



Faculty of Economics and Business

**Assessing the Farmer's Sustainable Livelihood Outcome of Rice Sectors
Development in Sarawak**

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Menilai Hasil Kelestarian Penghidupan Petani bagi Pembangunan Sektor Padi
di Sarawak

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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ABSTRACT

This study focused on the paddy farmers from the northern and southern parts of Sarawak to identify the relationship between the production, socioeconomic and environmental factors with the sustainable livelihood outcomes of the farmers. The study was conducted in ten locations in Miri and Kuching divisions. This study implemented a qualitative study which adopted the empirical study. To obtain the information regarding the rice production and the livelihood strategy, interviews were conducted with thirty selected respondents. The obtained data were then analysed descriptively. This study demonstrates a need to gather information not only on the production level but on the sustainable practices based on the factors of production. The study revealed that land size, capital, subsidies, and incentives are all factors that have significant effect to the rice production and livelihood of the farmers. Therefore, government intervention in standardizing the Guaranteed Minimum Price (GMP) rate between Sarawak and Peninsular Malaysia is essential to enhance farmer's income. Paddy cultivation land should be preserved and officially gazetted to prevent its conversion into cash crop plantations as well as ensuring the sustainability of paddy agriculture in Sarawak. Additionally, this study underlines the importance of fair rice pricing and land protection for Sarawak's paddy farmers. It emphasizes the need of taking into account factors other than output levels while developing sustainable lives and addressing climate change. Finally, government intervention and modern agricultural practices will be required to ensure food security, improve farmer quality of life, and ensure the long-term viability of Sarawak's paddy agriculture.

Keywords: Land size, capital, subsidies, incentives, sustainable practices

**Menilai Hasil Kelestarian Penghidupan Petani bagi Pembangunan Sektor Padi di
Sarawak**

ABSTRAK

Kajian ini tertumpu kepada pesawah dari bahagian utara dan selatan Sarawak untuk mengenal pasti hubungan antara faktor pengeluaran, sosioekonomi dan alam sekitar dengan hasil mata pencarian mampan para petani. Kajian dijalankan di sepuluh lokasi di bahagian Miri dan Kuching. Kajian ini melaksanakan kajian kualitatif yang menggunakan kajian empirikal. Bagi mendapatkan maklumat berkenaan pengeluaran padi dan strategi sara hidup, temu bual telah dijalankan dengan tiga puluh orang responden terpilih. Data yang diperoleh kemudiannya dianalisis secara deskriptif. Kajian ini menunjukkan keperluan untuk mengumpul maklumat bukan sahaja pada tahap pengeluaran tetapi mengenai amalan mampan berdasarkan faktor pengeluaran. Kajian itu mendedahkan bahawa saiz tanah, modal, subsidi, dan insentif adalah semua faktor yang mempunyai kesan yang ketara kepada pengeluaran padi dan mata pencarian petani. Oleh itu, campur tangan kerajaan dalam menyelaraskan kadar Harga Minimum Terjamin (GMP) antara Sarawak dan Semenanjung Malaysia adalah penting bagi meningkatkan pendapatan petani. Selain itu, tanah kawasan penanaman padi harus dipelihara dan diwartakan secara rasmi bagi mengelakkan penukarannya kepada tanaman kontan serta memastikan kelestarian pertanian padi di Sarawak. Selain itu, kajian ini menekankan kepentingan penetapan harga padi yang adil dan perlindungan tanah bagi petani padi di Sarawak. Ia menegaskan keperluan untuk mempertimbangkan faktor selain daripada tahap pengeluaran dalam membangunkan kehidupan yang mampan dan menangani perubahan iklim. Akhirnya, campur tangan kerajaan dan amalan pertanian moden diperlukan untuk memastikan keselamatan makanan,

meningkatkan kualiti hidup petani, dan menjamin kelestarian jangka panjang pertanian padi di Sarawak.

Kata kunci: *Saiz tanah, modal, subsidi, insentif, amalan lestari*

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LIST OF ABBREVIATIONS

COVID-19	Coronavirus Disease 2019
DFID	Department For International Development
DID	Department of Irrigation and Drainage Sarawak
DOA	Department of Agriculture
DOSM	Department of Statistic Malaysia
FAO	Food Agriculture Organization
GDP	Gross Domestic Product
GI	Geographical Indication
IADA	Kerian Integrated Agriculture Development Area
JKKK	Jawatankuasa Kemajuan dan Keselamatan Kampung
KAS	Konrad-Adenauer-Stiftung
KADA	Kemubu Authority Development
KETARA	North Terengganu Integrated Agriculture, Development
KRI	Khazanah Research Institute
kg	Kilogram
MADA	Muda Agricultural Development Authority
MARDI	Malaysian Agricultural Research and Development Institute
M-FICORD	Ministry of Food Industry, Commodity and Regional Development
MOA	Ministry of Agriculture & Agro-Based Industry
MyGap	Malaysia Good Agricultural Practices
PPK	Persatuan Peladang Kawasan
SDI	Sarawak Development Institute
SEA	Southeast Asia

SDG	Sustainable Development Goal
SLA	Sustainable Livelihood Approach
SLF	Sustainable Livelihood Framework
UPM	Universiti Putra Malaysia
YPS	Yayasan Perpaduan Sarawak

