]	663.40	
Labour cost[4]	343.42	
Machinery cost[5]	1,146.30	
Others[6]	21.16	
TOTAL cost (with input subsidies)	3,766.26	(E)
Input subsidies[7]	1,466.60	(F)
TOTAL cost (without input subsidies)	5,232.86	(E) + (F) = (G)
Net Profit (per Ha)		
Net profit with input subsidies	2,892.39	(D) – (E)
Net profit without input subsidies	1,425.79	(D) – (G)

Notes:

1 *The cut-off rate in 2014 was 17%*

2 *Paddy price is the sum of Guaranteed Minimum Price (GMP) (currently at RM1,200/Ha) and paddy price subsidy under Skim Subsidi Harga Padi (at RM248.10/Ha before it was increased to RM300/Ha in 2016)*

3 *Input cost: cost of paddy seeds, fertilisers, pesticides, and seed treatments*

4 *Labour cost: wages for sowing seeds, fertilising, applying pesticides, and liming*

5 *Machinery cost: cost of ploughing, transplanting, harvesting, and transportation*

6 *Others: quit rent and irrigation duty*

7 *Fertiliser subsidy (Subsidi Baja Padi Kerajaan Persekutuan): RM621.60/Ha. Another input subsidy (Skim Insentif Pengeluaran Padi): RM845.00/Ha*

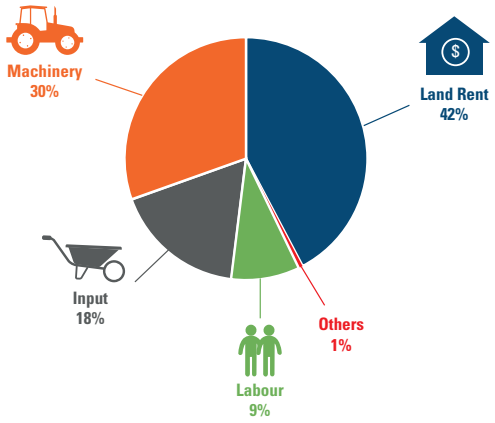
The slight discrepancy in calculations may occur due to rounding off

Sources:

Jadual 7.2 Pengeluaran Padi Bersih Kedah, MADA, MADA Kedah dan MADA Perlis (pg. 69) and Jadual 7.15 Kos pengeluaran padi sehektar mengikut musim di kawasan Muda (pg. 94) in MADA (2014) and calculations by KRI

Land rental is more than 40% of the total cost of paddy cultivation in MADA

Figure 4.9. Cost of paddy production breakdown for a renter in MADA, 2014 (RM/Ha)

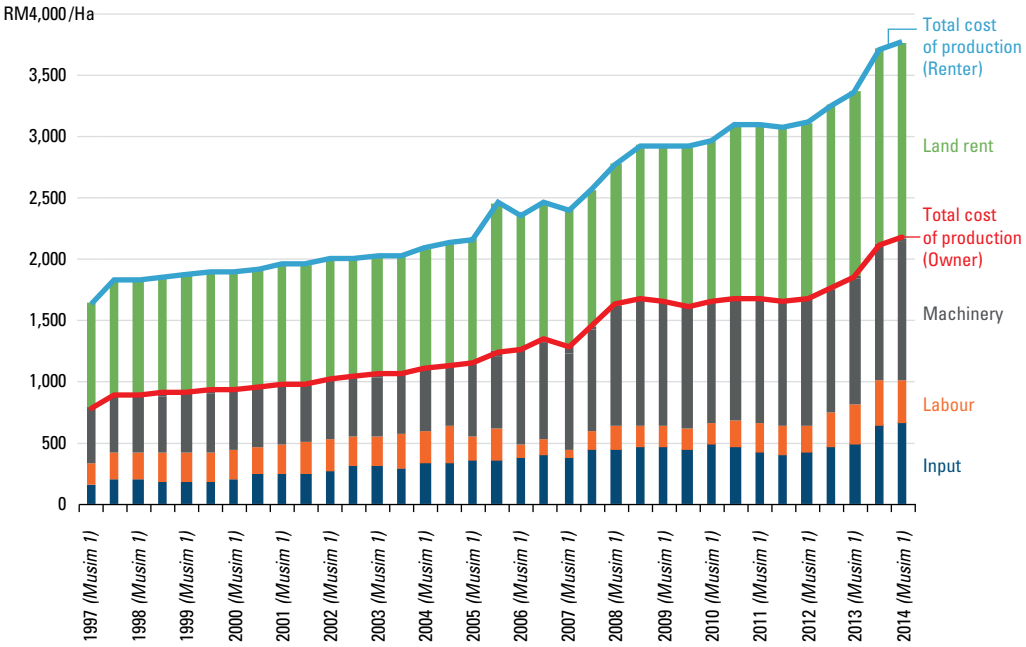


Notes:

1. *Input cost consists of costs of paddy seeds, fertilisers, pesticides and seed treatments*
2. *Labour cost consists of wages for sowing seeds, fertilising, applying pesticides and liming*
3. *Machinery cost consists of costs of ploughing, transplanting, harvesting and transportation*
4. *Others include quit rent and irrigation duty*

Source:
Jadual 7.15 Kos pengeluaran padi sehektar mengikut musim di kawasan Muda in Perangkaan MADA 2014, MADA (2014)
Chart by KRI

Figure 4.10. Cost of paddy production in MADA 1997 – 2014, by season (RM/Ha)



Notes:

1. *Input cost consists of costs of paddy seeds, fertilisers, pesticides and seed treatments*
2. *Labour cost consists of wages for sowing seeds, fertilising, applying pesticides and liming*
3. *Machinery cost consists of costs of ploughing, transplanting, harvesting and transportation*
4. *Others include quit rent and irrigation duty*

Source:

Jadual 7.15 Kos pengeluaran padi sehektar mengikut musim di kawasan Muda in Perangkaan MADA 2014, MADA (2014)
Chart by KRI

D. Cost of Production and Return on Investment – 27 PPKs in MADA

MADA is the nation's largest producer of rice. Each year, around 100,000 Ha of land is cultivated with paddy by more than 50,000 farmers. This area can be divided into 27 smaller areas, called PPKs. Each PPK has its own management structure and central office and acts as the point of contact for the authorities, the private sector and researchers, as well as a channel for extension programmes. Every season, MADA conducts a survey (Cross Cutting Survey, CSS) comprising 25 respondents from each PPK, totalling a sample size of 675.

KRI conducted non-parametric statistical testing on the CSS data to compare the cost of production between PPKs. Results showed that there is a significant difference in the cost of production between PPKs (Table 4.4). When Sungai Limau Dalam was compared to 26 other PPKs, the cost of production was significantly different ($P<0.05$) to some PPKs such as Tunjang, Kubang Sepat and Tambun Tulang. It is not significantly different to PPKs known to be top performers such as Guar Chempedak, Sanglang and Kerpan, in agreement that Sungai Limau Dalam is also a top PPK (See Appendix for a full list of analysis).

When compared to the average yield, some PPKs showed a higher return on investment (ROI) than others (Table 4.5 and 4.6). Top performing PPKs include Sungai Limau Dalam, Kerpan, Tajar, Guar Chempedak, Arau and Sanglang as they have a lower cost of production but a higher yield, leading to a larger net profit margin for both 2015 and 2016 data. There are many possible reasons for this: closer engagements/cooperation with MADA due to its geographical vicinity; active involvement with researchers on new technologies; adoption of contract farming; better environmental conditions; and an effective PPK management team, to name a few. In conclusion, it would be worthwhile for the local authorities to identify location-specific differences between PPKs with low and high ROIs to allow for more effective and targeted improvements.

Coincidentally, Sanglang and Kerpan are contract farming areas and both PPKs were ranked top 10 in ROI in 2015 and 2016. The next section intends to explore the issue related to economies of scale and the potential of contract farming to help improve farm management and achieve better ROI for other PPKs.

Table 4.4. Statistical comparison of the average cost of production between PPK Sungai Limau Dalam and other PPKs in MADA, 2016

PPK 1	26 other PPKs	PPK 1 (RM/Ha)	PPKs (RM/Ha)	Difference (RM/Ha)	P-value*
Sungai Limau Dalam	Tunjang	1,712.00	2,593.13	881.13	0.00
	Kubang Sepat	1,712.00	2,506.23	794.23	0.00
	Tambun Tulang	1,712.00	2,427.56	715.56	0.00
	Simpang Empat Kangkong	1,712.00	2,400.46	688.46	0.00
	Kayang	1,712.00	2,399.39	687.39	0.00
	Pendang	1,712.00	2,376.03	664.02	0.00
	Bukit Besar	1,712.00	2,350.87	638.86	0.00
	Alor Senibong	1,712.00	2,304.01	592.00	0.00
	Jerlun	1,712.00	2,233.11	521.11	0.00
	Hutan Kampung	1,712.00	2,297.04	585.04	0.00
	Kobah	1,712.00	2,236.52	524.52	0.00
	Pengkalan Kundor	1,712.00	2,203.88	491.88	0.00
	Kepala Batas	1,712.00	2,208.05	496.05	0.01
	Jitra	1,712.00	2,189.31	477.31	0.01
	Permatang Buluh	1,712.00	2,174.96	462.96	0.01
	Kuala Sungai	1,712.00	2,190.03	478.02	0.02
	Kodiang	1,712.00	2,105.38	393.37	0.06
	Kerpan	1,712.00	2,086.76	374.76	0.15
	Batas Paip	1,712.00	2,102.76	390.76	0.27
	Titi Hj. Idris	1,712.00	2,052.52	340.52	0.73
	Guar Chempedak	1,712.00	2,094.19	382.18	0.78
	Sanglang	1,712.00	2,001.42	289.42	1.00
	Kangar	1,712.00	1,999.42	287.42	1.00
	Arau	1,712.00	1,999.15	287.14	1.00
	Simpang Empat	1,712.00	1,946.48	234.48	1.00
	Tajar	1,712.00	1,717.97	5.97	1.00

Notes:

1. **Kruskal Wallis and Dunn Bonferroni non-parametric testing. P-value of less than 0.05 is considered significant*
2. *The above is representative of the PPK-level statistical analysis for one PPK: Sungai Limau Dalam against other PPKs*
3. *Refer to Appendix for the full results for all other PPKs and sampling details*
4. *Rent was omitted as some PPKs had no renters. The cost of tax was also omitted as it is a fixed cost across all data*

Source:
Cross Cutting Survey (CSS) data from Musim 1 2016 (pers. comm. with MADA)
Table and analysis by KRI

Table 4.5. The average cost of production and yield for 27 PPKs in MADA and the return on investment (ROI), *Musim* 1, 2015

	PPK Area	Cost of Production[2] (RM/Ha)	Yield (kg/ha)	Ratio (COP/Yield)	Net profit (RM/Ha)	ROI per hectare (Net Profit/COP)
1	Kerpan	1,881.90	6,830.12	0.276	6,030.66	3.20
2	Sungai Limau Dalam	1,884.70	6,657.27	0.283	5,827.61	3.09
3	Jerlun	2,015.30	6,936.16	0.291	6,020.10	2.99
4	Tajar	1,856.55	6,356.57	0.292	5,507.41	2.97
5	Kepala Batas	1,852.13	6,213.65	0.298	5,346.26	2.89
6	Arau	1,981.98	6,338.62	0.313	5,361.18	2.70
7	Sanglang	2,047.48	6,526.41	0.314	5,513.24	2.69
8	Guar Chempedak	2,285.65	7,104.36	0.322	5,944.61	2.60
9	Kangar	1,844.90	5,572.01	0.331	4,610.16	2.50
10	Kayang	2,214.39	6,638.35	0.334	5,476.01	2.47
11	Bukit Besar	2,237.31	6,535.21	0.342	5,333.60	2.38
12	Batas Paip	2,249.91	6,446.68	0.349	5,218.44	2.32
13	Tambun Tulang	2,261.41	6,463.65	0.350	5,226.60	2.31
14	Jitra	2,339.76	6,673.68	0.351	5,391.56	2.30
15	Kodiang	2,085.59	5,783.48	0.361	4,614.46	2.21
16	Simpang Empat	2,317.64	6,425.00	0.361	5,125.59	2.21
17	Permatang Buluh	2,170.20	5,935.43	0.366	4,705.88	2.17
18	Kobah	2,337.40	6,271.68	0.373	4,928.22	2.11
19	Alor Senibong	2,422.40	6,063.90	0.399	4,602.51	1.90
20	Kubang Sepat	2,582.91	6,360.26	0.406	4,785.32	1.85
21	Titi Hj. Idris	2,419.72	5,932.92	0.408	4,453.45	1.84
22	Pendang	2,475.22	6,043.00	0.410	4,525.47	1.83
23	Hutan Kampung	2,430.42	5,881.78	0.413	4,383.50	1.80
24	Kuala Sungai	2,780.21	6,668.41	0.417	4,945.01	1.78
25	Pengkalan Kundor	2,446.11	5,378.02	0.455	3,784.22	1.55
26	Simpang Empat Kangkong	2,478.21	5,350.20	0.463	3,719.89	1.50
27	Tunjang	2,602.43	5,380.57	0.484	3,630.85	1.40

Notes:

1. *Refer to Appendix for the full results and sampling details*
2. *Rent was omitted as some PPKs had no renters, the cost of tax was also omitted as it is a fixed cost across all data*
3. *Net profit = [(100% - Cut-off Rate) × Yield × (GMP+ Price Subsidy)] – Cost of Production. The cut-off rate is 20%, the GMP is RM1,200/MT, and the price subsidy in 2015 was RM248.10/MT*

Source:
Cross Cutting Survey (CSS) data from Musim 1 2016 (pers. comm. with MADA)
Table and analysis by KRI

Table 4.6. The average cost of production and yield for 27 PPKs in MADA and the return on investment (ROI), *Musim* 1, 2016

	PPK Area	Cost of Production[2] (RM/Ha)	Yield (kg/ha)	Ratio (COP/Yield)	Net profit (RM/Ha)	ROI per hectare (Net Profit/COP)
1	Sungai Limau Dalam	1,712.00	6,754.70	0.253	6,393.64	3.73
2	Tajar	1,717.97	6,084.74	0.282	5,583.72	3.25
3	Simpang Empat	1,946.48	6,478.50	0.300	5,827.72	2.99
4	Guar Chempedak	2,094.19	6,901.72	0.303	6,187.87	2.95
5	Arau	1,999.15	6,455.03	0.310	5,746.89	2.87
6	Sanglang	2,001.42	6,428.81	0.311	5,713.15	2.85
7	Batas Paip	2,102.76	6,683.03	0.315	5,916.88	2.81
8	Kerpan	2,086.76	6,416.71	0.325	5,613.29	2.69
9	Kodiang	2,105.38	6,466.55	0.326	5,654.48	2.69
10	Permatang Buluh	2,174.96	6,626.49	0.328	5,776.83	2.66
11	Kangar	1,999.42	5,798.12	0.345	4,958.32	2.48
12	Jerlun	2,233.11	6,466.30	0.345	5,526.45	2.47
13	Kepala Batas	2,208.05	6,366.38	0.347	5,431.61	2.46
14	Kuala Sungai	2,190.03	6,124.68	0.358	5,159.59	2.36
15	Kobah	2,236.52	6,223.70	0.359	5,231.92	2.34
16	Kayang	2,399.39	6,642.51	0.361	5,571.62	2.32
17	Bukit Besar	2,350.87	6,457.69	0.364	5,398.36	2.30
18	Tambun Tulang	2,427.56	6,609.31	0.367	5,503.61	2.27
19	Jitra	2,189.31	5,960.57	0.367	4,963.37	2.27
20	Pengkalan Kundor	2,203.88	5,815.65	0.379	4,774.90	2.17
21	Hutan Kampung	2,297.04	6,052.85	0.379	4,966.38	2.16
22	Pendang	2,376.03	6,204.00	0.383	5,068.77	2.13
23	Alor Senibong	2,304.01	6,005.13	0.384	4,902.15	2.13
24	Tunjang	2,593.13	6,520.68	0.398	5,231.69	2.02
25	Kubang Sepat	2,506.23	6,268.47	0.400	5,015.93	2.00
26	Titi Hj. Idris	2,052.52	4,950.58	0.415	3,888.18	1.89
27	Simpang Empat Kangkong	2,400.46	5,421.55	0.443	4,105.40	1.71

Notes:

1. *Refer to Appendix for the full results and sampling details*
2. *Rent was omitted as some PPKs had no renters, the cost of tax was also omitted as it is a fixed cost across all data*
3. *Net profit = [(100% - Cut-off Rate) × Yield × (GMP+ Price Subsidy)] – Cost of Production. The cut-off rate is 20%, the GMP is RM1,200/MT, and the price subsidy is RM300/MT*

Source:
Cross Cutting Survey (CSS) data from Musim 1 2016 (pers. comm. with MADA)
Table and analysis by KRI

Reducing Cost of Production – Economies of Scale & Farm Management

In theory, attaining economies of scale in farming is seen as a way to improve farm management and reduce the cost of production. Economies of scale can be achieved when there is a reduction of the average cost per unit (in this case per hectare) as the size of the farm increases, since costs can be spread over a larger area and farming can be made more efficient. However, in practice, economies of scale are more difficult to achieve and can be region-specific.

In fact, there are cases where productivity is higher in smaller land sizes. This is the case when an area relies fully on family labour with low technological adoption[127]. FAO (2018)'s *Dynamic Development, Shifting Demographics, Changing Diets* book elaborated that family labour has incentives to work harder than hired labour. However, in areas where there is an adoption of technologies and labour is expensive, economies of scale could work. For example, it is cheaper to hire one harvester to visit one site and harvest a large area, rather than to have the same harvester come in multiple times to harvest small areas managed by multiple individuals. In Japan, the highest profits are attained when the paddy farm size is between 5 and 10 Ha[128]. In Korea, the largest farms (10 Ha and above) have the lowest average costs of production[129].

In conclusion, the ideal land area and the need for economies of scale are site-specific. Malaysia likely falls in between the two scenarios described above.

KRI stakeholder engagements with producers and local authorities in the Northern Peninsular revealed that paddy farmers indeed experience issues with economies of scale due to the small farm size.

127 Dynamic Development, Shifting Demographics, Changing Diets, FAO (2018)
128 Otsuka (2015) as cited in FAO (2018)
129 Statistics Korea (2017) as cited in FAO (2018)

In 2016, a total of 194,931 paddy farmers worked on 681,342 Ha of land in Malaysia[130]. This equates to an estimation of just 3.5 Ha of cultivated paddy land per farmer. To help minimise the cost of production, it is therefore imperative that the issue of economies of scale is addressed. Unfortunately, land consolidation or getting individual farmers to coordinate their farming activities is a challenging process. Furthermore, to maximise the reduction of costs through economies of scale, this process needs to be achieved together with good farm management and extension programmes.

Both the public and the private sector have taken numerous initiatives to address this problem with mixed results (Table 4.7). These initiatives include:

a) **Land consolidation** – Federal Land Consolidation and Rehabilitation Authority (FELCRA);
b) **Centralised farming** – Entry Point Project (EPP) 10 MADA Estate Programme and PPK initiatives; and
c) **Contract farming** – A shared-risk approach between the downstream private sector and the producers (See Box Article 6).

While the lack of economies of scale is frequently cited by almost all stakeholders engaged, there have not been any quantitative studies conducted to identify the incidence of diseconomy, its impact (if any) or the ideal size for economies of scale in paddy farming. When asked, stakeholders responded that the optimal farm size per manager varies from 10 Ha to as high as 30 Ha.

Identifying the optimal farm size to achieve economies of scale is important. Too large would require a higher level of professional management, which may not be available in rural areas, while targeting a size that is still too small may risk not obtaining the benefits from the efforts taken to increase the farm size. Thus, further research into this issue is crucial.

"There have not been any quantitative studies conducted to identify the incidence of diseconomy, its impact (if any) or the ideal size for economies of scale in paddy farming"

130 *Statistik Tanaman (Sub-Sektor Tanaman Makanan)* 2017, DOA (2017)

Table 4.7. Comparing two initiatives introduced to help improve farm productivity and increase economies of scale

	Northern Corridor Implementation Authority (NCIA)	MADA NKEA Estate
Farm Model	Contract farming model	Estate model
Strengths	• Brings multinational and local companies closer to the farmers and vice versa. Improves extension programme and the quality of paddy produced • While it still involves multiple farmers, the private company acts as a central coordinator and often works closely with farmers throughout the production process	• Improves economies of scale • Improves coordination between irrigation activities and farm activities • Reduces illegal activities (farm is better monitored)
Management style	Semi-Private	Government Agency
Role	Funds, extension programme, link between organisations, farm coordination	Farm management, extension programme
Primary source of financing	Government and private	Government
Target areas	Low-yielding areas (less than 4.0 MT/Ha) in Penang, Kedah and Perlis	MADA region
Project Objective	8.0 MT/Ha	8.0 MT/Ha
Projects/Locations	NCIA-Runduk Padi in Batu Kurau, Perak NCIA-Nestlé in Kerpan, Kedah	Throughout the MADA area
Success	• 58 Ha of idle land at Batu Kurau, Perak had the yield increase from 2.0 MT/Ha to 4.0 MT/Ha within two years • 800 Ha of land in Kerpan has seen an increase from 4.5 MT/Ha to 7.0 MT/Ha after two planting seasons	• From 5,000 Ha of land in 2011 to 25,000 Ha of land under the estate programme in 2015 • Average yield difference is 1.0 MT/Ha compared to non-NKEA EPP area (pers. comm. MADA 2016)
Challenges	Projects are on a case-by-case basis, unique to a specific location. Because of this, it is difficult to implement each successful model to other areas	Farmers are reluctant to fully participate in the programme

Source:
KRI's stakeholder engagements with MADA and NCIA
Table by KRI

Contract Farming – Improving Farmers' Income and Strengthening the Supply Chain

One of the key takeaways of the 2016 Asian Development Bank (ADB) Food Security Forum held in Manila is the development of Public-Private-Partnership (PPP) as part of a solution towards improving smallholder productivity. One such approach is to embrace contract farming as it could improve the efficiency of the supply chain and increase farmers' net profit in a sustainable manner as opposed to government cash handouts or subsidies.

In this shared-risk system, the public sector provides a supportive environment to allow the private sector (producers and downstream players such as millers and food manufacturers) to drive the economy by cooperating and supporting the farmers. It is a win-win situation: in return for providing farm advice, management and extension services to the farmers, the midstream players are able to obtain a consistent supply of quality grains according to their required standards. The farmers, upon receiving adequate training and information, would be able to increase their farm yield and quality, thereby selling their harvests at competitive prices and earning higher profit margins.

Contract farming is "an agricultural production system carried out according to an agreement between a buyer and farmers, which establishes conditions for the production and marketing of a farm product or products"[131]

131 FAO (2012)

This form of agreement allows farmers to be connected to the global value chain in a market-oriented commercial production. It links farmers and buyers through:

- Contracting firms/buyers provide farmers with market information, technology and skills; and
- Farmers provide goods at an agreed price, volume and quality.

Contract farming may be favourable to the government because:

- It does not require high and continuous public expenditure as it is private sector-driven;
- It is initiated by the private sector with a vested interest in the farmer's welfare and farm productivity;
- It is a new and low-risk strategy, as opposed to continue pushing for cooperatives, which may require large initial capital injections from the government; and
- It does not marginalise the midstream players. Previous programmes such as *'Jihad Memerangi Orang Tengah'* (Jihad Against the Middlemen) have the tendency to undermine the important role of the midstream players.

Policies governing contract farming should allow manufacturers to make profits, but at the same time ensure income stability and farm management improvements for farmers. On the contrary, policies that stifle manufacturers (Chapter 5) should be avoided as they only create more friction and distrust between the farmers and millers. This further weakens the linkage between the production and midstream segment of the supply chain.

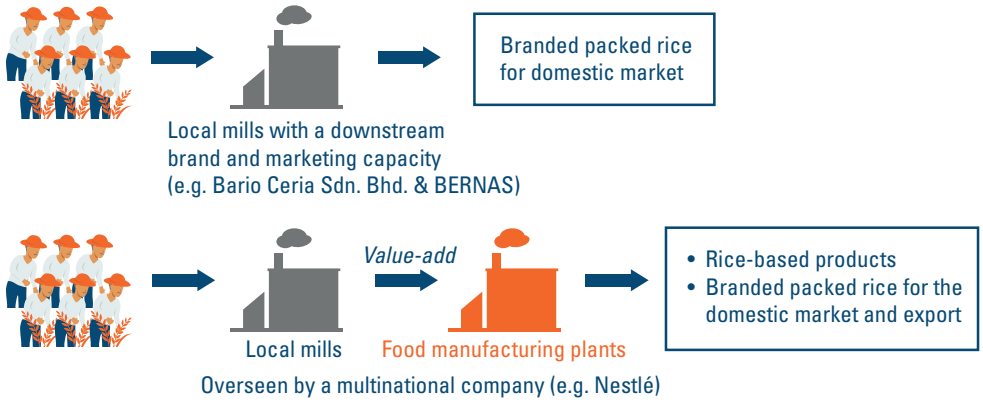
In Malaysia, contract farming has been implemented in one way or another that fits the definition above, either via written contracts or through mutual understandings. Several downstream companies are already exploring this in the paddy and rice industry with promising outcomes (Box Article 6).

BOX ARTICLE 6: Contract Farming in Paddy Cultivation

There are a few examples of contract farming within the paddy and rice industry. These can be simplified into two forms:

a) Farmers contracting with a miller that has a downstream food packaging and marketing capacity where the rice is sold primarily in the domestic market; and
b) Farmers contracting with a multinational food manufacturing company whereby the final product is value-added and sold internationally (Figure 4.11).

Figure 4.11. The two types of contract farming present in Malaysia



Examples of private midstream companies participating in paddy contract farming (informal/formal agreements) are further elaborated and include:

a) Nestlé Paddy Club, over 800 Ha in Kerpan and Sanglang, Kedah;
b) NCIA-Runduk Padi Sdn. Bhd. project over 50 Ha in Batu Kurau, Perak;
c) *Program Rakan Ladang Dibuk* covering about 29 Ha by Dibuk in Kedah;
d) BERNAS initiative over 10 Ha of land in Pasir Putih and Besut; and
e) Bario Ceria Sdn. Bhd. rice farming project with the Kelabit people in Bario, Sarawak.

Nestlé (Malaysia) Berhad with Kedah farmers[132]

One such initiative is the Shared Value Concept (SVC) initiated by Nestlé, known as the Nestlé Paddy Club in Kerpan and Sanglang, Kedah. According to a representative from Nestlé, the company requires high-quality rice with low levels of arsenic (<100 ppb), aflatoxin (<0.1 ppb) and other chemical contaminants for its production of baby food, Cerelac®. To ensure the rice supplied meets the required international standard and driven by the company's SVC principles, Nestlé established the Nestlé Paddy Club in 2011. Farmer's membership is voluntary with a fee of RM10.00 per planting season. In 2011, there were 20 farmers over 40 Ha of land participating in this programme. In 2017, this figure increased to 284 farmers over ~800 Ha of land, producing around 8,000 MT of paddy over two planting seasons. The project assists farmers by providing farm management advice and microbial soil enhancers in the form of soil conditioner/supplement (Organica Biotech Sdn. Bhd.). In return, the farmers must sell the paddy to two designated millers at the GMP of RM1,200/MT. Upon milling, the product will be integrated into the downstream food manufacturing processes in Nestlé factories. There are about 300 types of rice-based food produced from paddy cultivated by these farmers, including Cerelac®, which are exported to countries throughout SEA and baby snacks exported to the European Union (EU).

132 KRI engagement with Nestlé Paddy Club and member farmers

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Northern Corridor Implementation Authority (NCIA) with Perak farmers[133]

Another initiative is the NCIA-Runduk Padi project. In this initiative, Runduk Padi Sdn. Bhd. works closely with NCIA to improve the yield of 50 Ha of previously abandoned paddy land in Perak. The company rented the land from multiple owners and coordinates with local PPKs to improve farmers' paddy management practices. In this project, NCIA supplies free soil conditioners (Organica Biotech Sdn. Bhd.) and assistance in improving local infrastructure. Since the start of the project two years ago, the average paddy yield has doubled from 2 to 4 MT/Ha.

133 KRI engagement with NCIA and Runduk Padi Sdn. Bhd.

Padiberas National Berhad (BERNAS) with Kelantan and Terengganu Farmers[134]

Despite being a post-harvest company, BERNAS recognises the importance of involvement in the upstream segment, so as to achieve not only sustainability in its business operations but, more importantly, to be actively involved in the farming community beyond concession requirements. As proof of concept, in January 2017, BERNAS entered into a contract farming program with 8 local farmers involving 10 Ha of paddy land; Pasir Putih, Kelantan (2 farmers, 5 Ha) and Besut, Terengganu (6 farmers, 5 Ha). In this initiative, the company provides funds/input for the production as well as farm management guidance to the farmers. In return, farmers are expected to produce better quality paddy to be sold to BERNAS and/or its joint venture (JV) mills. The result of the first planting season was encouraging, with some farmers experiencing a 10% yield increment, but the performance of the second season was less impressive as the project was hit with rodents. With further improvements, the company believes this programme is the way forward, as it provides the missing link between paddy production (supply) and the market (demand). Given the potential of contract farming, the program is to be expanded to 30 Ha by the end of 2018.

134 KRI engagement with BERNAS

Dibuk Sdn. Bhd. with Kuala Perlis Farmers[135]

'Program Rakan Ladang Dibuk' is an initiative introduced by Dibuk Sdn. Bhd. to help farmers manage their paddy fields in Kuala Perlis. It was adapted from a system learned during a company visit to Taiwan. The target of the programme is to have every 100 *relong* (~29 Ha) combined into one management. In total, there is about 40 Ha of land under this programme involving up to 24 farmers. Through this initiative, Dibuk supplies all the farm requirements including seeds, chemicals, heavy machinery and labour as well as assists in training and farm management. According to the Managing Director of Dibuk, Tuan Haji Marzukhi Othman, through this programme, farmers reduced their cost of production by 50% and yield increased by 35%. In this case, a win-win initiative is achieved whereby the company helps to increase the farmer's income and, at the same time, ensures that Dibuk mills consistently acquire high-quality paddy grains. Most importantly, such a system helps create trust and cooperation between farmers and millers.

135 KRI engagement with Dibuk Sdn. Bhd.

Bario Ceria Sdn. Bhd. with Bario Farmers[136]

In 2012, a contract farming model was adopted in Bario, Sarawak to help improve the income of the local Kelabit community and develop their economy through the cultivation of the specialty Adan rice.

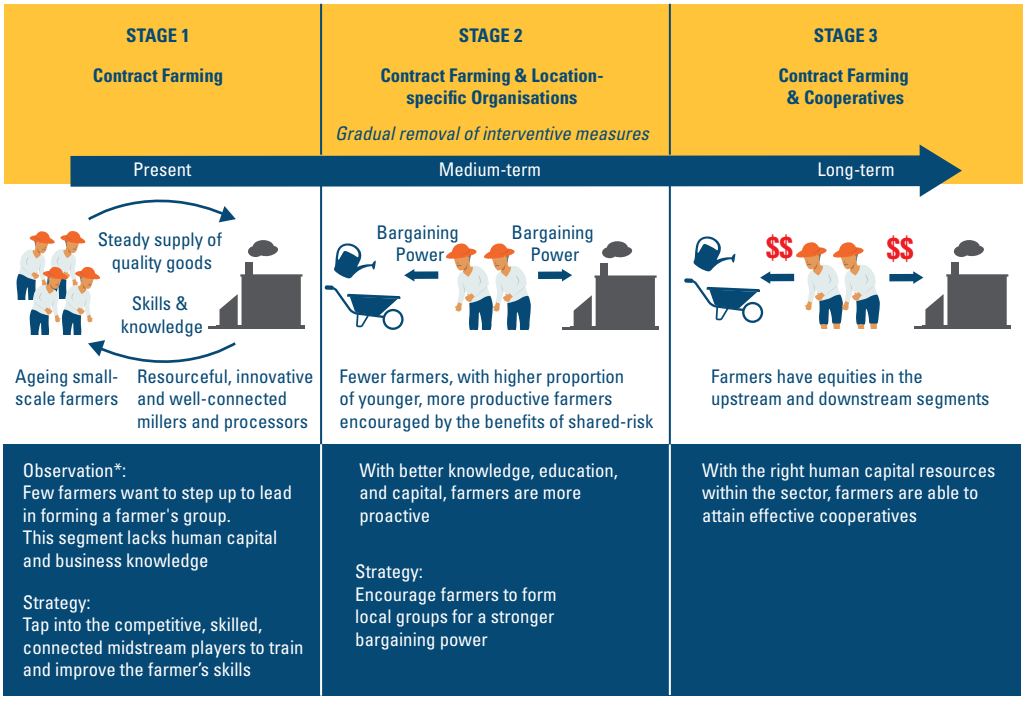
Through the Entry Point Project 11 of the Economic Transformation Programme, a total land area of around 200 Ha in Bario was designated for paddy cultivation with around 178 farmers. Within the 200 Ha, farmers have two choices for cultivating their paddy. For the first option, a farmer has a contractual agreement with a private company, Bario Ceria Sdn. Bhd. (BC), over a season. In that season, BC will fully manage the farmer's land with a division of 70:30 (BC: farmer) of the final profit made. For the second option, a farmer cultivates the land himself and utilises BC's services as and when needed. BC also plays the role of an extension service provider, having its trained managers to provide advice and oversee paddy cultivation in Bario. As the contract is renewed for each planting season, a farmer may change options, depending on his resources and ability. The first option addresses the issue of ageing farmers in Bario, as many younger Kelabit landowners are working elsewhere but still intend to generate income from cultivating paddy.

136 KRI engagement with Bario Ceria Sdn. Bhd., a subsidiary company of Ceria Group

Policy Recommendation for Contract Farming

Considering the combination of factors of low farm productivity (Chapter 4) and a 'squeezed' midstream segment (Chapter 5), contract farming may be the preferred short to mid-term solution. Establishing cooperatives by farmers involves large capital, high levels of expertise and vast experience in the business operations of the midstream segment, which may not be at the farmers' immediate disposal. Therefore, under current circumstances, it may not be practical to push for the farmers' entry into milling. Instead, a three-stage approach is recommended, with contract farming being adopted in the first stage (Figure 4.12).

Figure 4.12. A three-stage strategy of contract farming



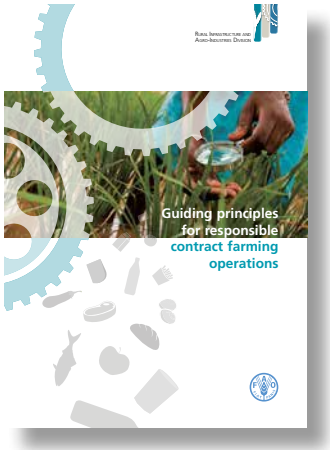
Source:
**Based on engagement with paddy farmers, rubber tappers and the related agencies and associations*
Illustration by KRI

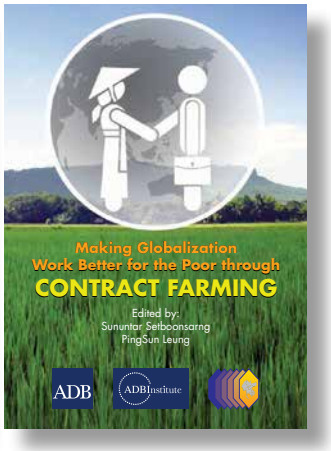
In **Stage 1**, the farmers may leverage on the midstream players' vast knowledge in paddy quality standards, market conditions and access to skilled farm managers. The midstream players can count on the farmers for high quality, adequate and consistent supply of paddy. In theory, a positive outcome is the increased profit margin and improved paddy quality which, over time, encourage the entry of younger farmers already in the rural areas or those moving out of the urban areas into paddy production.

By **Stage 2**, the total number of paddy farmers would have fallen due to natural mortality. However, presuming land consolidation by younger agropreneurs, the hectarage and paddy yield per farmer may be higher. It is expected that at this stage, these younger, more tech-savvy, better networked farmers are more informed, connected and able to form groups to allow stronger bargaining power with companies in the input as well as the midstream segment.

Come **Stage 3**, farmers are closely linked throughout the supply chain, have knowledge access to both domestic and international markets, are able to produce high-quality paddy that meets international standards and are relatively more financially stable. At Stage 3, it is expected that the midstream segment may be more encouraging for new entrants. At this point, a cooperative system may work towards further empowering the farmers and strengthening the linkage between segments of the supply chain.

Further reading materials on contract farming:





CHAPTER KEY TAKEAWAYS

Farmers' Demographics

- Over the last three decades, there has been a decline in the share of people employed in the agriculture sector.
- According to the Labour Force Survey, in 2016, **1.6 million** people were employed within Category A (agriculture, forestry, and fishing), which is **11.4%** of the total number of employed persons in Malaysia, the third largest after Category G (wholesale and retail) and Category C (manufacturing).
- In 2016, there were **194,931 paddy farmers**, mostly aged 50 years and above.

Farmers' Income

- Previous agricultural policies were successful in the gradual eradication of hardcore poverty, but farmers remain relatively poor compared to their comtemporaries.
- To help improve farmers' income through paddy farming, challenges related to farm production (yield), grain quality and cost of production need to be addressed at the PPK level.
- It is worth noting that when addressing issues related to a farmer's household income, the matter should be viewed **holistically**, incorporating alternative sources of income in an interlinked manner. These issues are beyond the scope of this report.

Cost of Production (COP) and Farm Yield

- **Land rental** is more than 40% of the total cost of paddy cultivation in MADA, followed by farm machinery at 30%.
- There is a **lack of quantitative studies** on the issue of **economies of scale** and on the determination of the ideal size to achieve the benefits of economies of scale especially in reducing the COP.
- **A stronger bargaining power** of the farmers when negotiating with the suppliers, service providers and landlords may help to control drastic increases in the costs of production.
- It is also worthwhile to **better understand the rental market** and changes over time, landlord's motivations for renting and/or increasing rent and the number of farmers who are renters, owners and those that are both renter and owner.
- **Relative to other countries, data showed that Malaysia's COP is not as high as commonly perceived.** When compared to key rice-growing regions in other countries in Asia, MADA has a COP at USD1,151/Ha (RM 3,766/Ha) with the second highest net profit at USD884/Ha (RM 2,892/Ha). This puts MADA as having the lowest COP compared to other rice importing countries and only slightly higher than rice exporting countries. However, when input subsidies are removed, the COP significantly rises to USD1,599/Ha and the net profit fell to be the second lowest at USD436/Ha.
- Regionally, the average annual growth rate (AAGR) in yield for Vietnam has been the most significant at 2.4%/year from year 1986 to 2016 despite having lower GDP per capita than Malaysia. Malaysia's average annual growth in yield growth has been a low 0.8%/year.