CHAPTER 1

INTRODUCTION

1.1 Rice Sector Development in Malaysia

Rice is a fundamental dietary component for over 50% of the global population, with Asian countries being the primary cultivators responsible for almost 90% of the world's rice production. Nevertheless, a mere 7% of rice production is allocated for exportation from the country of origin. Hence, rice and paddy have a crucial significance in ensuring food security, government interventions, and socio-cultural aspects in many developing nations (Firdaus, Mou, Rahmat & Gunaratne, 2020). Paddy cultivation is believed to have spread from the Indian subcontinent to Southeast Asia and east to China and Japan, but the origin of paddy is still unknown until today. Two species of rice commonly grown are known as *Oryza sativa* and *O. glaberrima*. *Oryza sativa* is indigenous to Asia and is cultivated globally, whereas *Oryza glaberrima* is exclusively cultivated in the West African region (Linares, 2002). There exists a total of 20 distinct species of wild rice that are distributed over the continents of Asia, Africa, Latin America, and the Caribbean. The actual number of rice variations in the world remains unknown, while some sources suggest that there may be over 140,000 variants (Kheng, 1999). The official population estimate for Malaysia in 2024 is approximately 34.1 million people, and at this figure, sustainable food production is important as food security to ensure that it can cater the demand of food of the society. Agricultural sector plays an important role in maintaining and providing food supplies to the nation. The agriculture sector contributed 7.3 per cent (RM99.5 billion) to the Malaysian Gross Domestic Product (GDP) and the paddy production in Malaysia rose 2.7 per cent from

2,570.5 thousand tonne to 2,639.9 thousand tonne in 2019. It is estimated that Malaysians consume about 78 kilograms (kg) of rice per year and this amount is equivalent to 200 grams (g) each day for one person. According to (Department of Statistics Malaysia, 2020), in order to meet the needs of households in Malaysia, the country needs to provide about 2.5 million tonne of rice a year. Hence, domestic rice supply is still under control taking into account the consistent position of rice stocks of about 400,000 to 500,000 metric tons (mt) at all times apart from local rice production as well as import supply is still operating as usual. In addition, the Paddy and Rice Regulatory Section, the Ministry of Agriculture and Agro-Based Industry Malaysia (MOA) revised the control mechanism through the issuance of licenses to industry players that should be used best in balancing the distribution of rice throughout the country despite the global health crisis due to transmission of COVID-19.

The agricultural sector has been a significant contributor to the Malaysian economy since the 1960s, serving as the primary source of income for the country. Additionally, the rural sector has played a crucial role in fostering economic, social, and political development. The early development stage of the Malaysian economy relied heavily on the rural sector for agricultural input and production, which therefore contributed to the country's export earnings and growth during the 1960s and 1970s (Arshad & Shamsudin, 1999). The National Agro-Food Policy (2011-2020) and Eleventh Malaysia Plan (2016-2020) have contributed to the growth of rice production in Malaysia. As a result, the government aims to raise the production of local rice to 75% by 2022, in order to decrease reliance on imported rice (Firdaus et al., 2020). Since the 1940s, appropriate actions have been taken to improve output. As a result, within a span of 30 years, the total production has significantly increased. This has led to the self-sufficiency level (SSL) exceeding 60%. However, Malaysia still

relies on imported rice rather than solely depending on locally produced rice. Figure 1.1 shows the Southeast Asia's country SSL in year 2016.

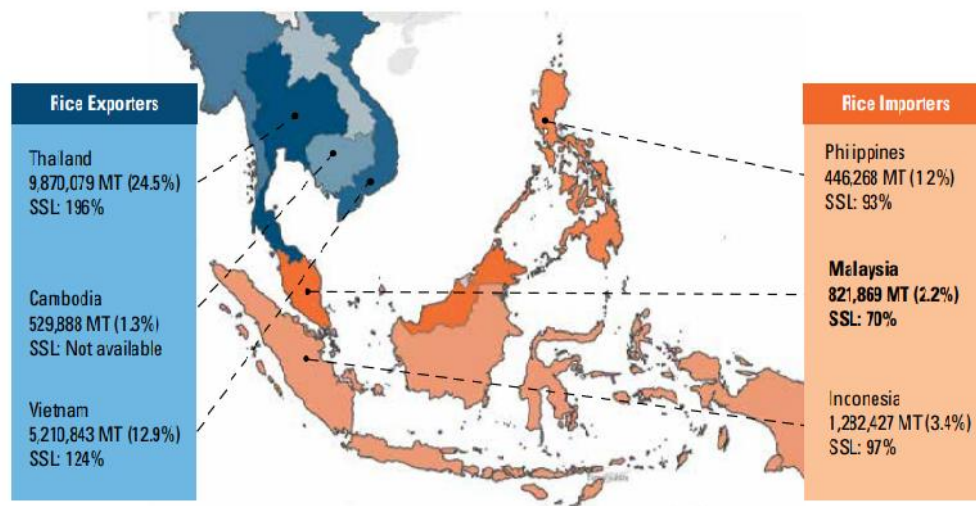


Figure 1.1: Quantity and share of the world's rice export/import and country's self-sufficiency level (SSL) of the top rice exporters and importers in Southeast Asia, 2016

Source: Khazanah Research Institute [KRI], (2019)

The Southeast Asia (SEA) region has been the pillar of the world's rice economy. In 2016, this region contributed 16 million metric tonnes, equivalent to 39.9% of the world's rice exporters, with Vietnam and Thailand being the top exporters (Omar, Shaharudin, & Tumin, 2019). However, not all SEA countries are rice exporters. Malaysia, Indonesia, and the Philippines are net importers. Based on Figure 1.1, Malaysian imports stood at 2.2%, with the SSL lingering around 60–70%. Malaysia might continue to be a net importer of rice, provided the domestic rice can be produced sustainably and farmers can earn a sustainable income. International Rice Research Institute (2008) stated that rose of international trading price of rice caused food crisis happened in year 2008 bring significant effects. According to Childs and Kiawu (2009), this phenomenon occurred as a result of price increases and

was not caused by crop failure or a particularly tight global rice supply scenario. Instead, trade restrictions enforced by key suppliers, panic buying by a number of major importers, a weak dollar, and record oil prices were the immediate drivers of rising rice prices.

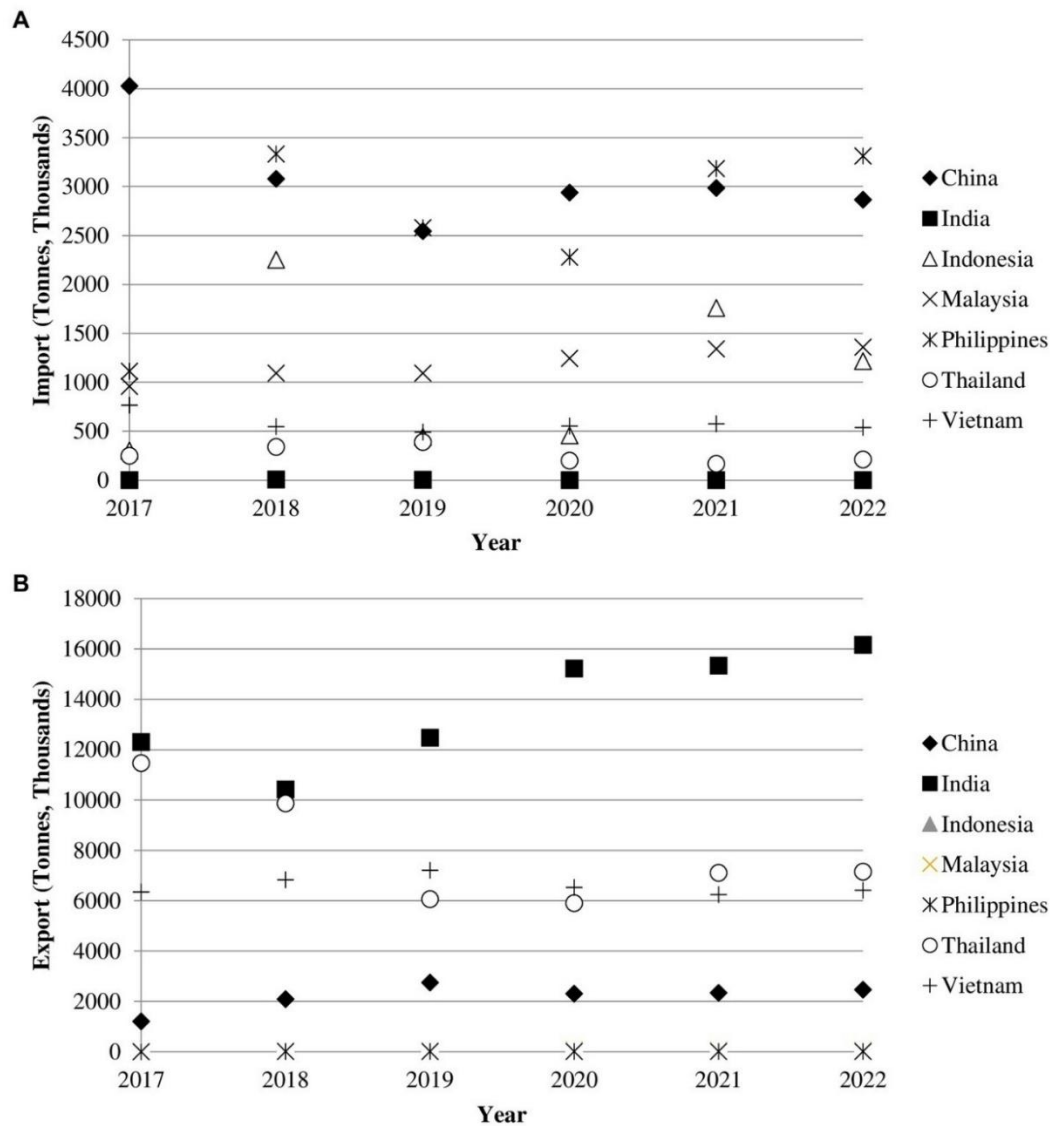


Figure 1.2: Rice Import (A) and Export (B) Values in Selected Asian countries (2017-2022)

Source: FAOSTAT, (2023)

Based on Figure 1.2, Philippines imported around 3,400 tonnes of rice in year 2022 and 2021 respectively and among the highest rice importer in Southeast Asia. While

Malaysia imported the highest amount of rice which is 1,400 tonnes in year 2022. In term of export, India consistently exporting the highest amount of rice since 2017 to 2022 among the Asian countries, in which India exports the highest in 2022 amounted to 16,000 tonnes of rice.



Figure 1.3: Sustainable Development Goals (SDGs) (2016 – 2030)

Source: DOSM (2020)

Under the Sustainable Development Goals (SDGs) indicators provided by DOSM (2020) as shown in Figure 1.3, the second goal is to end hunger by achieving food security, improving nutrition, and promoting sustainable agriculture. 2030 is the year when everyone will have enough access and sufficient food all year, in particular the poor and people in vulnerable situations.

Additionally, Malaysia has identified 12 granary areas, including Muda Agricultural Development Authority (MADA), Kemubu Agricultural Development Authority (KADA), Kerian Integrated Agriculture Development Area (IADA), and Barat Laut. The areas mentioned are Selangor Integrated Agriculture Development Area, Seberang Perak

Integrated Agriculture Development Area, Pulau Pinang Integrated Agriculture Development Area, North Terengganu Integrated Agriculture Development (KETARA), Kemasin Semerak Integrated Agriculture Development Area, Pekan Integrated Agriculture Development Area, Rompin Integrated Agriculture Development Area, Integrated Agriculture Development Areas (IADA) of Kota Belud and Batang Lupa (Rahmat, Firdaus, Shaharudin & Lim, 2019).

The granary zones were designated to attain a minimal degree of self-sufficiency in rice production. Rahmat et al. (2019) state that the paddy industry in Malaysia receives significant subsidies, amounting to almost two billion, from the federal government. This is due to the importance of paddy as the main source of food in the country surpassing the support given to other crops. Table 1.1 shows the production of rice by granary areas from 2016-2020.