- To study the possible differences in farming performance for different locations within the same region, KRI conducted a statistical yield and cost of production analysis across 27 PPKs in MADA. Results showed that there were significant ($P<0.05$) differences in both yield and the cost of production between different PPKs. This shows that, despite being in the same region, factors such as local farm management, pests and diseases and soil fertility, among others, may be important determinants of higher net profits, yield and return on investment (ROI).
- Therefore, given that the performance of the granary areas has a direct influence on the performance of the nation's paddy industry, it is important to further investigate the unique reasons for these inefficiencies at the PPK level.

Contract Farming

- **Recommendation:** To help improve farm ROI (and therefore, a farmer's net profit) and strengthen the supply chain as a whole, a three-stage approach is suggested:
  1) **Stage 1** involves a shared-risk approach using contract farming;
  2) **Stage 2** involves fewer but better informed, younger farmers grouping together for stronger bargaining power. Subsidies and incentives can be gradually removed; and
  3) **Stage 3** involves the establishment of effective cooperatives at the back of well-developed human capital in the agriculture sector. At this stage, subsidies and incentives are no longer required.

CHAPTER

05

SUPPLY CHAIN: MIDSTREAM & IMPORT

CHAPTER 5

SUPPLY CHAIN: MIDSTREAM & IMPORT

Malaysia's Paddy and Rice Supply Chain

In this chapter, the focus on the midstream segment will be primarily on milling and the processing of paddy into rice. The chapter will also describe the import and stockpile segment of the paddy and rice supply chain, activities primarily overseen by BERNAS.

Processing Paddy into Rice

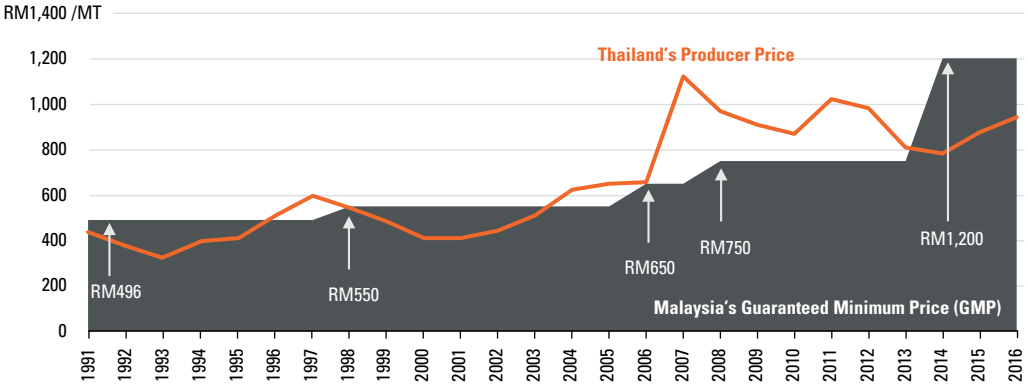
Upon harvesting, paddy grains are sold to the millers either directly by the farmers or through brokers. In this segment, the millers will grade the paddy, purchase it at a price that is equal or higher than the Guaranteed Minimum Price (GMP) and process the paddy into rice. Not all the milled paddy will be converted into rice. In 2015, BERNAS milled 400,906 MT of paddy but only about 60.7% was sold as graded rice, while the rest became crushed rice, *temukut rice*, rice bran or lost during the milling process[137].

The processed rice is then sold to wholesalers for subsequent logistical, packaging or branding processes before delivery to retail stores. If private millers refuse to purchase the grains, usually for not meeting the quality standards needed, farmers can sell to BERNAS, a private entity that has been given the mandate to be the buyer of last resort and to purchase the paddy at the pre-determined GMP. The GMP was introduced as early as the 1940s to ensure that the farmers' incomes are protected by preventing millers from offering an unacceptably low price for the farmers' harvests (Figure 5.1).

137 From Table 6.1 *Pengeluaran beras tempatan Kilang Beras* BERNAS 2015 (pg. 25) in *Maklumat Perangkaan Industri Padi dan Beras 2016*, MOA (2016b)

Malaysia's producer price for harvested paddy remains tightly controlled for more than seven decades, with the largest GMP hike in 2014

Figure 5.1. Producer price for paddy in Thailand and the Guaranteed Minimum Price (GMP) for Malaysia, 1990 – 2016 (RM/MT)



Sources:

1. *Thailand's producer price from Prices: Producer Prices – Annual: Producer Price (LCU/tonne): Rice, paddy, FAOSTAT (Accessed 23 Oct 2018), converted to RM by KRI*
2. *Malaysia's GMP from Jadual 7.18: Siri Purata Harga Padi (pg. 98 – 102), Perangkaan MADA 2014*
3. *The exchange rate from Official exchange rate (LCU per US$, period average), World Bank (Accessed 23 Oct 2018)*

Chart and calculations by KRI

In the 1990s, the GMP was RM496, which rose to RM550 in 1998, increased again to RM650 in 2006, then up to RM750 in 2008 and lastly to RM1,200 in 2014. On the contrary, for other countries such as Thailand, the producer price fluctuates according to market conditions. The implementation of the GMP and the grading of paddy has been one of the most challenging and debated issues among industry players, including the farmers and millers as well as the authorities.

In 2008, a gazette was released stating that a miller must purchase paddy at a minimum price of RM750/MT[138]. The actual purchasing price varies across states. This is because some states such as Kelantan produced lower quality grains and, as such, it was priced below RM1,000/MT, while other states were able to sell their higher quality grains above RM1,000/MT (Figure 5.2).

138 Dewan Rakyat (2008), pg. 4

In 2014, the government announced the increase of the minimum paddy purchase price to RM1,200/MT[139] and the price is to be standardised across the states in Peninsular Malaysia. This was done through the *Program Jihad Memerangi Orang Tengah*[140]. Prior to that, only Selangor had the paddy price above RM1,200/MT while in other states farmers sold their paddy below RM1,200/MT (Figure 5.2).

When the GMP price was standardised to RM1,200, millers in some states noted that they were unable to bear the costs of purchasing low-quality grains at RM1,200/MT and had to be more stringent on the cut-off value during grading than before (elaborated in the next section)[141]. On the other hand, the farmers were frustrated as they felt that their grains were worth more than the cut-off value given. Consequently, distrust and frustration are high between players within the supply chain especially with regard to the selling of harvested paddy for milling.

"... distrust and frustration are high between players within the supply chain especially with regard to the selling of harvested paddy for milling"

Regardless of whether it is the seller or the buyer that is at fault, this distrust was perpetuated by a policy that targets one segment (farmers) at the cost of the next segment (milling). Instead of strengthening the industry, the resulting high level of distrust between farmers and millers weakens the supply chain linkage between the farmers and the millers.

139 Zaain Zin (2014)

140 *Maklumat Perangkaan Industri Padi dan Beras 2016*, MOA (2016b)

141 Upon delivery of harvests, millers will weigh the paddy and gauge the cut-off percentage (*pemutuan*). This value is higher in lower-quality harvests than good quality ones, as low-quality batches often contain more contaminants and a mixture of immature grains with mature grains. Given the informal method of gauging paddy quality, both parties often cannot agree on the acceptable level of cut-off value and result in a high level of distrust between the sellers and the buyers.

Before the standardisation of GMP in 2014, farmers in Selangor sold their paddy up to RM1,300/MT, while farmers in Kelantan sold their paddy for RM980/MT

Figure 5.2. Selling prices for paddy according to states, 2013 and 2014 (RM/MT)

Notes:

1. *Prices are reported as either a range or a value*
2. *Price ranges/values in 2011 and 2012 are the same as in 2013, except for Terengganu (2011: RM1,000 - RM1,050, 2012 and 2013: RM1,050)*

Source:

Jadual 2.9: Harga jualan padi mengikut negeri (pg. 29) in Maklumat Perangkaan Industri Padi dan Beras 2016, MOA (2016b)
Chart by KRI

Tight Profit Margin

The rice supply chain in Malaysia has an almost 'hourglass' shape, with a few input suppliers, a high number of farmers, a small number of midstream players and, at the end, almost 31 million consumers[142]. The nature of this market structure and the perceived importance of rice to the public meant that policies have always focused on the largest number of individual players at both ends of the supply chain. Specifically, policies focus on protecting 31 million consumers through price controls (Figure 5.3) and almost 200,000 poor paddy farmers through input subsidies and a price floor (GMP).

While the price floor (GMP) of paddy kept increasing, the price ceiling of rice remained the same over the same period

Figure 5.3. Squeezed midstream in the rice supply chain

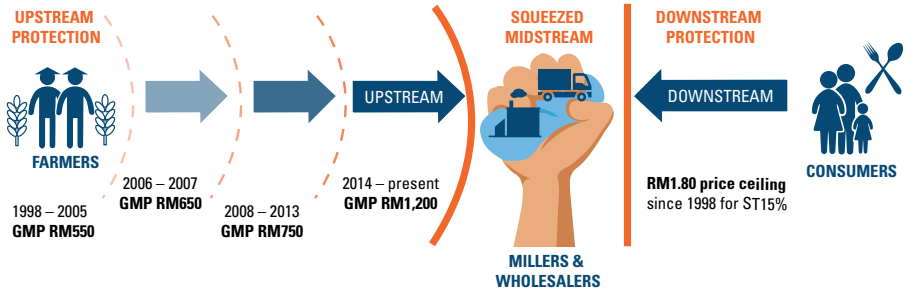


Illustration by KRI

Table 5.1. Price ceiling for *Super Tempatan* 15% (ST15%) Rice Grade

Zone	Maximum Price (RM/kg)	Location
Zone 1	1.65	Kedah, Perlis, Kelantan, Seberang Perai North and South
Zone 2	1.70	Terengganu, Penang Island, Perak
Zone 3	1.75	Federal Territory, Selangor
Zone 4	1.75	Negeri Sembilan, Melaka
Zone 5	1.80	Johor, Pahang

Source:
Senarai Gred dan Harga Beras, http://www.elesen.moa.gov.my (Accessed 29 Aug 2018)
Table by KRI

142 Malaysia's population from Special Aggregates: Geographical groups: Total population – Both sexes, World Population Prospects 2017, UN Desa/Population Division (Accessed 19 Oct 2018)

As highlighted by Wong et al. (2010), the strength of the overall supply chain is determined by its weakest point. Squeezing the midstream segment may disable the whole paddy and rice industry. Current pressures on the midstream arise from both upstream and downstream policies. The continued increase in the paddy price floor (GMP) and a fixed price ceiling at the retail end means that millers and wholesalers wholesalers experience tightening of their profit margin overtime (Figure 5.3). The most recent GMP increase to RM1,200/MT and its standardisation across states had a significant impact on the midstream segment. This is because previously, prices of paddy varied according to states (Figure 5.2) with Kelantan having the lowest market price at around RM900/MT.

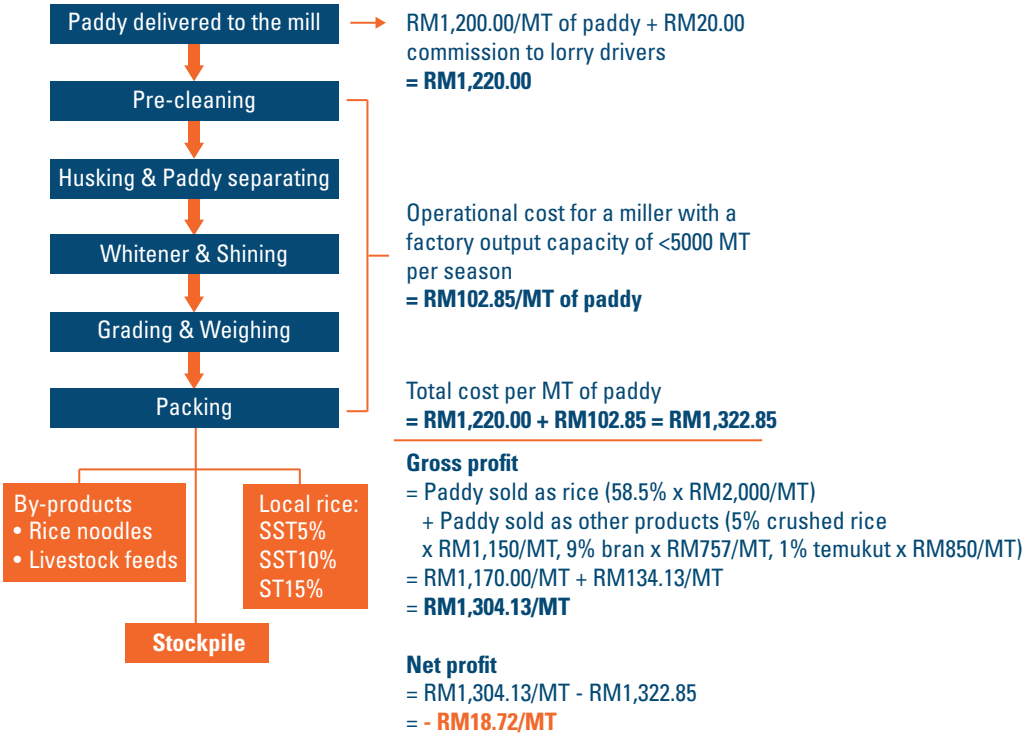
As an example, purchasing paddy at RM1,200/MT and selling it at RM2,000/MT of ST15% to wholesalers, a small miller in Kedah operates at a loss of RM18.72/MT (Figure 5.4). Given that prior to this, the paddy in the Kedah area was sold around RM1,050 to RM1,100/MT, the loss is likely to be greater in Kelantan as the quality of the paddy sold is lower, but millers must now purchase at RM1,200/MT.

As a result, to continue operating, private millers had to diversify into other businesses and expand their activities downstream and/or upstream as well as invest in machinery and automation. Some millers had to resort to malpractices or increase the stringency in the grading of the delivered paddy, which perpetuated the mistrust between farmers and millers. The inability to do the above meant that private millers, especially small millers, had to cease operations. According to a report prepared by the *Bumiputera* Small Millers Association (*Persatuan Pengilang-Pengilang Beras Melayu* Malaysia, PPBMM), the number of millers fell from 31 in 2006 to 23 in 2015[143]. Prior to 2014, there were 16 millers in Kelantan. By 2016, all millers had to cease their business operations with BERNAS having to then play the role of buyer of last resort (BOLR)[144].

An additional observation is that millers sell the lowest quality milled rice, ST15%, at RM2,000/MT to the wholesalers. However, in retail, the prices of ST15% rice has a ceiling price of RM1,650 to RM1,800/MT (Table 5.1). This price inconsistency is worth investigating further. In addition, from observation, ST15% is not a common grade seen in most retail stores or sundry shops.

143 Data from PPBMM and *Majlis Tindakan Ekonomi Melayu* (MTEM) (2015)
144 Dewan Rakyat (2016)

Figure 5.4. The estimated costings of a medium-sized mill (<5,000 MT/season)



Notes:

1. *Calculations are done on the weight of paddy after grading has been done (pemutuan)*
2. *58.5% is the conversion rate from paddy to rice*
3. *Assuming that the miller does not participate in any malpractices*

Source:
Pers. comm. with PPBMM
Chart by KRI

Policy Recommendations

"…as long as the milling segment remains restricted and has high barriers to entry, there is little opportunity for farmers to establish cooperatives and enter the segment"

It is imperative that we do not view the midstream players (brokers, millers and wholesalers) negatively and restrict their business operations. By doing so, the target groups that the policies were meant to protect (farmers and consumers) would be disadvantaged as a result of a weaker supply chain. Instead, a regulatory environment that encourages the growth and success of each segment of the supply chain is important for the industry to grow.

A possible solution to enhance trust between farmers and millers is through transparency-improving technologies such as Blockchain. A Blockchain system may weigh and record paddy quality without tampering from any parties. For a given delivery of harvested paddy, it may be able to identify the farmer and the source of the plot, the miller the grain was sold to and its subsequent downstream journey to the wholesaler and retailer. Customers may also benefit as they can access the recorded data and determine the quality of the product, and its compliance to MyGap on the farm and Good Manufacturing Practices in manufacturing.

It is worth studying further, the impact of having the GMP at RM1,200/MT, its standardisation across states and reviewing the need for ceiling prices of rice at the retail end.

It is important to highlight that as long as the milling segment remains restricted and has high barriers to entry, there is little opportunity for farmers to establish cooperatives and enter the segment. Pushing for cooperatives now may be ineffective at empowering the farmers. A possible mid-term or bridging solution to this is a form of contract farming between the midstream players and the farmers. Such an engagement has been done with promising outcomes in Malaysia and it is a model that is worth considering (Chapter 4).

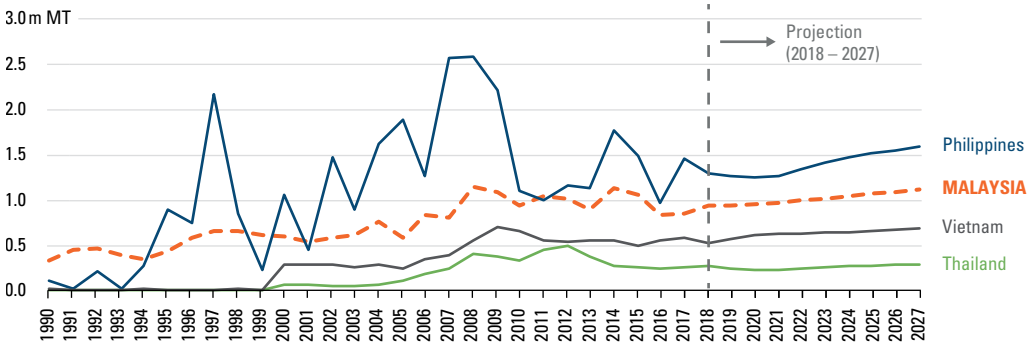
Import of rice

Import Statistics

The OECD-FAO Agricultural Outlook predicted that Malaysia's rice import will continue to rise (Figure 5.5). This is due to increasing rice consumption and limited resources for cultivation, especially in expanding areas planted with rice.