Table 1.1: Production of Rice by Granary Area (2016-2020)

	2016	2017	2018	2019	2020	2021 ^P
MADA	691,111Mt	633,352	668,763	645,584	681,041	590,763
KADA	161,312	156,319	163, 897	131,958	168,725	179,407
IADA Kerian	107,268	111,304	107,764	97,605	87,033	99,181
IADA Barat Laut Selangor	144,321	107,621	113,380	113,158	111,675	108,942
IADA Pulau Pinang	96,393	95,329	86,864	83,282	85,116	95,843
IADA Seberang Perak	67,202	57,329	61,610	51,925	51,070	48,107
IADA Ketara	35,643	32,785	33,907	32,718	36,911	35,621
IADA Kemasin Semerak	17,846	17,509	18,300	18,351	20,860	21,502
IADA Pekan	8,726	6,686	11,169	11,372	9,028	9,698
IADA Rompin	9,384	11,069	9,591	7,878	15,007	17,014
IADA Kota Belud	-	14,367	18,961	16,126	16,268	15,816

Table 1.1 continued

IADA Batang Lupar	-	1,351	1,676	1,852	1,748	1,932
TOTAL	1,339,206	1,245,021	1,295,882	1,211,809	1,284,482	1,223,826

Note: p = provisional. Report of rice production of IADA Kota Belud and IADA Batang Lupar started from 2017 onwards.

Source: KRI (2022)

As mentioned previously, majority of paddy production in Malaysia is concentrated in granary areas within Peninsular Malaysia, which accounted for 98.4% of total paddy production in 2020 based in Table 1.1.

Paddy cultivation in these areas primarily consists of high-yielding, cost-effective, medium-grained plain rice varieties, predominantly developed by the Malaysian Agricultural Research and Development Institute (MARDI) to enhance SSL in both states. However, both Sabah and Sarawak maintain rice SSL below 60%, and overall, East Malaysia remains a relatively minor contributor to domestic rice production in terms of total output volume (Mail, 2023).

The Integrated Agriculture Development Areas (IADA) of Kota Belud in Sabah and Batang Lupar in Sarawak are among the 12 granary areas, though their rice production contributions are relatively small, accounting for only 1.4% and 0.2% of the total granary area production respectively.

However, paddy farmers in both granary and non-granary areas face several challenges. Non-granary areas in Sarawak often contribute less to national rice production and have lower self-sufficiency levels (KRI, 2022). Additionally, most paddy farms in Sarawak are upland and rain-fed, making them prone to floods and droughts. As a result,

farmers often resort to traditional methods, neglecting nutrient requirements and pest control. This reliance on rainfall typically limits farmers to planting only one crop per season (Yusop, Aziz, Saili, Nor, & Sahmat, 2021). According to Yusop et al. (2021), physical constraints such as unsuitable land conditions and declining soil fertility, along with technological limitations, pose significant challenges to paddy production. Furthermore, there may be insufficient government support and incentives to optimize paddy production.

Nodin, Mustafa, and Hussain (2021) highlighted that granary areas also face infrastructure issues, particularly damage to irrigation networks. Additionally, several diseases threaten paddy growth and weedy rice poses a significant risk to rice production (Siwar, Idris, Yasar, & Morshed, 2014).

In terms of socioeconomic factors, Abidin and Dardak (2023) emphasized that farmers sociological aspects influence yield levels. Infrastructure, agricultural practices, and farmers attitudes contribute to the yield gap. A lack of agricultural knowledge and failure to follow good agricultural practices can further reduce productivity.

Figure 1.4 displays the rice production data for Peninsular Malaysia, Sabah, and Sarawak from 2005 to 2016.

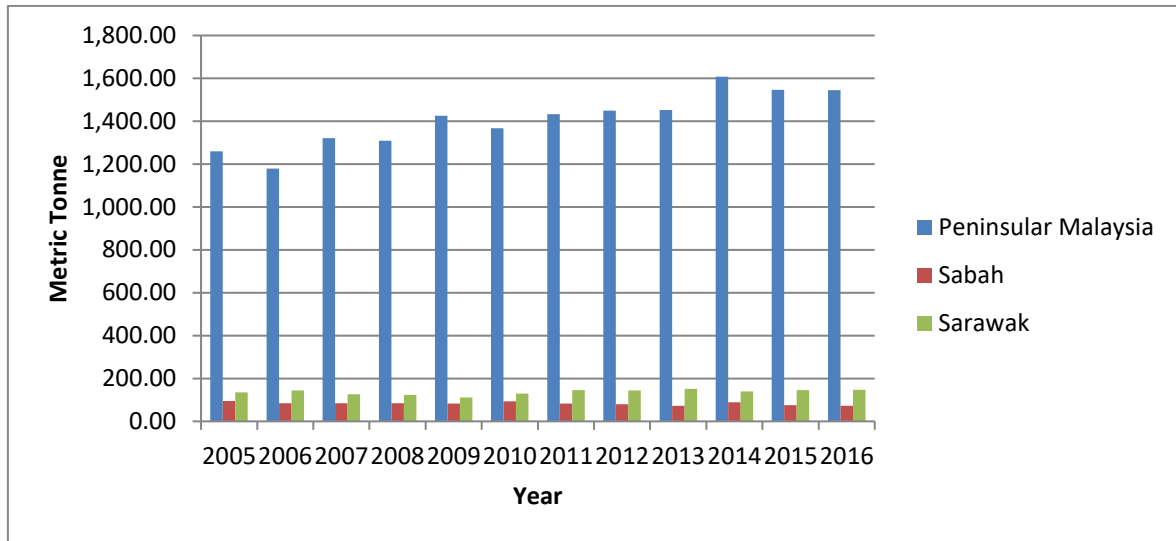


Figure 1.4: Production of Rice of Peninsular Malaysia, Sabah and Sarawak, 2005-2016

Source: Census and Economic Information Center [CEIC], (2021)