Malaysia's total rice import is projected to increase

Figure 5.5. Annual total rice import for Malaysia and neighbouring countries, 1990 – 2027 (m MT)



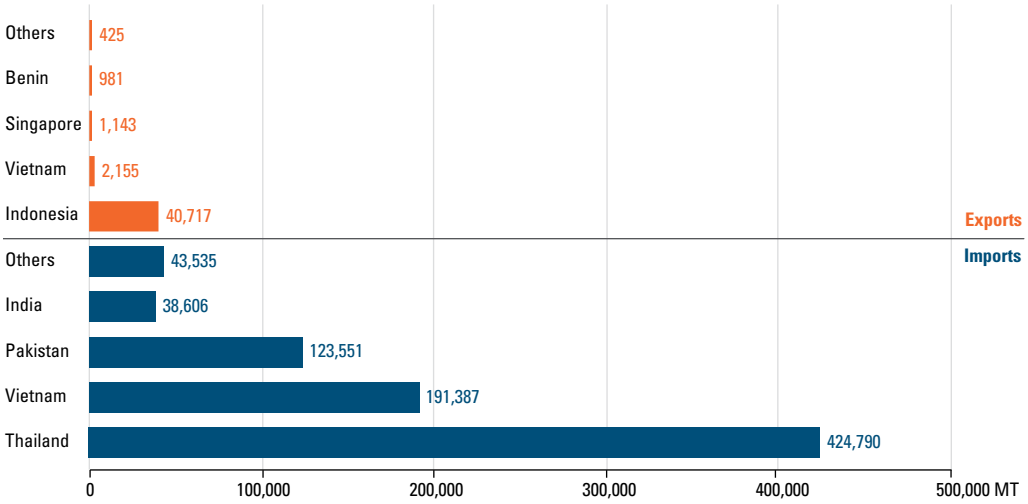
Source:
OECD-FAO Agricultural Outlook 2018-2027 (Accessed 29 Aug 2018)
Chart by KRI

Indeed, Malaysia has always been a net importer of rice, sharing a similar status with Indonesia and the Philippines. In 2016, Malaysia imported a total of 821,869 MT of rice and exported a total of 45,421 MT of rice, resulting in a net import of 776,448 MT[145]. About half of the total imported rice originated from Thailand, followed by Vietnam and Pakistan (Figure 5.6). In the export segment, Malaysia exported 89.6% of its total exported rice to Indonesia.

145 FAOSTAT

Most of Malaysia's rice imports are from Thailand and Vietnam

Figure 5.6. Import origins and export destinations of rice for Malaysia, 2016 (MT)



Source:
Trade: Detailed Trade Matrix: Import quantity & Export Quantity: Rice – total (Rice milled equivalent), FAOSTAT (Accessed 29 Aug 2018)
Chart by KRI

Malaysia May Continue to be a Net Importer

Geography is one of the possible reasons that a SEA country is a net rice importer or exporter. A linear regression analysis showed that there was an almost perfect correlation (R^2 of 0.92) between paddy production per capita and percentage of land area devoted to rice in eight countries in SEA[146]. These countries were categorised into two distinct groups: importers (Malaysia, the Philippines and Indonesia) and exporters (Myanmar, Vietnam, Thailand, Laos and Cambodia).

According to Dawe et al. (2014), the larger crop area devoted to paddy by the exporters reflected the country's geographic suitability for rice cultivation[147]. Exporting countries such as Thailand and Vietnam are on the mainland, with large supplies of fresh water from dominant river deltas, vast areas of flat lands and cheap labour. This equates to a lower cost of production per hectare and the ability to produce in large quantities. On the other hand, importing countries tend to be islands or peninsular such as Malaysia, Indonesia and the Philippines, where fresh water and large areas of flat land are limited.

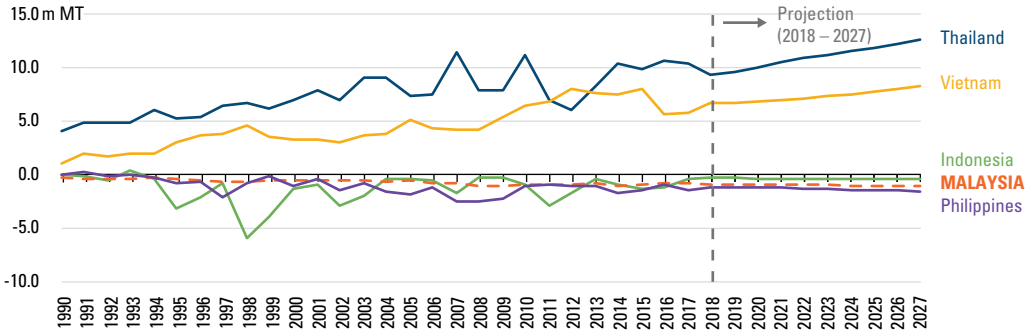
This could help explain why historical data showed that island SEA countries are net importers. Data since the 1990s showed that countries such as Indonesia, Malaysia and the Philippines almost constantly have a rice trade balance deficit (Figure 5.7).

This is such despite having a government that is actively involved in the industry and policies aiming to increase rice production. On the contrary, Thailand and Vietnam's trade balances have shown increasing trends and are expected to further increase by 2027.

146 Dawe (2013)
147 Dawe et al. (2014)

Malaysia has always been a net importer of rice and is projected to remain an importer

Figure 5.7. Rice trade balance for selected Southeast Asia countries, 1990 – 2027 (m MT)



Note:
Trade balance (MT) = Export (MT) – Import (MT)
Source:
OECD-FAO Agricultural Outlook 2018-2027 (Accessed on 29 Aug 2018)
Chart by KRI

Policy Implications

Given that island/peninsular countries have a natural disadvantage relative to mainland countries, should these countries aim to be net rice exporters? The total cropped area for rice cultivation in island countries is low because there are alternative crops that are more profitable. Given that paddy cultivation often have low economic viabilities, restricting farmers to the cultivation of paddy-only areas will end up reducing their income[148]. Hence, policymakers in island countries face a trade-off between achieving national rice self-sufficiency and ensuring the security of rural household income. According to Dawe (2013), if SSL is achieved through measures leading to higher domestic prices, such as trade restrictions and price controls, governments in the island/peninsular countries should expect substantial costs. Also, instead of protecting the poor, such strategy would possibly lead to achieving only the first part of the food security definition: availability. It would still not be possible for the poor to access rice due to its higher domestic prices[149].

148 Jaffee and Anh Tuan (2015)
149 Ibid. & Dawe (2013)

In agreement with the conclusions reached by Dawe (2013), local studies showed that the scenario of reaching 100% rice SSL in Malaysia is unlikely. A system dynamic modelling study showed that 50 years from 2011, under the best-case scenario, Malaysia's domestic paddy production could reach only up to 63% SSL[150]. This is further supported by a polynomial curve analysis based on historical patterns of domestic production and consumption[151]. The study concluded that Malaysia is likely to experience a declining supply of local rice which can only be offset by an increase in imports. Furthermore, it is also unlikely that exporting countries would completely cease being rice exporters. Nguyen (2012) showed that under various production, demand and productivity scenarios, even in the worst-case situation, Vietnam would be able to continue to produce a surplus of rice for export[152]. This does not suggest that Malaysia should rely solely on Vietnam for its rice import. Instead, diversifying the source countries may help minimise risks should any exporting countries cease their trade activity.

Taking note of the above, expecting Malaysia to be a net exporter is unrealistic. Having said this, while Malaysia is at a relative disadvantage compared to mainland SEA countries, it should not abandon all paddy production. This is because geographically, Malaysia is a country made of two large lands: Peninsular and Borneo. While it does not have vast flat lands with river deltas such as mainland SEA, it is also not a country made up of hundreds of small islands such as Indonesia and the Philippines.

As such, a realistic target would be to achieve a balance of being a net importer but with local farmers producing high quality grains and adhering to good agricultural practices. Hard and soft infrastructures for paddy have already been built, costing the nation billions of Ringgit. It would be a waste to discard these investments. Furthermore, due to its location in the equator, the country receives a lot of rain with the main paddy growing areas having access to large dams. In conclusion, there is potential for Malaysia to cultivate paddy responsibly, productively and still achieve better income for the farmers.

150 Bala et al. (2014)
151 Rajamoorthy and Munusamy (2015)
152 Nguyen et. al. (2012)

Targeting higher productivity by focusing on reducing production costs through investments in R&D may be a good approach for the island/peninsular countries in SEA. Such strategies would enable long-term improvements in productivity, despite the geographical limitations[153]. For example, even though paddy is not traditionally grown in the US and Australia, both countries invested heavily in R&D. As a result, farm management improved significantly and made both countries efficient paddy producers.

Considering the points mentioned, remaining as a net rice importer may not warrant concern. The country may instead focus its resources on R&D and improvements in sustainable farming practices. More in-depth studies are needed to determine the optimal SSL range that is not too low such that it risks national food security (availability) and not so high as to be unrealistic.

Stockpile

First introduced in 1949 by the British government, stockpile or buffer stocks are used in Malaysia to stabilise domestic price fluctuations and as an emergency reserve[154]. In 2016, there were 11 warehouses in Peninsular Malaysia, 8 in Sabah and 6 in Sarawak to store the nation's buffer stock of rice[155]. Domestic prices can be stabilised through buffer stocks by managing the bulk purchase of rice and its controlled release into the domestic market[156].

The government determines the amount of the national stockpile, and BERNAS is tasked with managing this stock. Before the 2008 Global Food Crisis, the national stockpile stood at 92,000 MT. Post-crisis, the stockpile was increased to 292,000 MT as a knee-jerk reaction. According to BERNAS, the current stockpile stands at 150,000 MT. At this amount, it costs BERNAS around RM30m/year for storage purposes[157]. There are ongoing discussions regarding the appropriateness of this amount and the determination of a lowered level that better reflects recent market trends. According to BERNAS, at any given time, there is enough rice to meet the nation's demand for 6 months with

153 Flores-Moya et al. (1978) & Evenson (2001)

154 Vengedasalam (2013)

155 Data from *Kedudukan Terkini dan Lokasi Stokpail 2015*, Seksyen Kawalselia Padi dan Beras MOA (n.d.). Note that this report is not publicly available.

156 Stakeholder engagement with BERNAS indicate that the use of the national stockpile to manage domestic price stability has not been utilised.

157 Pers. comm. with BERNAS

150,000 MT stockpile plus 180,000 MT trading stock together with ~500,000 MT rice stored in wholesale and retail (not including stocks in millers). Considering this and the fact that since its inception in 1949, the stocks were never used for emergency purposes, stockpile in Malaysia can be said to merely provide a psychological sense of security.

Given that there is little information publicly available on this matter, this KRI report will not expand further on issues related to the national stockpile.

BERNAS in the Supply Chain

Based on previous sections, the stakeholders at the midstream segment of the paddy and rice supply chain consist of a few private millers and wholesalers, who are constrained by various government policies at the production-end and consumption-end of the supply chain. This section looks into one of the main stakeholders of the segment, BERNAS. The company is a privately-owned state trading enterprise with commercial and social obligations. The next sub-sections will give a brief overview of BERNAS in the context of the country's midstream segment of the paddy and rice supply chain.

History of BERNAS

BERNAS was corporatised as Syarikat Padi Beras Nasional from *Lembaga Padi dan Beras Negara* (LPN) in July 1994 through the *Lembaga Padi dan Beras Negara* (Successor Company) Act 1994. Brief history and functions of LPN are explained in Box Article 7.

BOX ARTICLE 7: History of *Lembaga Padi dan Beras Negara*

In 1965, the government established the Federal Agricultural Marketing Agency (FAMA) to regulate the food marketing system in the country. According to the First Malaysia Plan (RMK1), the objective of FAMA is to coordinate the activities of public and private agencies involved in agricultural marketing. RMK1 noted that small farmers were challenged by an array of market imperfections including "limited bargaining power, lack of market information, lack of grades and standards, middlemen monopsony, cartels and price-fixing". FAMA was to devise appropriate schemes to ensure effective and efficient marketing of agricultural produce, including forming marketing boards for selected commodities.

Consequently, the Paddy and Rice Marketing Board (PRMB) was established in February 1967[158]. Its main role was to ensure that paddy was bought from farmers by licensed agents at the GMP. On the other hand, policies related to the import and distribution of rice as well as stockpiling were administered by the Ministry of Commerce Industry. The National Paddy and Rice Board (*Lembaga Padi dan Beras Negara*, LPN) was formed in 1971 and it then assumed all the three duties.

Based on the *Lembaga Padi dan Beras Negara* Act 1971, there were five stipulated functions of LPN. To achieve its functions, LPN had a wide range of instruments at its disposal and was entrusted with certain powers (Table 5.2).

158 Arkib Negara (n.d.)

Table 5.2. Functions, instruments and powers of LPN

Functions of LPN	Instruments of LPN	Powers of LPN
• To conserve and maintain an adequate supply of paddy and rice • To ensure a fair and stable price of paddy for farmers • To ensure a fair and stable price of rice for consumers • To ensure sufficient supply of rice to meet all emergencies • To make recommendations to the government on policies designated to promote the development of the paddy and rice industry	• Implementing GMP for paddy • Enforcing fair and stable price for consumers • Maintaining stockpiling, licensing of wholesalers, retailers, rice millers, importers and exporters • Regulating and controlling the milling of paddy into rice including the rate and regularity of milling operations • Regulating the production of paddy • Prohibiting, regulating, or controlling the movement of paddy and rice • ... others	• Power to obtain information • Power to enter premises • Power of arrest, seizure, investigation and persecution • Power to stop and search conveyance

Source:
Lembaga Padi dan Beras Negara Act 1971
Table by KRI

In 1974, due to the world food crisis, LPN became the sole rice importer, playing the role of *gatekeeper*[159]. LPN was initially placed under the Ministry of Public Enterprises before being moved to the Ministry of Agriculture in the 1980s. The capacity of LPN continued to expand with the number of staff increased from 29 personnel in 1970 to nearly 5,000 by 1983[160]. By 1985, LPN was purchasing almost half of the paddy produced in the country[161]. Nevertheless, LPN had incurred losses almost every year since its inception before recording profits in 1992 and 1993, the last two years before it was corporatised. From 1983 to 1987, the loss amounted to M$200m[162,163]. From 1988 to 1991, LPN's total loss was RM94.9m[164].

159 Being the sole importer of rice, LPN controlled the access of international rice into the domestic market, an act that is referred to as gatekeeping.
160 Davidson (2018)
161 Ibid
162 Dewan Negara (1989)
163 Note that Malaysia's local currency was Malaysian Dollar (M$) before being replaced with Ringgit Malaysia (RM) in 1993.
164 Dewan Rakyat (1994)

The corporatisation of LPN into BERNAS also entailed the establishment of the Control of Paddy and Rice Section (commonly referred as *Kawalselia*) through the Control of Padi and Rice Act 1994. While the social and commercial functions of LPN were transferred to BERNAS, *Kawalselia* took over the regulatory role of LPN.

There were three stated reasons for the corporatisation of LPN into BERNAS, namely[165]:

a) To increase the efficiency of paddy and rice management for the benefit of producers and consumers;
b) To ensure that the surveillance and control of matters related to purchasing, marketing, milling, storing, pricing, stockpiling and ensuring the quality of paddy and rice are managed in the best and most profitable manner; and
c) To reduce the government's burden of managing LPN with an annual operating cost of RM20m[166].

In January 1996, the company was privatised as Padiberas Nasional Berhad (BERNAS). The privatisation of BERNAS was consonant with the then Prime Minister, (Tun) Dr Mahathir Mohamed's privatisation agenda. For example, Telekom Malaysia was formed in 1987 to succeed Telecommunications Department, Tenaga Nasional Berhad was established in 1990 to replace National Electricity Board, and Postal Services Department was corporatized as Pos Malaysia Berhad in 1992. This privatisation agenda was in line with global economic thinking at that time. World leaders then, including Margaret Thatcher (the Prime Minister of the United Kingdom from 1979 – 1990), Ronald Reagan (the President of the US from 1981 – 1989), and Bob Hawke (the Prime Minister of Australia from 1983 – 1991), were strong proponents of privatisation.

165 Ibid.

166 Based on our pers. com. with BERNAS, however, the average annual expenditure of BERNAS from 1972 to 1994 was RM56m, for both the development and operating expenditure.

When BERNAS was first established in 1996, seven parties formed a joint venture company called Budaya Generasi Sdn. Bhd. (BGSB) to purchase 75% of the shares in BERNAS from the federal government[167]. The seven parties included four public entities, namely, *Pertubuhan Peladang Kebangsaan* (NAFAS), *Persatuan Nelayan Kebangsaan* (NEKMAT), *Syarikat Perniagaan Peladang* (MADA) Sdn. Bhd. (SPPM)[168] and *Syarikat Perniagaan Peladang* (KADA) Sdn. Bhd. (SPPK)[169] and three private entities, namely, Permatang Jaya Sdn. Bhd. (PJSB), ZAW Ventures Sdn. Bhd. (ZAW) and Simpletech Sdn. Bhd. The Ministry of Finance held a golden share of 10% with veto power over the board's decisions and the remaining 15% were held by other entities[170].

Under the agreement between BERNAS and the government signed on 12 January 1996[171], BERNAS was granted exclusive rights to import rice for 15 years from 1996 to 2010. This is in return for them performing social obligations[172]. The agreement was later extended in 2010, which lengthened the privilege mandated to BERNAS for another 10 years, ending in 2021[173]. The government has always maintained that single importation is to ensure the stability of the domestic rice market and food security[174]. The exclusive importing rights of BERNAS also makes the company Malaysia's sole state trading enterprise (STE) in the international rice market and the only company selling imported rice to wholesalers. This market structure is an important feature of the paddy and rice supply chain for Malaysia. The concept of market structure, consequences of different market structures and STE are explained in Box Article 8.

167 Davidson (2018) & Court of Appeal of Malaysia (2015)
168 SPPM is a company under Muda Agricultural Development Authority (MADA).
169 SPPK is a company under Kemubu Agricultural Development Authority (KADA).
170 Davidson (2018)
171 Dewan Negara (2010)
172 Ibid.
173 BERNAS (2011)
174 Parlimen Malaysia (2016)

BOX ARTICLE 8: Market Structures and State Trading Enterprise (STE)

Market structure refers to the characteristics of agents (firms or sellers and buyers), goods produced and traded and barriers to entry and exit, as well as the flow of information in a market. The structure of a market determines how agents make decisions and behave, and consequently the quantity of trade, price and profit in the market.

A perfectly competitive market is one that is defined by the presence of numerous firms, selling similar goods and the ability of any firm to freely enter or exit the market. In this setting, firms are price-takers. However, few markets are perfectly competitive and most markets have various imperfections.

A one-firm market structure is called a monopoly (one-firm seller) or a monopsony (one-firm buyer). A key feature of this market is its high barrier to entry and only one firm remains in the market. This firm has high market power and can determine the price and/or quantity of goods in the market. Market features that lead to this structure include:

i) Sole ownership of resources;
ii) Government policies or regulations; and
iii) Specific production process leading to natural monopolies.

Patent, copyright laws and exclusive selling or buying rights are examples of government policies that can give a specific firm high market power. In some instances, the efficiency of production is achieved when the market only has one firm, for instance in the distribution of water and power for an area, leading to the creation of natural monopolies.

Between perfect competition and monopoly, there exist other market structures such as monopolistic competition, duopoly and oligopoly—each with different market characteristics and outcomes not elaborated here but discussed further in Mankiw (2008), *Economics: Principles and Applications*[175].

175 Mankiw (2008), Economics: Principles and Applications

Economic effects of monopoly[176]

By understanding the structure of a market, we can understand the behaviour of firms and the likely outcomes in the market. For instance, perfectly competitive markets are said to produce economically efficient price and quantity outcomes. On the other hand, monopolies produce inefficiencies in the market because the final price of a good is too high and the quantity of goods produced is too low. There is welfare loss[177] in the economy as the good becomes unaffordable for some consumers and less of the good is consumed.

For this reason, monopolies are closely monitored by policymakers and often regulated.

State Trading Enterprise (STE)[178]

A State Trading Enterprise (STE) is a specific example of a one-firm entity created by governments. These enterprises are given exclusive rights by governments to import or export certain goods[179]. STEs are prevalent in developed and developing, as well as exporting and importing countries. Notable examples of STEs include the US Commodity Credit Corporation, the Canadian Wheat Board, the Japanese Food Agency, the Indonesian *Badan Urusan Logistik* (BULOG) and Malaysia's BERNAS.