Figure 1.4 shows the production of rice for Peninsular Malaysia, Sabah and Sarawak, spanning 11 years. Based on the figure shown, Peninsular Malaysia recorded the highest production of rice compared to Sabah and Sarawak, where Sabah produced the lowest amount of rice among all states in Malaysia. This is due to eight major granaries in Malaysia are mostly located in Peninsular Malaysia; hence that explains why the total production of rice in Peninsular Malaysia is high. The data reached a highest number at 1,607.200 Ton (t) in 2014 and record a low number of 1,137.600 Ton (t) in 2006. For Sarawak, the highest production yield was recorded at 152, 200 Ton (t) in 2013 and the lowest amount was at 124,100 Ton (t) in 2008. Sabah, recorded all-time high of 103, 700 Ton (t) in 2001 and the lowest is at 73, 000 in 2016. The rice production in Malaysia shows a fluctuating trend which may due to the external factors that affects harvest volumes because rice production is highly volatile. Factors such as weather conditions, irrigation water supply and consumer demand for other agricultural crops can all affect rice growing.

Makhtar, Zainal Abidin, and Islam (2022) found that Malaysia's rice industry faces number of issues as a result of urbanization and the spread of other industrial enterprises, including land competition caused by the use of various chemical fertilisers that have diminished soil fertility. As a result, there is a scarcity of land for agricultural purposes, which will have a severe influence on the environment, notably water pollution. This statement is supported by Wan Ismail and Ngadiman (2017) where it is identified that paddy land on the outskirts of cities is a target for land conversion from agriculture to building or industrial use. In addition, Azizan and Hussin (2015) added that the demand for housing is a major reason why paddy land is converted for other uses because as populations grow, developers seek to build more houses and stores to accommodate this demand. This causes a problem since the government wants to develop the area to attract investors, but this puts pressure on local land administration and jeopardizes the lives of farmers who rely on rice growing (Azizan & Hussin, 2015).

1.2 Sustainability of Rice Production in Sarawak

Sarawak has the potential to become the primary rice producer in Malaysia, since the federal government recognises the capabilities of this largest state in addressing the issue of poor rice output. The government has enlarged extensive agricultural areas in Sarawak with the aim of increasing rice output and achieving a national self-sufficiency level of 80 percent. The agricultural sector is a significant economic activity for the people of Sarawak, particularly in rural areas. Sarawak has consistently been identified as one of the states in Malaysia with the highest poverty rate since gaining independence. This is particularly true in rural areas, where the majority of impoverished individuals are farmers who rely on paddy cultivation as a crucial agricultural activity within the sector (Echoh, Nor, Salfarina &

Masron, 2017). Typically, paddy planting is primarily for livelihood, with any excess being sold to acquire essential items like salt, sugar, and other necessities.

Sarawak ranks fifth among the state with largest rice producing, following Kedah, Perak, Kelantan, and Perlis with 134, 260 ha of land planted with lowland and upland rice (Clifton, Yeo, Trawas, Embuas, Kalu, Shabdin & Lai, 2024). The rice economy of Sarawak, Peninsula Malaysia, and Sabah is characterised by the prevalence of subsistence-cropped and low-yielding hill paddy, rather than wet paddy. Table 1.2 shows the list of paddy locations in Sarawak.

Table 1.2: List of Paddy Locations in Sarawak

No	Paddy Locations
1,	Bario
2.	Ba’Kelalan, Lawas
3.	Long Semadoh, Lawas
4.	Sundar, Limbang
5.	Kampung Lubok Punggur, Gedong
6.	Sungai Entuloh, Kapit
7.	Skuduk-Chupak, Siburan
8.	Skim Paya Payang, Tebedu
9.	Lingga-Banting, Sri Aman
10.	Stumbin, Sri Aman
11.	Tanjung Bijat, Sri Aman
12.	Tanjung Purun, Lundu
13.	Lubok Teranggas, Samarahan
14.	Lubok Nibong, Saratok

Source: DOA, (2024); UPM (2024)

Based on Table 1.2, the list paddy locations in Sarawak are considered as the main paddy producer in Sarawak. Majority of the paddy locations listed are under government

scheme or project. According to KRI (2022), Ba' Kelalan participated in a project called Ba'kelalan Systems of Rice Intensification (SRI) programme which is under the state government to promote sustainable farming practices. While Bario has Bario Ceria company which mainly assisting the farmers in term of mechanization, good farming practices and market the Adan rice. A report by DID (2024) mention that Sarawak government allocated RM46 million under 'Project Rakyat' to upgrade the drainage and irrigation in Mid-Sadong for Kampung Lubok Punggur, Gedong mainly to boost the paddy farming in that area. Additionally, according to Ministry of Food Industry, Commodity and Regional Development (2024), government are planning to develop more than 20,000 hectares of large-scale paddy plantations in Lundu, Simunjan, Gedong, Sri Aman, Limbang and Lawas. Sarawak will be able to harvest paddy five times in two years thanks to modern technologies and hybrid rice varieties.