In the agriculture market, an STE carries out various functions. For example, statutory marketing boards are usually involved in stabilising prices, while export marketing boards aim to maximise profits in international trade. STEs differ by countries' trade policies and domestic priorities. The exclusive rights granted to STEs might raise concerns about the creation of monopoly (right to sell/export) and/or monopsony (right to buy/import) power. STEs are also often viewed as unfair traders in the international agriculture market.

176 Based on ibid. and Varian (1992)
177 In economics, welfare loss is the efficiency loss due to not achieving competitive equilibrium outcomes.
178 OECD (2001)
179 Ibid.

However, the effects of STEs must be understood in tandem with a country's other international trade policies as STEs are not necessarily non-competitive[180]. Moreover, STEs must also be assessed in terms of their domestic non-economic or non-commercial obligations as these might impose different costs to the STEs and the presumed profits might be over or underestimated.

BERNAS was listed on the Kuala Lumpur Stock Exchange (KLSE, now known as Bursa Malaysia) in August 1997. Growing foreign ownership of BERNAS led to growing public concerns over foreign ownership in a company with national interests. A Hong Kong-based company, Wang Tak Company Limited (WTCL) started buying shares in BERNAS in 2000[181] and by 2009 owned a 31.5% stake in BERNAS[182]. Politicians and the Federation of Malaysian Consumers Associations (FOMCA) expressed worries over the matter[183]. In February 2010, Tradewinds (M) Berhad (TWM) obtained a 72.3% stake in BERNAS with the acquisition of shares from WTCL, BGSB and a mandatory offer to other shareholders[184]. The acquisition of shares from WTCL was deemed as having its foreign shares transferred back to a local company.

In November 2013, BERNAS undertook voluntary delisting from Bursa Malaysia (formerly KLSE). The rationale behind the delisting, as quoted[185], was to resolve the issue of non-compliance with the 25% public shareholding spread requirement set by the bourse[186]. As of 4 November 2013, BERNAS only had a public shareholding spread of 16.3% while TWM controlled 83.7% of its shares[187].

180 Ibid.
181 BERNAS (2000) & BERNAS (2001)
182 Dewan Rakyat (2009)
183 The Edge (2009)
184 BERNAS (2009)
185 The Edge (2013)
186 According to Bursa Malaysia, at least 25% of a listed company shares must be held by not less than 1,000 public shareholders. This is called public shareholding spread requirement.
187 The Edge (2013)

Figure 5.8. Key events in the evolution of BERNAS

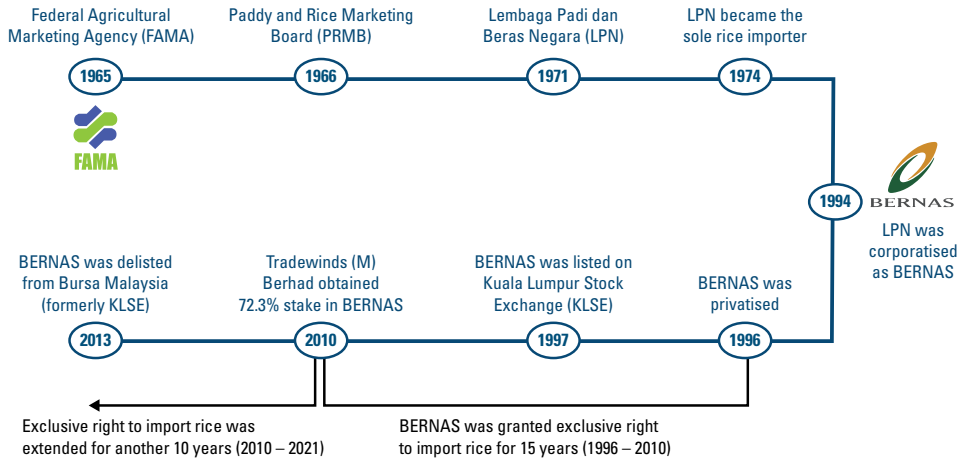


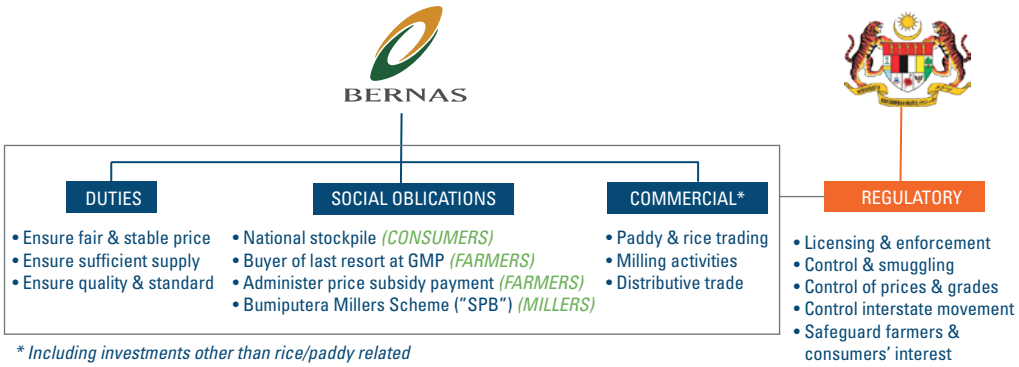
Chart by KRI

The Activities of BERNAS

Presently, BERNAS plays several roles in the paddy and rice industry. In addition to its commercial interests, the company has social and financial obligations (Figure 5.9). However, it does not have any statutory power or authority and the government remains the regulator for the whole industry[188].

188 World Trade Organization (WTO) (2016)

Figure 5.9. Functions of BERNAS

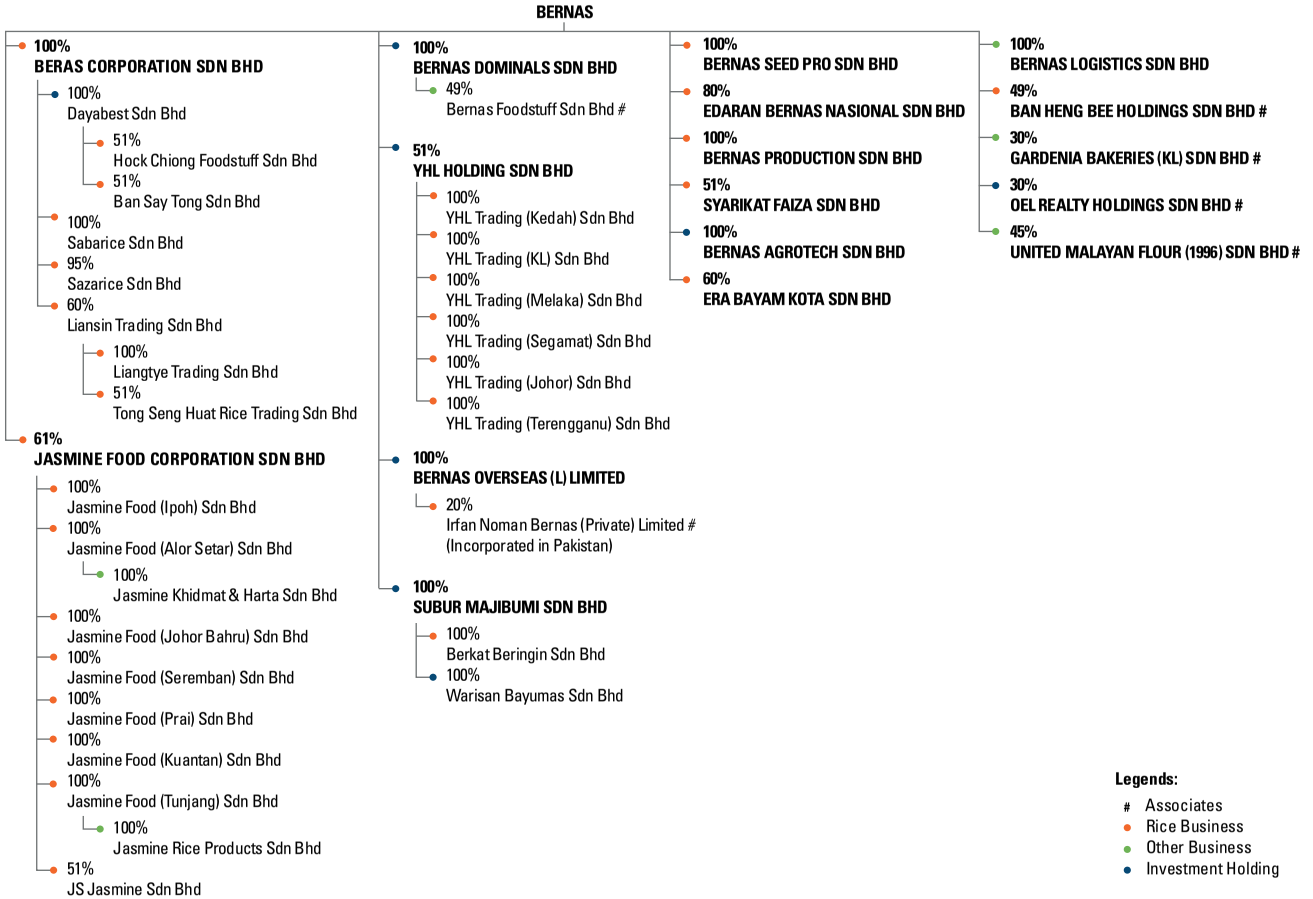


Source:
Strategic and Planning Department, BERNAS website
Chart by KRI

In its commercial capacity, BERNAS is involved extensively in the whole paddy and rice supply chain—from the production of paddy seeds to rice milling, local trading and distribution to overseas trading[189]. In addition, BERNAS is also involved in non-rice businesses such as feedstuff, logistics, flour and bakeries. Figure 5.10 shows BERNAS's range of businesses.

189 BERNAS (2012)

Figure 5.10. Subsidiary companies of BERNAS

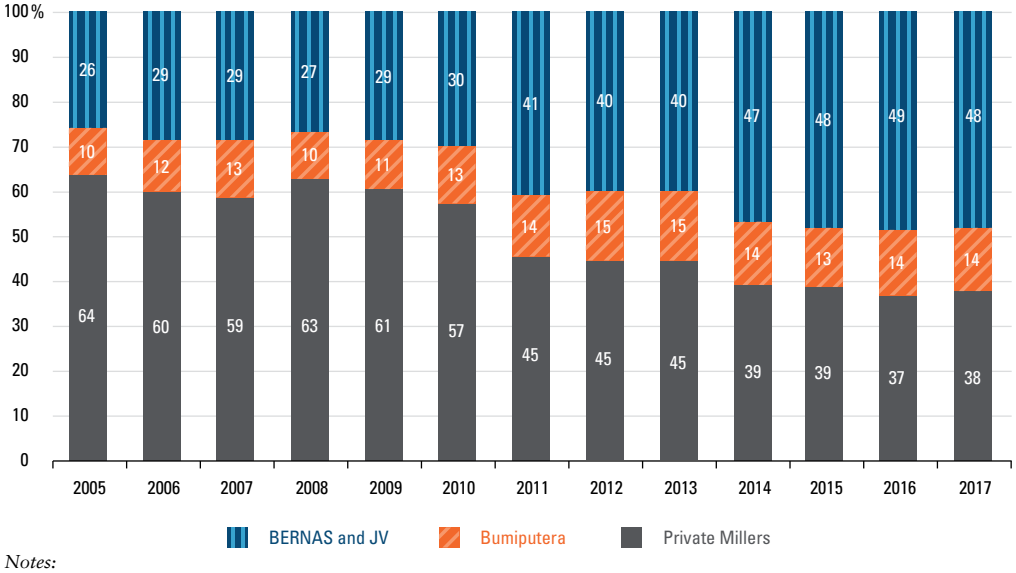


Source:
Corporate Structure (pg. 10 – 11), Annual Report 2012, BERNAS

Besides importing rice from other countries and distributing them to wholesalers, BERNAS also procures paddy from local farmers and millers and markets them. This procurement is not only part of its commercial interest but also one of its social obligations to be the BOLR. The company owns and operates 28 out of 400 commercial rice mills in Malaysia, mainly located in the major granary areas of Kedah, Perlis, Kelantan, Perak and Selangor. It is the largest rice miller in Malaysia, milling around 15% of the paddy produced in 2015 which gave 13% of the total domestic rice output[190]. This, however, does not include paddy processed by BERNAS' joint ventures (JV) millers. The total share of paddy processed by both BERNAS and JV millers in 2015 was 48% (Figure 5.11). Over the years, the market share of BERNAS and its subsidiary companies in the milling segment has increased while the market share of private millers has been declining.

Market share of private millers has been declining

Figure 5.11. Market share in the milling segment, 2005 - 2017 (percentage)



Notes:

1. *Market share is based on the purchasing profile of milling companies in the sector*
2. *JV refers to subsidiary companies of BERNAS*
3. *Bumiputera refers to millers under the Skim Pusat Belian (SPB) scheme and the Skim Upah Mengering dan Kisar (SUMK) scheme. Pre-2010, SPB and SUMK are the same entities*

Source:
Pers. comm. with BERNAS
Chart by KRI

190 Based on the estimate from BERNAS' website.

However, high market share does not automatically equate to monopoly or abuse of dominant power. Further market review by the Malaysia Competition Commission (MyCC) may be required. The Competition Act 2010 states that "(1) The Commission may, on its own initiative or upon the request of the Minister, conduct a review into any market in order to determine whether any feature or combination of features of the market prevents, restricts or distorts competition in the market. (2) This market review includes a study into (a) the structure of the market concerned; (b) the conduct of enterprises in the market; (c) the conduct of suppliers and consumers to the enterprises in the market; or (d) any other relevant matters."[191] Moreover, even if a company has a dominant position, the Act only prohibits abuse of this dominant position and does not prohibit any dominant enterprise from activities with reasonable commercial justifications[192]. BERNAS does not have the power to set the price for rice, which is determined by the government through ceiling prices. For rice grades without ceiling prices, the company sets the price based on rice quality and targeted market[193].

BERNAS has 20 distribution centres and warehouses around Malaysia (9 in Peninsular Malaysia and 11 in East Malaysia). These warehouses also store the national stockpile managed by BERNAS as part of the privatisation agreement.

Besides managing the rice stockpile, BERNAS also has three other social obligations namely being the BOLR at the GMP, administering price subsidy scheme and managing the *Bumiputera* Rice Millers (BRM) Scheme.

There are two instances where BERNAS acts as the BOLR. The first instance is when there are no or insufficient private millers in certain paddy planted areas. For example, due to the GMP standardisation exercise in 2014, many millers were forced to shut down in Kelantan. As a result, BERNAS, due to its social obligation as a BOLR, had to buy paddy from farmers in Kelantan, regardless of the quality[194]. The second instance is when the private millers have met their daily drying capacity during peak harvesting seasons. In the past, all these purchases were done based on the market price, above the GMP[195].

191 Competition Act 2010. "Commission" refers to the Competition Commission established under this act. "Minister" refers to the Minister charged with the responsibility for domestic trade and consumer affairs.

192 Malaysia Competition Comission (MyCC) (n.d.)

193 World Trade Organization (WTO) (2016)

194 Dewan Rakyat (2016), pg. 14

195 Malaysian Institute of Economic Research (MIER) (2009)

BERNAS is also responsible for managing the delivery of the price subsidy scheme (*Skim Subisidi Harga Padi*) to all registered paddy farmers on behalf of the government. The price subsidy scheme is distributed in mills that are licensed under *Kawalselia*. The subsidy funds are deposited by the government into BERNAS' special paddy price subsidy accounts and the unutilised portion is to be placed into fixed deposit accounts. The funds are not recorded in the assets and liabilities of BERNAS[196].

There are three types of schemes under the BRM Scheme:

1. *Skim Pusat Belian* (SPB) where BERNAS provides funding to BRM for paddy procurement;
2. *Skim Upah Mengering dan Kisar* (SUMK) where BERNAS supplies wet paddy to BRM for drying and milling; and
3. *Skim Upah Kisar* (SUK) where BERNAS supplies dried paddy to BRM for milling.

These schemes are a continuation from schemes previously conducted by LPN.

In conclusion, BERNAS is a key institution and a commercial company in the midstream segment of the paddy and rice supply chain in Malaysia. Given its history, the development of commercial interests and non-commercial obligations and its functions as the country's STE in the international rice market, understanding the company's operations, effectiveness, relevance and effects on the industry is a complex exercise, involving not only the company but other stakeholders in the paddy and rice supply chain.

Despite being the sole importer of rice, BERNAS may not fit our textbook understanding of a monopoly. The quantity of rice imported and sold to wholesalers is determined by non-commercial considerations such as annual rice deficit and stockpile requirements for food security, both of which are determined by the government[197]. The operations of the company must also be understood in the context of its various social obligations, as mandated and supervised by the government.

Finally, due to the long-standing social obligations of BERNAS, the domestic paddy industry must first be strengthened before attempts are made to change BERNAS's role including its exclusive rights to import rice. For the same reason, carefully evaluate the impact of the intended changes prior to implementation.

196 BERNAS (2012)
197 World Trade Organization (WTO) (2016)

CHAPTER KEY TAKEAWAYS

Midstream – Milling & Processing

- There is distrust between millers and farmers.
- **Recommendation:** A decentralised, independent data keeping system (such as Blockchain) may help address this problem.
- As the nation focuses on protecting the farmers and consumers at either end of the supply chain, the profit-margin in the midstream segment gets 'squeezed'. This is made worse when the GMP was standardized across states to RM1,200/MT in 2014.
- To survive, some private millers had to resort to **malpractices**, **diversify their operations** or **cease functioning**.
- We should not view the midstream players negatively and restrict their business operations. A regulatory environment that encourages the growth and success of each segment of the supply chain is important for the industry to grow.
- **Recommendation:** Adopt a risk-sharing approach. A possible framework for this is contract farming (Box Article 6, Chapter 4).
- An additional observation is that millers sell the lowest quality milled rice, ST15%, at **RM2,000/MT to wholesalers**. However, in retail, ST15% rice has a ceiling price of **RM1,650** to **RM1,800/MT**. This **price inconsistency** is worth investigating further.

Import

- Malaysia is still a net importer of rice despite decades of policies and billions of Ringgit spent to help increase rice production.
- The OECD-FAO Agricultural Outlook 2018-2027 predicted that **Malaysia's rice import would continue to increase**.
- Malaysia's **island-like geography** is one of the possible reasons it is a net rice importer.
- In addition, there is an **increasing trend** of consuming **premium**, imported **specialty rice**.
- Therefore, Malaysia is expected to continue to be a net importer and this should not be seen as a failure of the industry.

- **Recommendation:** The country may focus its resources on R&D and improvements in sustainable farming practices. The nation may consider targeting lowered rice SSL but with the domestic rice produced sustainably, responsibly, safely and where farmers earn a significant profit.
- **Recommendation:** An in-depth study is needed to determine the optimal SSL range that is not too low such that it risks food security (availability), and that is not unrealistically high.

Stockpile

- Before the 2008 Global Food Crisis, the national stockpile stood at 92,000 MT.
- Post-crisis, the nation's stockpile was immediately increased to 292,000 MT.
- According to BERNAS, the current stockpile stands at 150,000MT. At this amount, it costs BERNAS around RM30m/year for operating expenditure.
- There is little literature available regarding the nation's stockpile and even less publicly available data for further analysis.
- **Recommendation:** Discussions regarding the relevance of maintaining the current volume of rice stockpile and the ideal volume should be explored further.

BERNAS in the Supply Chain

- **BERNAS has both commercial interests and social obligations.** However, it does not have any statutory power or authority and the government remains the regulator for the whole industry.
- Over the years, the market share of BERNAS and its subsidiary companies in the milling segment has increased, while the market share of private millers has been declining.
- Having said this, the Competition Act 2010 recognises that market share is not the only conclusive determinant of dominant power in the market.
- Understanding BERNAS's operations, effectiveness, relevance and effects on the industry is a complex exercise and care is needed when determining policies affecting this company.

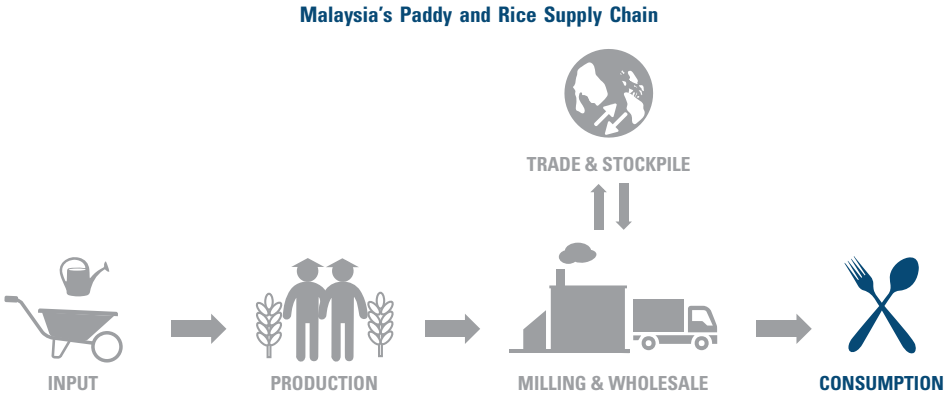
CHAPTER

06

SUPPLY CHAIN: RICE CONSUMPTION

CHAPTER 6

SUPPLY CHAIN: RICE CONSUMPTION



This chapter looks at how 31 million people consume rice in Malaysia. Specifically, Chapter 6 will explore the nation's consumption level compared to its neighbours and its domestic consumption behaviour across income groups, states and ethnicities.

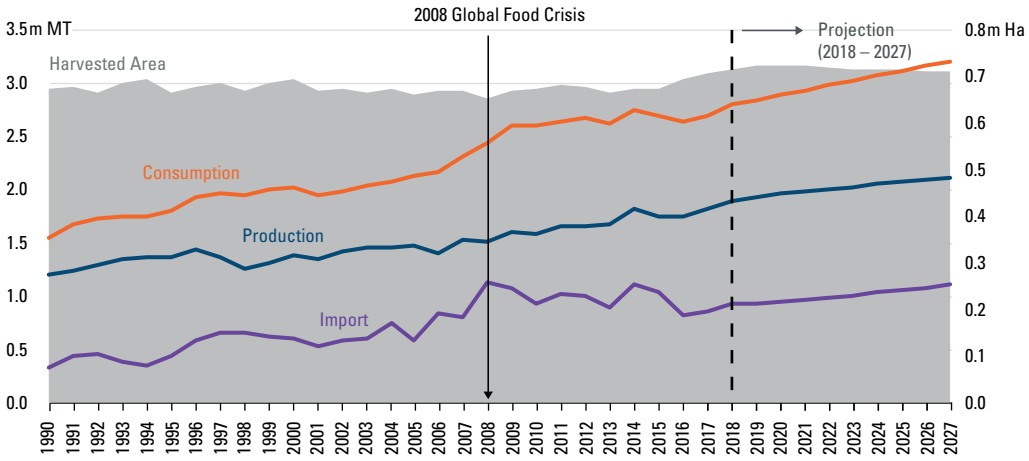
This chapter will also look into *invisible* consumption, which is the estimated consumption of rice by both documented and undocumented migrant workers. This group is noted to be one of Malaysia's most vulnerable groups of people with regards to food security.

Rice Consumption – How Much Do We Eat as a Nation?

For the year 2016, Malaysia's consumption of rice was at 2.7m MT[198] and according to projections by the OECD, the consumption trend is expected to continue to increase as the national population grows (Figure 6.1). This happens despite a near constant harvested paddy area, indicating that the gap between production and consumption of rice in Malaysia will likely widen especially if the yield per hectare increases at a slower rate than the consumption growth. It is likely that increasing demand will be met by increasing imports (Figure 6.1).

198 Agrofood Statistics 2016, MOA (2016a). Total apparent consumption = total domestic rice production + import – export.

Figure 6.1. Annual rice production, consumption, import and harvested area in Malaysia, 1990 – 2027 (m MT and m Ha)



Source:
OECD-FAO Agricultural Outlook, 2018-2027 (Accessed 24 October 2018)
Chart by KRI

Rice consumption per capita[199] is the estimated amount of rice 'consumed' per person. The rice consumption per capita does not only include the consumption of rice as human food such as in the form of steamed rice, rice flour and rice noodles, but also non-food consumption such as cosmetics, animal feed and other by-products.

Despite an initial decline of the rice consumption per capita from the late 1990s to the early 2000s, the consumption level recorded an increase in 2003 and the trend has hovered above 80kg/person/year since 2008 (Figure 6.2). It recorded the highest level of 83.9kg/person/year in 2009. There is not enough information to explain the observable trend of rice consumption per capita and it can only be speculated that this may be due to adjustments to the national stockpile or changes in the use of rice and/or its by-products in the manufacturing sector.

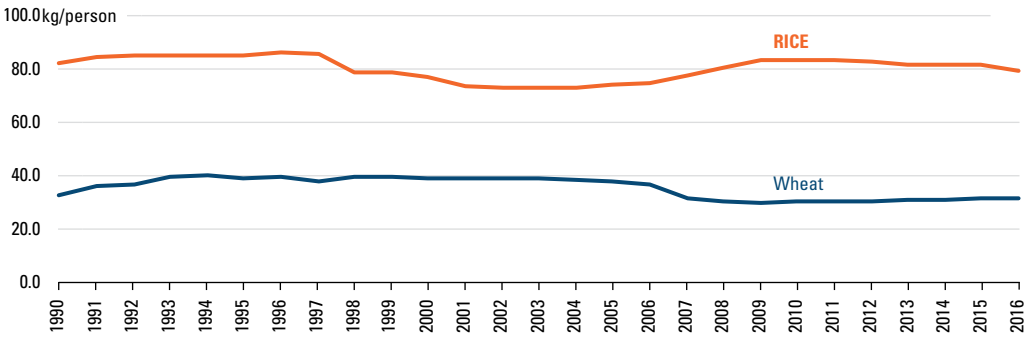
199 Rice consumption per capita = (domestic production + import) / population size

The percentage share of the total caloric supply from rice has been steadily declining since the 1960s (Figure 6.3). The observation is consistent with Bennett's law that says as countries become more affluent, they diversify their diet away from starchy staples to more complex sources of calories[200]. The diversification means that food security should be considered from a more holistic perspective, involving other sources of food.

Despite dietary diversification, rice remains the main source of carbohydrate in Malaysia. Comparing the consumption per capita of rice and wheat, rice consumption stood at almost three times more than that of wheat (Figure 6.2), suggesting that it is still an important source of carbohydrate for most Malaysians as it is the nation's staple food. As such, the performance of the paddy and rice industry remains an important matter for the country.

Over the years, the nation consumed almost three times more rice than wheat

Figure 6.2. Rice and wheat per capita consumption in Malaysia, 1990 – 2016 (kg/person)

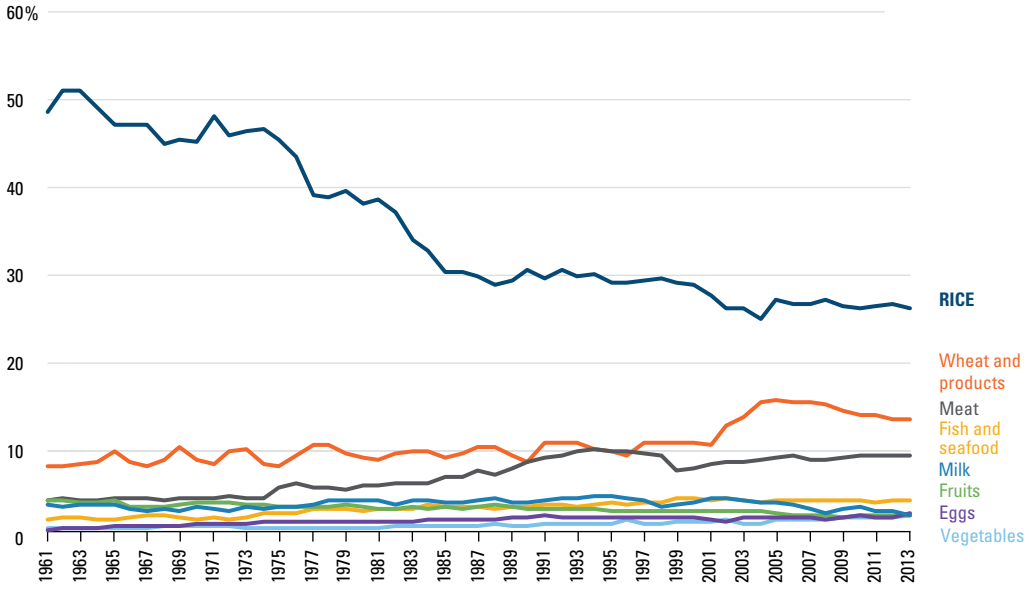


Source:
OECD-FAO Agricultural Outlook, 2018-2027 (Accessed 24 October 2018)
Chart by KRI

200 Bennett (1954) as cited in Reardon and Timmer (2014)

The share of rice in the total caloric supply has been declining since the 1960s. However, it still remains the highest source of calorie for Malaysians compared to other sources

Figure 6.3. The percentage share of caloric supply of total calories, 1961 – 2013

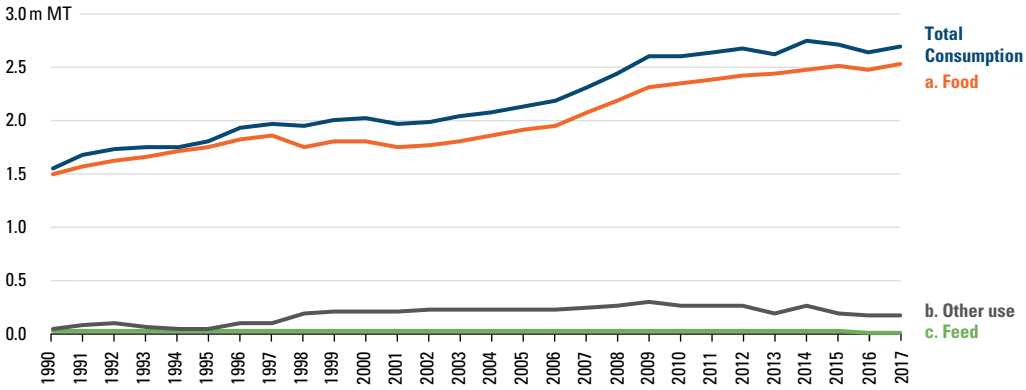


Note:
The share of caloric supply is calculated by taking the percentage of the caloric supply of each food item to the total caloric supply. Data from FAOSTAT is in kcal/person/day.
Source:
Food balance sheets: Food supply (kcal/capita/day), FAOSTAT (Accessed 7 November 2018)
Chart and calculaton by KRI

The total national consumption of rice showed an increasing trend, with food comprising the biggest proportion. Data from OECD showed that rice consumed as food is the main contributor to the increase in the total rice consumption, with feed and other uses having little impact on the increasing trend. It is worth noting that the total national rice consumption almost doubled from 1.6m MT in 1990 to 2.7m MT in 2016 (Figure 6.4.).

In Malaysia, rice is mostly consumed as food. A smaller portion is used for feed and other use

Figure 6.4. Malaysia's total rice consumption and its components, 1990 – 2017 (m MT)

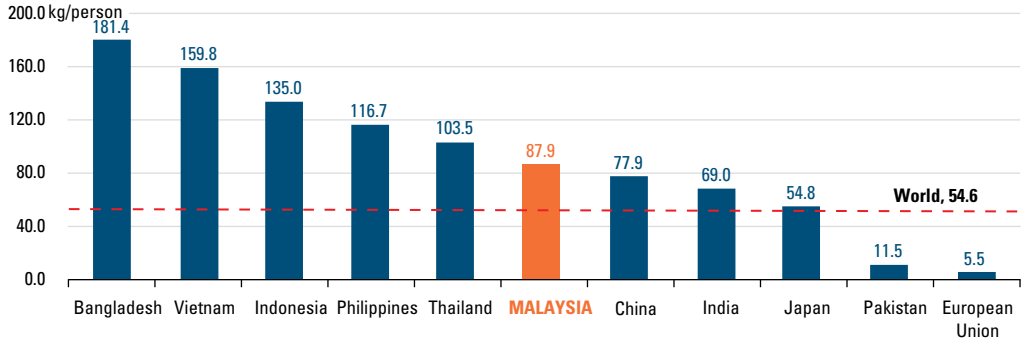


Source:
OECD-FAO Agricultural Outlook, 2018-2027 (Accessed 24 October 2018)
Chart by KRI

Compared to other countries where rice is also the staple food, in 2016 (Figure 6.5), Malaysia's rice consumption per capita was estimated to be above the world average (54.6kg/person), more than India (69.0kg/person) and Japan (54.8kg/person) but less than Indonesia (135.0kg/person), the Philippines (116.7kg/person) and Thailand (103.5kg/person).

Malaysia's rice consumption per capita is at 87.9kg/person, which is well above the world average of 54.6kg/person

Figure 6.5. Rice per capita consumption by country, 2016 (kg/person)



Notes:

1 *Data above is from an older version of OECD-FAO Agricultural Outlook because the latest report did not have consumption data for Bangladesh*

2 *Note the data discrepancy for Malaysia: based on OECD-FAO Agricultural Outlook 2018-2027, Malaysia's rice consumption per capita in 2016 is 80.0kg/person*

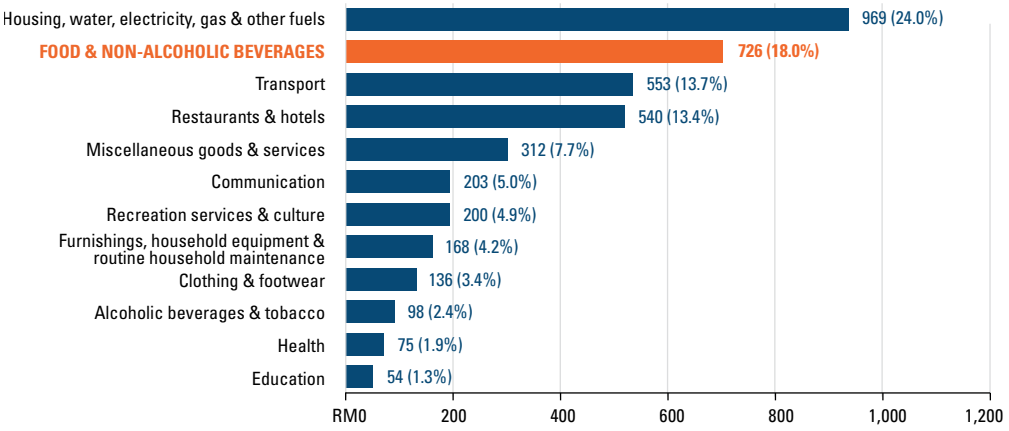
Source:
OECD-FAO Agricultural Outlook, 2017-2026 (Accessed 24 October 2018)
Chart by KRI

Rice Consumption – How do Different Groups in Malaysia Eat?

Rice has always been an important source of energy especially for the rural and poorer communities in Malaysia. According to the national Household Expenditure Survey (HES) 2016, the the average household in Malaysia spent 18% of its total monthly expenditure on food and non-alcoholic beverages (F&B) or RM726 out of RM4,033 (Figure 6.6).

On average, households spent RM726 per month or 18% of the total monthly household expenditure on food and non-alcoholic beverages (F&B)

Figure 6.6. Monthly household expenditure, 2016 (RM/month)



Notes:

1. *Percentages are from the total of monthly household expenditure*
2. *The sum of expenditure of all categories in the figure above is RM4,034. The discrepancy is due to rounding off*

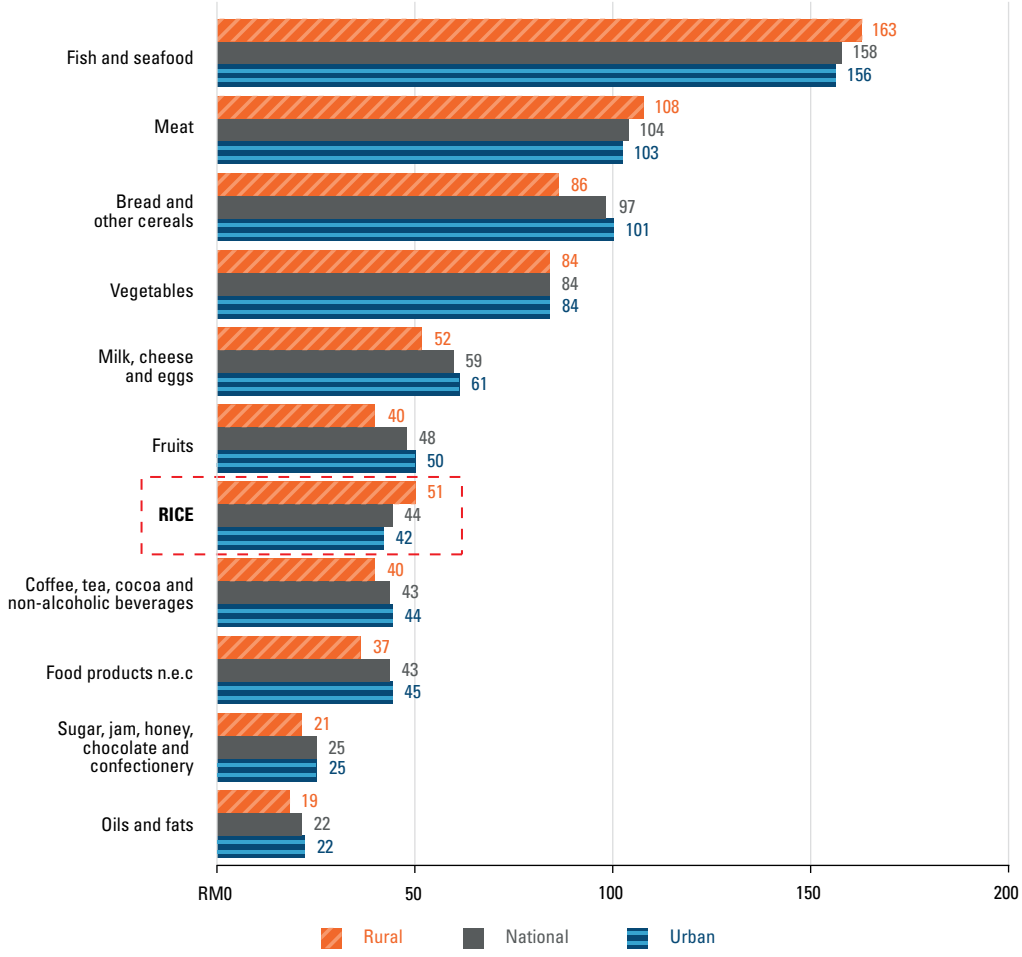
Source:

Table 2.1: Composition of monthly household consumption expenditure by strata, 2016 (pg. 55), Household Expenditure Survey (2016), DOS (2017) (Accessed 24 October 2018)
Chart by KRI

Within the F&B category, rural households spent more on rice than their urban counterparts. Referring to Figure 6.7, the average household spent 6.1% (RM44/month) of the total amount spent on F&B, on rice. Those in rural areas spent up to 7.2%, while those in urban areas spent 5.7% on rice (at RM51/month and RM42/month, respectively).