According to DOSM (2025) the population of Sarawak was 2.560 million in 2024 from 2.471 million in 2010. Hence, Sarawak population data was projected at 3.589 million the in 2040 (CEIC, 2025). Tan (2022) mentioned that Sarawak size (124,450 km²) is 95.3% the size of Peninsular Malaysia (130,590 km²) which indicates that Sarawak is almost as large as Peninsular Malaysia in area but has a significantly smaller population (Sheng, 2025). Peninsular Malaysia accounted to 80% of Malaysia overall population and Sabah and Sarawak account for the remaining 20%. The total population of Peninsular Malaysia in 2024 is approximately 28.38 million (DOSM, 2025). Sarawak is undertaking significant efforts to achieve self-sufficiency in rice production, addressing its current reliance on imports (Sarawak Development Institute [SDI], 2024). Sarawak is currently producing just 30 percent of the 240,000 tonnes of rice it requires, while 70 percent is imported (Boon, 2025). The state government will provide 1,500 hectares of land for rice production to ensure

food security in Malaysia (Malaymail, 2024). Sarawak has identified 14,000 hectares of land throughout Sarawak to be developed with paddy cultivation (Minister for Food Industry, Commodity and Regional Development [M-FICORD], 2025)

Sarawak is implementing various initiatives, including expanding cultivation areas, rehabilitating drainage and irrigation systems, and utilizing high-yield seeds along with sustainable agricultural practices (Boon, 2025). The statewide project would adopt the method farmers in Kampung Lubok Punggor used, utilising new technologies and hybrid rice varieties and a study with Universiti Putra Malaysia (UPM) found that one hectare can be cultivated for five seasons within 24 months, yielding eight tonnes of rice (DOA, 2024). Sarawak plans to develop about 20,000 hectares of land for this project, which will enable Sarawak to raise the country's rice production by 100 per cent by 2030 (Malaymail, 2024).

Sarawak can become a net exporter of rice like India and Vietnam as the state has the resources and technology available now. Sarawak farmers should embrace modern machinery and digital tools in order to achieve the targeted SSL as well as a sustainable livelihood. Plans are in place to develop other suitable paddy cultivation areas, particularly in the Rajang Basin and other regions such as Tanjung Manis, Julau, and Meluan (Boon, 2025). Several challenges exist, including the decreasing paddy land, therefore the state government is seeking federal assistance to manage the high infrastructure costs associated with constructing drainage and irrigation systems (Abidin & Dardak, 2023). Despite these challenges, Sarawak has the potential to not only achieve its 80% self-sufficiency target, but also contribute to national food security and potentially export rice by 2027 (UPM, 2024). SDI is undertaking research and engagement with stakeholders of modern paddy cultivation in Sri Aman to support how Sarawak can boost its rice SSL (SDI, 2024).

Sarawak has several government agencies that support the paddy and rice industry and its farmers. See Table 1.3 for the list of related agencies in rice industry in Sarawak.

Table 1.3: List of Government Agencies in Rice Industry in Sarawak

No	Government Agencies
1.	Department of Agriculture Sarawak (DOA)
2.	Pertubuhan Peladang Sarawak (PPS)
3.	Department of Irrigation & Drainage Sarawak (DID)
4.	Institut Penyelidikan Dan Kemajuan Pertanian Malaysia (MARDI)
5.	Ministry of Food Industry, Commodity and Regional Development (M-FICORD)
6.	Sarawak Development Institute (SDI)
7.	Ministry of Agriculture and Food Security
8.	Jabatan Pertanian Malaysia
9.	Department of Veterinary Services Sarawak (DVS)
10.	Lembaga Pemasaran Pertanian Persekutuan
11.	Jabatan Perkhidmatan Kuarantin & Pemeriksaan Malaysia
12.	AgroBank Malaysia

Source: DOA, (2025)

The main agencies involved in the rice and paddy industry in Sarawak include the Department of Agriculture Sarawak (DOA), which primarily focuses on research and development (R&D) to support agricultural development. Its role includes overseeing rice biodiversity, recommending rice varieties, assisting in the distribution of aid and subsidies, and providing knowledge to farmers in Sarawak (DOA, 2025). The Ministry of Food Industry, Commodity and Regional Development Sarawak (M-FICORD) ensures that agricultural development emphasizes commercialization through greater collaboration with global, domestic, and community partners, driven by data and innovation (M-FICORD, 2025). The Department of Irrigation and Drainage Sarawak (DID) is responsible for

managing irrigation and drainage infrastructure for agricultural areas (Department of Irrigation and Drainage Sarawak, 2025). Meanwhile, Pertubuhan Peladang Sarawak (PPS) represents farmers interests, provides support services, and promotes agricultural development at the grassroots level, with the mission of improving the socioeconomic status of its members (PPS, 2025). Lastly, the Malaysian Agricultural Research and Development Institute (MARDI) conducts research and development related to agriculture and food, including rice cultivation, and provides technological support to farmers (MARDI, 2025).

Malaysia is aiming to achieve 80% SSL in rice production to ensure national food security (Dorairaj & Govender, 2023). However, the nation is at 65% SSL, with the SSL above 60% considered a comfortable position (KRI, 2022). That being said the country still relies on imports to meet the remaining demand as the designated granaries are unable to meet the demand of rice locally. According to The Sun (2024), the Agriculture and Food Security Minister Datuk Seri Mohamad Sabu said Malaysia imported 1,358,718 metric tonnes of rice from Thailand, Vietnam, Pakistan, Cambodia, India, Taiwan, South Korea, Japan, Indonesia, Myanmar and Spain in 2024 to cater the national demand of rice.

KRI (2022) also mentioned that Sarawak SSL are below 60% and in 2023, Sarawak's total paddy production was about 118,000 tonnes or 32% SSL. Meanwhile Sarawak imports rice from both the Peninsular Malaysia and other countries like Vietnam and Thailand due to limited local rice production. Currently, Sarawak's local rice production only covers 34% of the state needs (UPM, 2023). In order to address this, Sarawak has opened four large-scale rice planting areas, totaling 10,000 hectares, in Kampung Lubok Punggur, Spaoh in Betong, Tanjung Bijat in Sri Aman, and Tanjung Purun in Lundu. According to UPM (2023), Sarawak is actively promoting the cultivation of hybrid paddy using modern agricultural

techniques. The aim is to increase the SSL from 51% to 70%, whereby Sarawak has designated some 14,500 ha for rice cultivation across the state. Moreover, the government has approved RM1 billion for farm infrastructure, such as advanced drainage and irrigation systems, in which for 2025, RM51 million will be allocated for this purpose (Mail 2024).