Rural households spent more on rice compared to urban households

Figure 6.7. Monthly household expenditure on F&B, 2016 (RM/month)

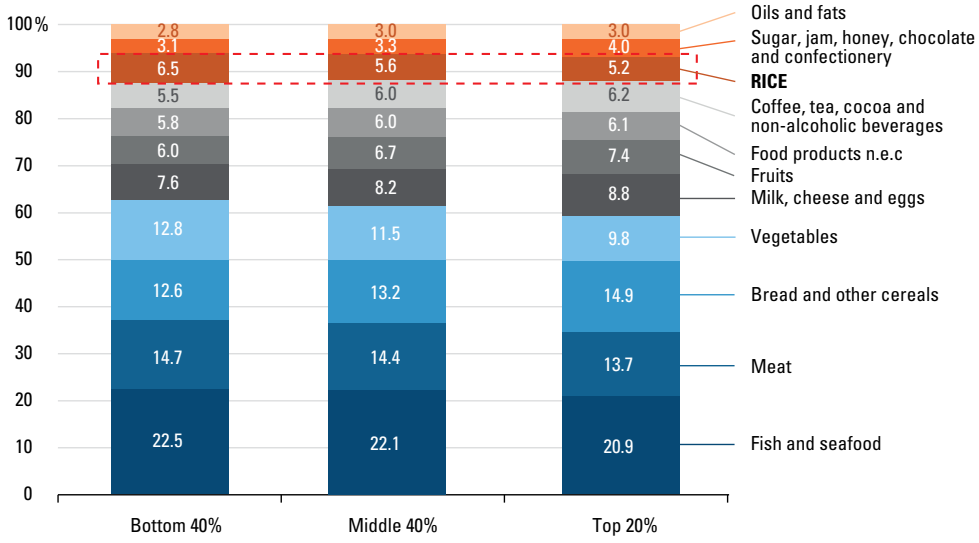


Source:
Table 2.1: Composition of monthly household consumption expenditure by strata, 2016 (pg. 55). Household Expenditure Survey (2016), DOS (2017) (Accessed 24 October 2018)
Chart by KRI

Not only do rural households spent more on rice, we also observe a higher percentage of expenditure on rice among the population in the bottom 40% of the income distribution, at 6.5% of the total amount spent on food compared to the population in the top 20% of the income distribution, at 5.2% of the total amount spent on food (Figure 6.8). Moving upwards in the income distribution, the percentage of monthly expenditure on rice decreases, but increases for bread and other cereals (Figure 6.9).

Malaysians in the bottom 40% of the national income group spent more on rice compared to other income groups in 2016

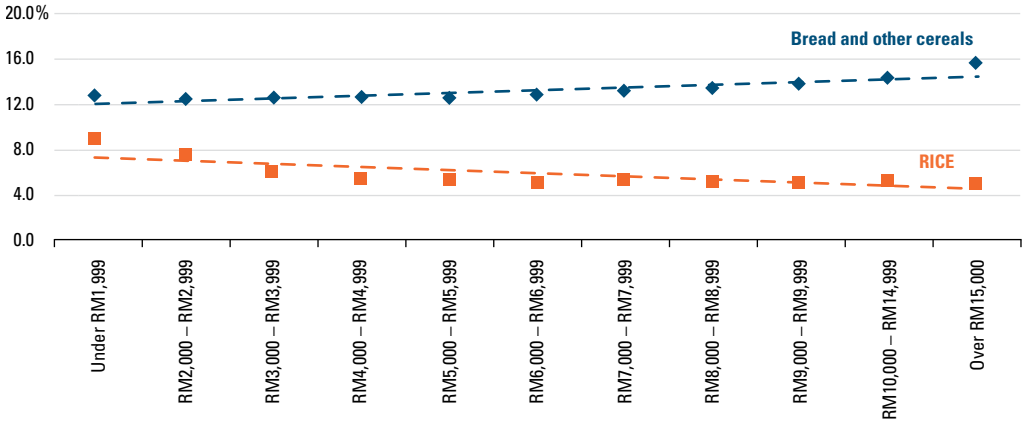
Figure 6.8. Percentage monthly household expenditure for different items in the F&B category according to income groups, 2016 (%)



Note:
F&B household expenditure of Bottom 40%, Middle 40% and Top 20% in 2016 is RM582, RM780 and RM959 respectively
Source:
Table 2.16: Composition of monthly household consumption expenditure by household income group, Malaysia, 2016 (pg. 102), Household Expenditure Survey (2016), DOS (2017) (Accessed 24 October 2018)
Chart by KRI

As income increases, the percentage spent on rice decreases and vice versa for bread and other cereals

Figure 6.9. Percentage monthly household expenditure on grains from the respective amount spent on F&B, by income level, 2016

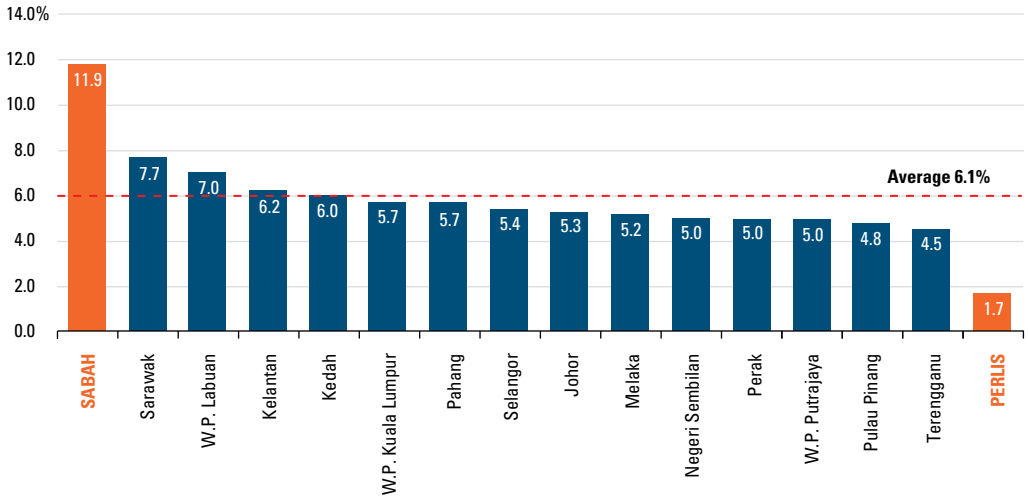


Source:
Table 2.12: Mean monthly household consumption expenditure by household income class and strata, Malaysia, 2016 (pg. 90). Household Income Survey (2016), DOS (2017) (Accessed 24 October 2018)
Chart by KRI

Interestingly, there is a large difference in the amount spent on rice between states in Malaysia. Perlis spent the least at just 1.7% from its total monthly expenditure on F&B (RM13/month), while Sabah spent the most at 11.9% (RM73/month) whereas the national average is at 6.1% (RM44/month) (Figure 6.10).

Households in Perlis spent the least on rice while households in Sabah spent the most on rice

Figure 6.10. Percentage of rice expenditure from the respective household expenditure on F&B, by state, 2016



Source:
Table 2.2: Composition of monthly household consumption expenditure by state and strata, Malaysia, 2016 (pg. 56 - 58). Household Expenditure Survey (2016), DOS (2017) (Accessed 24 October 2018)
Chart by KRI

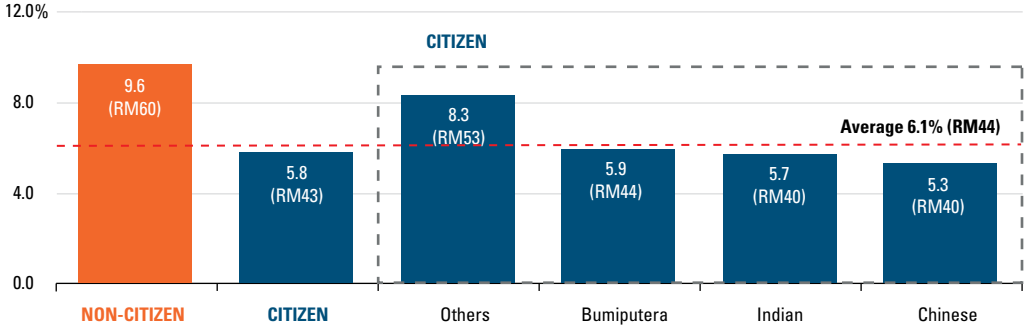
"... the poor, those from rural areas and migrant workers are most vulnerable to changes in rice supply and prices"

Among the main ethnic communities, *Bumiputera*[201], comprising 67.4% of the population (19.1 million), spent RM44/month/household on rice, followed by the Indians and Chinese both at RM40/month/household (Figure 6.11). The other races comprising 0.7% of the nation's population (0.2 million) spent the highest at RM53/month/household.

Having said this, the amount spent by the different ethnic communities in Malaysia on average is still less than non-citizens, which make up 8.2% of the population (2.3 million), that spent as high as RM60/month/household or 9.6% of their total monthly expenditure on F&B, on rice. Given that there are more than 2.0 million non-citizens in Malaysia who are mostly associated with being poor and from countries where rice is the staple food, these non-citizens are the most vulnerable communities. Unfortunately, the demographics of this group is the least understood as data on the number of migrant workers are limited. In short, the poor, those from rural areas and migrant workers are most vulnerable to changes in rice supply and prices.

Non-citizens living in Malaysia spent the highest on rice

Figure 6.11. Percentage of monthly expenditure on rice from the respective amount spent on F&B, by ethnicity and citizenship, 2016 (%)



Source:
Table 2.3: Mean monthly household consumption expenditure by ethnic group of head of household and strata, Malaysia, 2016 (pg 65). Household Expenditure Survey (2016), DOS (2017) (Accessed 24 October 2018)
Chart by KRI

201 According to the HES 2016, the ethnic group classification is according to the 2010 Population and Housing Census. In 2010, the population was 28.3 million, 91.8% Malaysian citizens, and 8.2% non-citizens. Among the citizens, *Bumiputera* comprise 67.4%, Chinese 24.6%, Indian 7.3% and Others 0.7%.

BOX ARTICLE 9: *Invisible* Consumption

"Immigrant labor plays a crucial role in Malaysia's development. Immigrants–both high- and low-skilled–will be needed for the country to achieve high income status by 2020"

Malaysia Economic Monitor, December 2015 - Immigrant Labor, World Bank

According to the 'Malaysia Economic Monitor December 2015, Immigrant Labor' report by the World Bank[202], migrant workers comprise both professionals and low-skilled workers with the latter forming more than 50% of the total foreign workforce.

It is thus assumed in the following paragraphs that non-citizens are largely represented by low-skilled workers. In the same report by the World Bank, there may be an additional 1.0 million more undocumented foreign workers in 2014 on top of the 2.1 million registered workers. This is about 15% of the total workforce in Malaysia.

Based on Figure 6.11, in 2016, non-citizens had the highest total expenditure on rice compared to Malaysian citizens. This may be a consequence of low income and a cultural preference for large rice consumption (Figure 6.5 and Figure 6.9).

Unfortunately, the large number of undocumented workers in Malaysia means that it is not possible to calculate the actual rice consumption of migrant workers and gauge future demand. Regardless of their citizenship status, given that migrants are the most vulnerable group of people, not being able to estimate the demand level of their staple food is not ideal. This is especially concerning, given that Malaysia pledged to commit to the United Nations 2030 Sustainable Development Goals (UN SDG) with its leading theme of "leaving no one behind".

202 World Bank (2015)

To gauge the consumption level of migrant workers, KRI used available data from the Ministry of Home Affairs (MOHA), Economic Planning Unit (EPU), OECD and Ministry of Agriculture (MOA) (Table 6.1).

For 2.1 million documented foreign workers, a total of 228,899 MT of rice is needed, assuming that the workers consume the cheapest rice available in retail stores, which is domestically produced rice. This is also assuming that the migrant workers consume the same amount of rice in Malaysia as they would in their own country.

As the number of workers increases by a million, the amount consumed increased by about 100,000 MT. If there were 4.0 million migrant workers (both documented and undocumented) and if they purchase only local rice in the market[203] then this amounts to consuming around 24.1%[204] of the total domestic rice produced in 2014 (Figure 6.12) and around 16.2%[205] of the total domestic consumption.

203 Assuming that the local rice a cheaper option compared to imported rice.

204 (441 471/1.835m)*100=24.1%, where domestic rice produced in 2014 is 1.835m MT. Source: Agrofood Statistics 2015, MOA (2015)

205 (441 471/2.719m)*100 = 16.2%, where apparent consumption (domestic production + net import) in 2014 is 2.719m MT. Source: Paddy Statistics of Malaysia 2014, DOA (2015c)

Table 6.1. Estimated rice consumption according to country of origin, 2014[206]

Country of Origin	Migrant Workers[a]		Estimated Rice Consumption[b]	
	Number (person) [A]	Percentage (%)	Consumption Per Capita (kg/person)[b] [B]	Amount (MT) [A] x [B] = [C]/1000
Indonesia	817,300	39.4	134.71	110,095
Bangladesh	296,930	14.3	180.67	53,647
Nepal	490,297	23.6	66.83	32,767
Myanmar	143,334	6.9	66.83	9,579
Philippines	63,711	3.1	117.74	7,501
India	105,188	5.1	69.06	7,264
Others	92,624	4.5	66.83	6,190
Thailand	12,467	0.6	101.14	1,261
Pakistan	51,563	2.5	11.50	593
TOTAL	2,073,414	100.0	-	228,899

Notes:

1. *"Others" include Cambodia, China, Vietnam, Sri Lanka and Laos*
2. *Consumption per capita estimates are based on each country's specific conditions (price, rice availabilities, cultural preferences etc.). It is assumed that migrant workers consume the same amount of rice in Malaysia as they would in their home country*
3. *For Nepal, Myanmar and Others, consumption per capita data used is from estimates for Least Developed Countries because they are not estimated by the OECD-FAO Agricultural Outlook report*
4. *Estimates are based on 2014 data because the World Bank's estimate for undocumented foreign workers in Malaysia is for 2014*

Source:

[a] *Ministry of Home Affairs, cited by EPU in Table 1.4.1: Number of Foreign Workers by Country of Origin, 2000 – 2015 (Accessed 22 May 2017)*

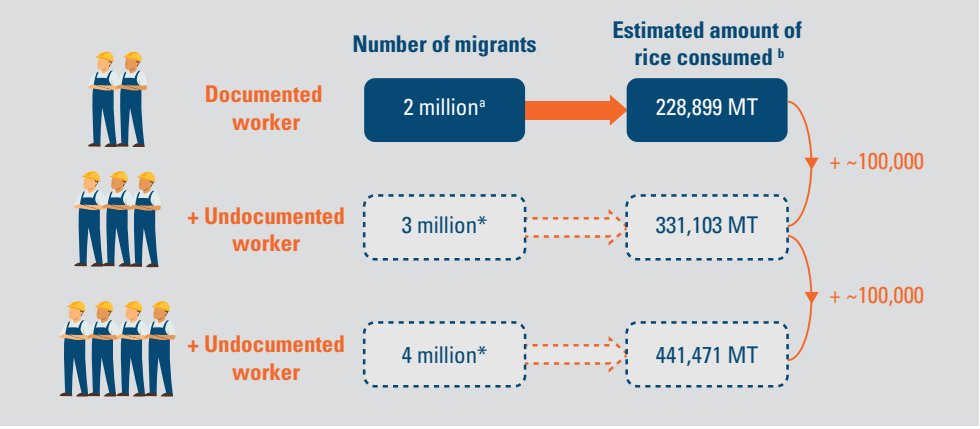
[b] *OECD-FAO Agricultural Outlook, 2016-2026 (Accessed 24 October 2018)*

Table and calculations by KRI

206 The year 2014 was used because it is a year where data from all the various sources are made available.

The actual number of migrant workers is not known; there are approximately 2.1 million documented migrant workers and the remaining are undocumented. Calculations show that for every hypothetical addition of 1.0 million workers, the amount of rice consumed increases by approximately 100,000 MT

Figure 6.12. The estimated amount of rice needed to feed Malaysia's migrant workers in 2014



Notes:

1. *Assuming migrants from each country increase by the same proportion*
2. ** Hypothetical*
3. *Estimates based on 2014 data because the World Bank's estimate for undocumented foreign workers in Malaysia is for 2014*

Sources:

a *Ministry of Home Affairs (MOHA), cited by EPU in Table 1.4.1: Number of Foreign Workers by Country of Origin, 2000 – 2015 (Accessed 22 May 2017)*

b *OECD-FAO Agricultural Outlook, 2016-2026 (Accessed 24 October 2018)*

Illustration and calculations by KRI

"Regardless of their citizenship status, given that migrants are the most vulnerable group of people, not being able to estimate the demand level of their staple food is not ideal"

Rice Subsidy – How Much of Our Rice is Publicly Funded?

"…for every kilogram of local rice bought in 2016, the government contributed a total of RM0.79 through subsidies and incentives at various stages of the supply chain"

Public resources are used to ensure food security in rice and to protect the welfare of poor farmers. This is done by ensuring that they attain a certain level of profit from their harvests and through incentives to encourage farmers to increase their yield. As a result, about 30 – 50% of the national budget allocated for the MOA goes directly to paddy and rice-related incentives and subsidies. In 2016, the government spent RM1.4b on *Subsidi Harga Padi*, *Subsidi Baja Padi Kerajaan Persekutuan*, *Insentif Pengeluaran Padi, Subsidi Benih Padi Sah*.

To estimate the total amount of public expenditure spent on the production of local rice by the time it reaches the retail store, the incentives and subsidies throughout the supply chain were included using data from the Federal Government Financial Statements (Table 6.2), coupled with paddy and rice data from Agrofood Statistics 2016.

Calculations showed that for every kilogram of local rice bought in 2016, the government contributed a total of RM0.79 through subsidies and incentives at various stages of the supply chain (Figure 6.13).

This is a relatively large amount, given that the price of ST15% is between RM1.65 and RM1.80 per kilogram of rice. Furthermore, public expenditure on building new infrastructures, R&D and the operating expenses of government departments and agencies directly relevant to the paddy and rice industry were not included in this calculation, which suggests that the amount could have been more.

Table 6.2. The total amount of government expenditure on rice and paddy incentives and subsidies, 2014 – 2016 (RM m)

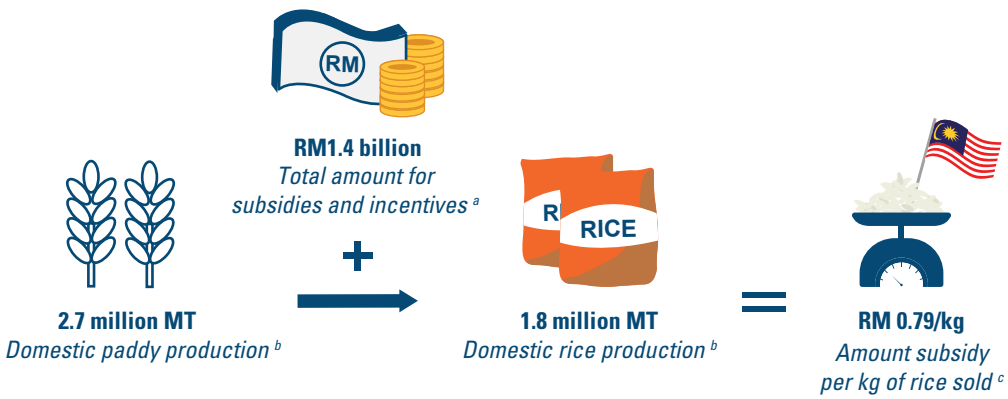
Programme	Actual Expenditure (m RM)		
	2014	2015	2016
Paddy Price Subsidy *(Subsidi Harga Padi)*	480	497	400
Fertiliser Subsidy *(Subsidi Baja Padi Kerajaan Persekutuan)*	457	389	400
Increase in Paddy Production Incentive *(Insentif Peningkatan Hasil Padi)*	80	-	-
Paddy Production Incentive *(Insentif Pengeluaran Padi)*	573	563	490
Rice Price Subsidy *(Subsidi Harga Beras)*	512	520	-
Certified Seed Subsidy *(Subsidi Benih Padi Sah)*	67	68	60
Hill Rice Fertiliser Subsidy *(Subsidi Baja Padi Bukit/Huma)*	-	20	39
Total Expenditure on Subsidies and Incentives (A)	2,168	2,057	1,389
Domestic rice production (m MT) (B)	1.84	1.77	1.76
Subsidy per kg of rice (RM/kg) [(A)/1000] / (B)	1.18	1.16	0.79
Total Expenditure for MOA (C)	4,422	3,954	3,385
Percentage Spent on Subsidies [(A)/(C)] x 100	49.0%	52.0%	41.0%

Sources:

(A) Sum of actual expenditure on paddy-related special programmes for B.21 Ministry of Agriculture and Agro-based Industries in Appendix 1: Operating Expenditure (pg. 117, 130-131, 126) of Federal Government Financial Statements (2014, 2015, 2016), Accountant General of Malaysia (1990-2017) (Accessed 24 October 2018)

(C) Actual expenditure of the total for B21. Ministry of Agriculture and Agro-based Industries in Appendix 1: Operating Expenditure (pg. 118, 132, 128) of Federal Government Financial Statements (2014, 2015, 2016), Accountant General of Malaysia (1990-2017) (Accessed 24 October 2018)

Figure 6.13. Estimation of the amount of public expenditure spent for each kilogram of rice sold in 2016



Assumptions:

1. *Figures for paddy and rice were produced in 2016*
2. *All 2.7m MT of paddy qualified for the subsidy and incentive programmes*
3. *Rice refers to all rice and rice-based products*

Sources:

- [a] *Subsidies data from Appendix 1: Operating Expenditure for B.21 Ministry of Agriculture and Agro-based Industries (pg. 117) in Federal Government Financial Statement 2016, Accountant General of Malaysia*
- [b] *Production data from Table 3.1.4: Production of Paddy and Rice, 2011 – 2016, Agrofood Statistics 2016, MOA (2016)*
- [c] *Calculations by KRI*

Illustration by KRI

Rice Prices

Impact of Rice Price Volatility

Since a large proportion of the human population consumes rice, especially those in developing countries, it is not surprising that many are vulnerable to its price volatility, which in turn could trigger food security-related issues. For example, after the sudden surge in food and fuel prices between 2006 and 2010, caloric food consumption declined in all developing regions, affecting as many as 4.5 billion people[207]. In another example, a community-based monitoring survey conducted in the Philippines estimated that a potential 40% rise in the price of rice could lead to a 2% increase in poverty within the population[208]. Social unrest is also a possible outcome. The 2007/2008 rice crisis led to the 2008 African food riots as prices of other food commodities rose, hitting countries such as Mozambique, Egypt and Morocco[209].

Considering this, policymakers recognise that production, consumption and price trends in the rice industry have possible implications for food security, poverty and the economic development of a nation[210]. In response, the rice industry in many Asian countries has been highly regulated to achieve domestic price stability and self-sufficiency[211]. But at what cost? What level of protection does the paddy and rice industry need? While rice is a crucial component in the diet of many Asians, other foods and other determinants of food security should not be ignored. Having a balanced focus on these matters is important.

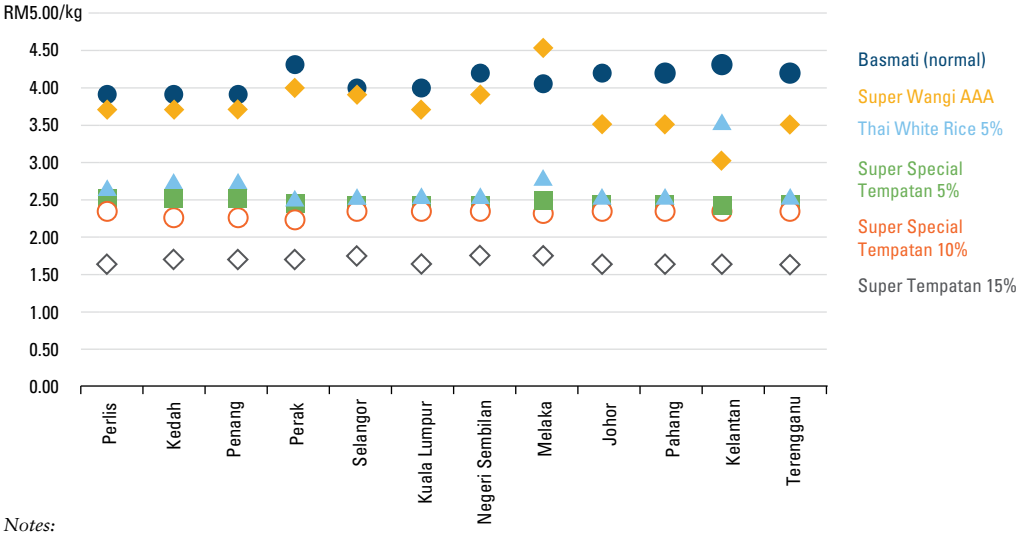
Domestic Prices

To protect Malaysian consumers from international price volatility, the domestic prices of rice have been fixed at a ceiling price. The price of ST15% was fixed since 1998 at a maximum price of RM1.80/kg whereas prices of SST10% and SST5% were fixed since 2008 at RM2.40/kg and RM2.60/kg respectively[212]. This is why, relative to imported rice, the prices of domestic rice are relatively consistent across the states and over the years (Figure 6.14 and Figure 6.15). However, as discussed in the previous chapters, there are costs to this price stability.

207 Brinkman et al. (2010)
208 Reyes et al. (2009)
209 Berazneva and Lee (2013)
210 Rejesus et al. (2012)
211 Tobias (2012) & Timmer (1989)
212 KRI's stakeholder engagements and MOA's elesen website

Prices of local rice remain relatively stable across the states compared to imported rice

Figure 6.14. Prices of different types of rice in eleven states in Malaysia, 2015 (RM/kg)



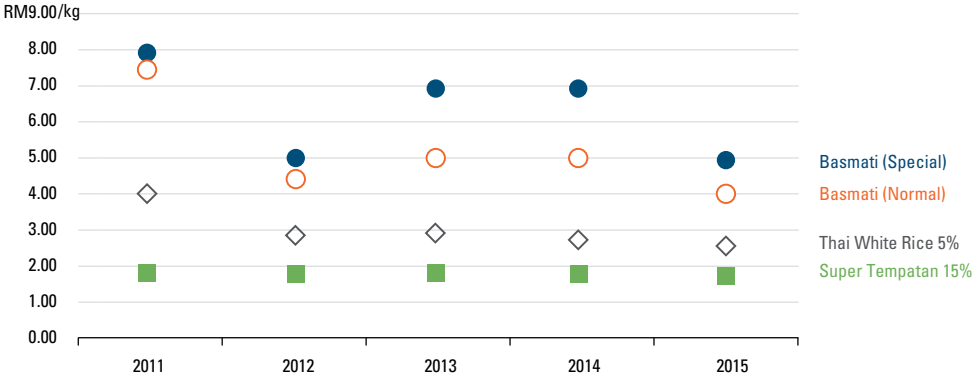
Notes:

1. *Retail prices are per 1kg*
2. *Basmati, Super Wangi and Thai White Rice are imported rice*
3. *Sabah and Sarawak are excluded due to missing data*

Source:
Table C5: Average Monthly Wholesale Prices by Grade of Rice and State, Malaysia, 2015 (pg. 96), Paddy Statistics of Malaysia 2015, DOA (2016b)
Chart by KRI

Prices of local rice remain stable relative to imported rice

Figure 6.15. Prices of different types of rice in Selangor, 2011 – 2015 (RM/kg)



Source:
Table C6: Average Monthly Retail Prices by Grade of Rice and State, Malaysia, Paddy Statistics of Malaysia (2011 – 2015), DOA (Various years)
Chart by KRI

CHAPTER KEY TAKEAWAYS

Trends in National Rice Consumption

- While there is dietary diversification, the average person still consumes rice as the main source of caloric intake in Malaysia.
- Furthermore, the increase in the total population means that as a whole, the national consumption of rice is increasing.
- Rice, therefore, is expected to remain an important staple food for Malaysia.

Patterns in Household Expenditure on Rice in 2016

- Within the F&B category, rural households spent more on rice than their urban counterparts. The average household spent **RM44/month** on rice, urban households spent **RM42/month** while rural households spent as high as **RM51/month** on rice.
- By state, households in **Perlis** spent the least at just **RM13/month** while households in **Sabah** spent the most at **RM73/month** on rice.
- By ethnicity, the main ethnic group households (*Bumiputera*, Chinese & Indian) spent a similar amount on rice ranging between **RM40 – 44/month**, while **non-citizen** households spent the highest at **RM60/month**.
- Thus, the poor and non-citizens are most vulnerable to rice price volatility.

Malaysia's *Invisible* Consumption

- **KRI estimated** that about 200,000 MT of rice was consumed by 2.0 million documented migrant workers in 2014.
- In addition to this, there is a large number of undocumented migrant workers living in Malaysia. The World Bank estimated that there is a minimum additional 1.0 million workers.
- For every additional 1.0 million migrants, the amount of rice consumed increases by 100,000 MT. If we assume that there are about 4.0 million migrants (both documented and non-documented) living in Malaysia, this results in them consuming about 24.1% of the total domestic rice produced.

- **Recommendation:** For Malaysia to keep its SDG pledge of "leaving no one behind", it is important to understand the rice consumption trends among its most vulnerable consumers: foreign workers who are poor and *invisible* to national databases.
- **Recommendation:** Improve data capture of migrant workers for the government to develop policies that are more inclusive.

Public Expenditure on the Production of Rice for Domestic Consumption

- In 2016, for every kilogram of local rice bought, the government contributed a total of **RM0.79** through subsidies and incentives at various stages of the supply chain.
- This is large given that the price ceiling of ST15% rice is between RM1.65 and RM1.80 per kilogram.

ABBREVIATIONS

ABBREVIATIONS		
ASEAN	:	Association of Southeast Asian Nations
b	:	billion
BC	:	Bario Ceria Sdn. Bhd.
BERNAS	:	Padiberas Nasional Berhad
BOLR	:	Buyer of last resort
BRM	:	*Bumiputera* Rice Millers
BULOG	:	Indonesian Bureau of Logistics
DOA	:	Department of Agriculture, Malaysia
DOS	:	Department of Statistics, Malaysia
DVS	:	Department of Veterinary Services, Malaysia
e	:	estimate
EPP 10	:	Entry Point Project 10 under the Economic Transformation Programme
EPU	:	Economic Planning Unit, Malaysia
ESA	:	European Space Agency
EU	:	European Union
F&B	:	Food and non-alcoholic beverages
FAMA	:	Federal Agricultural Marketing Authority, Malaysia
FAO	:	Food and Agricultural Organization of the United Nations
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority, Malaysia
GAS	:	Golden Apple Snail
GDP	:	Gross domestic product
GFSI	:	Global Food Security Index
GMP	:	Guaranteed Minimum Price
Ha	:	Hectare
HACCP	:	Hazard Analysis and Critical Control Points
HES	:	Household Expenditure Survey
HIS	:	Household Income and Basic Amenities Survey
IADA	:	Integrated Agricultural Development Area, Malaysia
IBPS	:	*Insentif Benih Padi Sah* (Certified Paddy Seed Incentive)
IFPRI	:	International Food Policy Research Institute
INGER	:	International Network for Genetic Evaluation of Rice
IPH	:	*Insentif Peningkatan Hasil* (Yield Improvement Incentive)
IRRI	:	International Rice Research Institute
ITPGRFA	:	International Treaty on Plant Genetic Resources for Food and Agriculture

ABBREVIATIONS

JKTBKKIP	:	*Jawatankuasa Teknikal Bantuan Kerajaan ke Industri Padi dan Beras* (Technical Committee of Government Assistance for Paddy and Rice Industry)
JV	:	Joint venture
k	:	thousand
KADA	:	Kemubu Agricultural Development Authority, Malaysia
KATS	:	Ministry of Water, Land and Natural Resources
kg	:	kilogram
km	:	kilometre
KPDNHEP	:	Ministry of Domestic Trade and Consumer Affairs
LPN	:	*Lembaga Padi dan Beras Negara* (National Paddy and Rice Board)
LPP	:	*Lembaga Pertubuhan Peladang* (Farmers' Organisation Authority)
m	:	million
MADA	:	Muda Agricultural Development Authority, Malaysia
MARDI	:	Malaysian Agricultural Research and Development Institute
MDTCC	:	Ministry of Domestic Trade, Co-operatives and Consumerism, Malaysia
MESTECC	:	Ministry of Energy, Science, Technology, Environment and Climate Change
MITI		Ministry of International Trade and Industry, Malaysia
MOA	:	Ministry of Agriculture and Agro-Based Industry, Malaysia
MOF	:	Ministry of Finance, Malaysia
MOH	:	Ministry of Health, Malaysia
MOHA	:	Ministry of Home Affairs, Malaysia
MOHR	:	Ministry of Human Resources, Malaysia
MOSTI	:	Ministry of Science, technology and Innovation (now replaced by MESTECC)
MT	:	Metric Tonne
MyGAP	:	Good Agricultural Practice (Malaysia)
NAFAS	:	National Farmers Organization, Malaysia
NAP	:	National Agricultural Policy
NCIA	:	Northern Corridor Implementation Authority, Malaysia
NEKMAT	:	*Persatuan Nelayan Kebangsaan* (National Fishermen Association)

ABBREVIATIONS

NIAB	:	National Institute of Agricultural Botany
NKEA	:	National Key Economic Area
NSC	:	National Seed Council
OECD	:	Organisation for Economic Co-operation and Development
PPE	:	Personal protective equipment
PPK	:	*Pertubuhan Peladang Kawasan* (District Farmer's Organisation)
PPP	:	Public-Private Partnership
PRMB	:	Paddy and Rice Marketing Board
R&D	:	Research and Development
RBI	:	Rice Bowl Index
RM	:	Ringgit Malaysia
SBPKP	:	*Skim Baja Padi Kerajaan Persekutuan* (Federal Paddy Fertilizer Scheme)
Sdn. Bhd.	:	*Sendirian Berhad* (Private Limited)
SEA	:	Southeast Asia
SIPP	:	*Skim Insentif Pengeluaran Padi* (Paddy Production Incentive Scheme)
SSHP	:	*Skim Subsidi Harga Padi* (Paddy Price Subsidy Scheme)
SST	:	*Super Special Tempatan*
ST	:	*Super Tempatan*
STE	:	State trading enterprise
SUK	:	*Skim Upah Kisar* (Milling Scheme)
SUMK	:	*Skim Upah Mengering dan Kisar* (Drying and Milling Scheme)
TWM	:	Tradewinds (M) Berhad
UK	:	United Kingdom
UN	:	United Nations
UN SDG	:	United Nations' Sustainable Development Goals
US	:	United States
USD	:	United States Dollar
WTO	:	World Trade Organization

GLOSSARY

GLOSSARY		
Area harvested	:	Data refer to the area from which a crop is gathered. Area harvested, therefore, excludes the area from which, although sown or planted, there was no harvest due to damage, failure, etc. It is usually net for temporary crops and sometimes gross for permanent crops. Net area differs from gross area insofar as the latter includes uncultivated patches, footpaths, ditches, headlands, shoulders, shelterbelts, etc. If the crop under consideration is harvested more than once during the year as a consequence of successive cropping (i.e. the same crop is sown or planted more than once in the same field during the year), the area is counted as many times as harvested. On the contrary, area harvested will be recorded only once in the case of a successive gathering of the crop during the year from the same standing crops. With regard to mixed and associated crops, the area sown relating to each crop should be reported separately. When the mixture refers to particular crops, generally grains, it is recommended to treat the mixture as if it were a single crop; therefore, the area sown is recorded only for the crop reported (*FAO Statistics Division*).
B40	:	The first 40% of the households in the income distribution are considered as the Bottom 40% (B40). Therefore, B40 data in 2016 HES report refers to the bottom 40% of households with monthly income of below RM4,360 (DOS).
BRICS	:	Brazil, Russia, India, China and South Africa (*OECD Stats*).
Economies of Scale	:	A proportionate saving in costs gained by an increased level of production (*Oxford Dictionaries*).
Least Developed Countries	:	African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao People's Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Samoa, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Soudan, Tanzania, Timor-Leste, Togo, Tuvalu, Uganda, Vanuatu, Yemen, Zambia (*OECD Stats*).

GLOSSARY

M40	:	The middle 40% of the households in the income distribution (i.e. between 41% to 80%) are referred to as Middle 40% (M40). M40 data in 2016 refers to the middle 40% with monthly income between RM4,360 and RM9,619 (*DOS*).
OECD	:	Australia, Canada, Chile, European Union-28, Israel, Japan, Korea, Mexico, Norway, New Zealand, Turkey, Switzerland and the United States (*OECD Stats*).
Parcel area	:	Parcel area is area cultivated with paddy in a season. This is different from total planted area (*kawasan bertanam*) and total harvested area (*kawasan tuaian*), which are the total planted/harvested area for multiple seasons in a year. Thus, paddy planted and harvested area are larger than parcel area (roughly double, given that paddy is planted and harvested twice a year).
Self-sufficiency Level (SSL)	:	Syn: self-sufficiency ratio, formula = [Production/(Production + Import – Export)] x 100 (*FAO statistics booklet*).
T20	:	Households in the last 20% in the income distribution, are referred to as Top 20% (T20). Therefore, for 2016, T20 refers to the top 20% of households with monthly income of RM9,620 and above (*DOS*).
World	:	For all OECD data, World includes its list of countries in developed and developing countries (*OECD Stats*).
Yield	:	Harvested production per unit of harvested area for crop products. In most of the cases yield data are not recorded but obtained by dividing the production data by the data on area harvested. Data on yields of permanent crops are not as reliable as those for temporary crops either because most of the area information may correspond to a planted area, as for grapes, or because of the scarcity and unreliability of the area figures reported by the countries, as for example for cocoa and coffee (*FAO Statistics Division*).

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