In addition to increasing the production of modern varieties, East Malaysia, especially Sarawak may consider venturing into the artisanal, premium rice segment by leveraging their traditional, heirloom varieties (KRI, 2022). Market expansion of specialty rice could potentially be a source of poverty alleviation, especially among rural communities as well as the excess rice cultivated can be sold at a premium price, giving the rural communities extra income. Sarawak needs 17,500 hectares of new land equipped with infrastructure for padi cultivation to achieve 100% rice SSL (UPM, 2023). Sarawak ambition to achieve SSL in rice production faces tough challenges that impacting both the livelihoods of farmers and the sustainability of rice production itself. While the Sarawak government is actively pursuing initiatives to boost local rice yields, significant hurdles remain that require comprehensive and innovative solutions.

Several factors have contributed to the decline in rice production over the years. These include a lack of paddy tertiary farm infrastructure, the high cost of production, aging farmers and stiff competition for land from other lucrative crops or cash crop like palm oil (Sam & Fung, 2023). Echoh et al. (2017) highlight that modernization and urbanization are causing younger generations to move to cities, leading to a decline in farming activities.

Traditional methods often yield insufficient harvests, and the high cost of essential inputs, including access to technology and machinery, creates a significant barrier to improved productivity. Many farmers are reluctant to invest in modern technology,

perceiving it as prohibitively expensive, thus perpetuating reliance on less efficient methods (Abidin & Dardak, 2023). Simultaneously, the sustainability of Sarawak's rice production is under pressure. The state's persistent reliance on rice imports underscores the gap between local output and demand. This dependency is caused by the growing threat of climate change, which brings unpredictable weather patterns and increases the risk of crop failure. Moreover, traditional farming methods face challenges related to pests, diseases, and declining soil fertility, further limiting productivity, and endangering the environment (Echoh et al, 2017).

According to DOA (2025), the fragility of existing rice environments, often characterized by poor irrigation and drainage, further restricts farmers to a single harvest per year. Ironically, the introduction of high-yield varieties and chemical fertilizers, while intended to boost production, can also contribute to the erosion of traditional knowledge and the loss of precious biodiversity (Yayasan Perpaduan Sarawak [YPS], 2024). According to Ho, Seng, Ling, Kwong and Gong (2024), even the adoption of hybrid rice farming is not without its challenges, as issues such as early ripening, labor shortages, and adverse weather conditions can lead to significant crop losses. Overcoming these complex challenges requires a holistic approach that goes beyond simply increasing yields. It requires a commitment to empowering farmers with the knowledge, resources, and support they need to thrive in a changing environment (YPS, 2024). UPM (2024) highlights that while government initiatives to promote hybrid rice seeds and upgrade irrigation systems are vital, they must be complemented by efforts to address the underlying issues of poverty, access to education and finance, and the adoption of sustainable farming practices. Preserving Sarawak's unique rice biodiversity, through initiatives such as establishing a dedicated biodiversity center, is also essential for building a more resilient and sustainable agricultural sector that ensures both food security and the well-being of its farming communities for

generations to come (DOA, 2025). The future of Sarawak's paddy farming depends on striking a delicate balance between embracing innovation and preserving the valuable traditions and knowledge that have sustained it for centuries (KRI, 2022).

According to a report by KRI (2022), Sarawak contributed 5.3% to Malaysia's total rice production in 2021. The rice economy of Sarawak, Peninsula Malaysia, and Sabah is characterised by the prevalence of subsistence-cropped and low-yielding hill paddy, rather than wet paddy. Upland or dry-land rice is cultivated in areas characterised by naturally permeable soils and absence of water pooling on the surface. This variety of rice, known as hill paddy, plays a crucial role in sustaining rural people, particularly those at the subsistence level. Hoki (1977) mentioned that Sarawak has utilizes both hill paddy also known as swidden and wet paddy systems long time ago but the wet paddy system is more significant due to its potential to increase rice production. Hill paddy cultivation continues to be a crucial agricultural practice for the vast majority of rural village inhabitants residing in the interior regions, serving as a method of ensuring their primary source of sustenance (DOA, 2019). Echoh et al. (2017) stated that the swidden technique of cultivating hill paddy is a significant agricultural practice in rural areas, particularly for the Iban community. YPS (2024) also agreed that the Iban and Bidayuh communities utilize wet rice cultivation in the fertile riverine plains of the coastal areas, while the Kelabit people have adapted to the rugged interior highlands with steep slopes and terraced fields. Practices can vary depending on the geographical factors and cultural heritage of the region. The traditional rice farming practices often involve farmers planting, waiting for 3-4 months, and then harvesting (DOA, 2024). These traditional varieties are typically low yielders and do not respond well to fertilizer application.

It was observed that hill paddy yield is lower in comparison to wet paddy production. The swidden technique is an appropriate approach due to the poor soil fertility, low soil quality, and the fact that paddy farming is solely for self-sufficiency. The swidden system is a kind of agriculture that involves clearing land for cultivation and allowing it to regenerate after a few years. This technique is well-suited for implementation in Sarawak, as the region has a prevalence of highly acidic soil, rendering it unsuitable for agricultural endeavours. Figure 1.5 displays the comprehensive estimated paddy output in Sarawak, categorised by division, for the years 2011-2020.

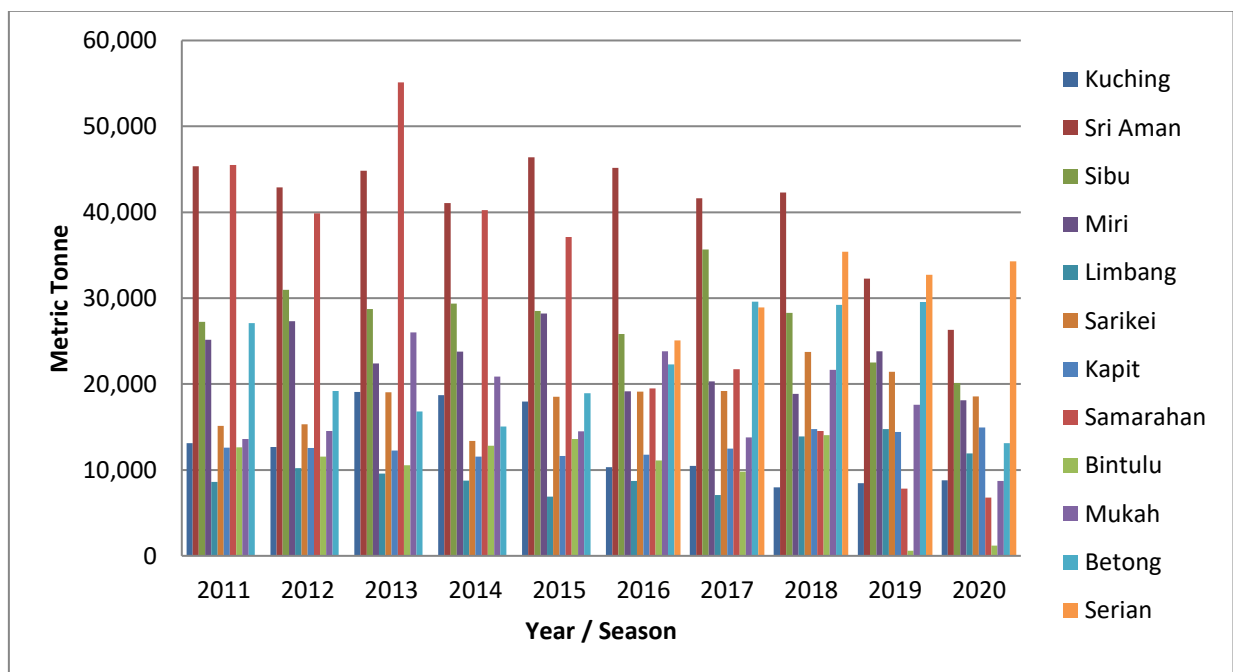


Figure 1.5: Sarawak's Total Estimated Production of Paddy by Division 2011-2020

Sources: DOA, (2021)

Sarawak produced an average of 8.2% of the total national rice production within period of the last two decades. In terms of the agricultural site in Sarawak, the percentage of paddy area is 9.1%, which is the third highest after palm oil (70.9%) and rubber (10.7%) in 2013 (Omar, Jasmin & Tumin, 2018). According to Omar et al., (2018), Sarawak produced

total of 250, 611 mt of paddy in 2017, in which Sri Aman and Sibu division produced the highest numbers of paddy with total of 77,280 mt. Many varieties of traditional rice are Sarawak specialties, where it is estimated to be not less than 300 varieties of rice from all over region in Sarawak. Sarawak has a potential in exploring the premium rice market due to the varieties of traditional rice they have.

Based on the figure, Sri Aman is consistently dominated the chart as the biggest rice producer in Sarawak then followed by Serian. Sri Aman and Serian could soon be the major rice producer in Sarawak. According to Department of Agriculture (DOA) Sarawak (2020), large scale of MR269 paddy production programme had been set out in Sri Aman division. MR269 is a new high-performance variety of paddy that can produce higher yields and can be planted twice a year with lower harvesting period compared to the previous variety. The previous variety which is the local paddy has low yields, can only be planted once a year and long harvesting period. It is not profitable for the farmers as it only can be planted once a year.

Sarawak has a history of producing its own rice seeds with native groups widely engaged in subsistence farming of both dry and wet rice (KRI, 2022). Traditional farmers in Sarawak have long understanding on the importance of maintaining high genetic diversity in their fields, planting multiple rice varieties together to reduce crop damage from pests and diseases, which has helped preserve genetic diversity. Sarawak is rich in rice biodiversity, and farmers cultivate over 100 varieties of rice, which are sold throughout the region (DOA, 2025).

Therefore, through the alternative of introducing modern varieties, it can help to increase the total production of rice and may reduce the reliability on the importation of paddy seeds from Peninsular Malaysia.

1.2.1 Aids, Subsidy and Assistance Programs

Subsidies and assistance programs form a crucial pillar of support for Sarawak's paddy and rice industry, serving as essential tools for ensuring fair prices, promoting farmer welfare, and maintaining market stability. These strategic interventions address the multifaceted challenges faced by farmers, enhance productivity, and foster socio-economic development within rural, low-income communities (Kari, 2018).

The Paddy Price Subsidy Scheme plays a vital role in ensuring that farmers receive a fair price for their produce, providing a vital buffer against the escalating costs of other essential commodities. Under this scheme, farmers receive subsidies in the form of coupons for every picul of paddy sold, offering a direct financial benefit that improves their overall income. Additionally, initiatives such as the Federal Rice Fertiliser Scheme (SBPKP) and the Rice Production Incentive Scheme (SIPP) provide farmers with essential resources like fertilizer and pesticide, enabling them to improve crop yields and combat potential threats (Bernama, 2024). These initiatives, coupled with special cash aid disbursements, demonstrate the government's commitment to providing comprehensive support to farmers (Ministry of Finance Malaysia [MOF], 2023).

These subsidies and assistance programs provide multifaceted benefits. First and foremost, they provide essential income support to farmers, guaranteeing a basic minimum income and helping to alleviate poverty within rural communities. According to MOF (2023)

the government's recent increase in the rate of the Paddy Price Subsidy Scheme, as well as the decision to raise the floor price of rice, reflects a clear commitment to improving the financial well-being of farmers. By ensuring a stable and affordable supply of rice, these programs contribute to food security and overall social stability. Furthermore, subsidies and incentives encourage farmers to enhance productivity in the agro-food sector, promoting the adoption of modern farming techniques and technologies (Bernama, 2024).

In addition to direct financial assistance, the Sarawak government and various agencies provide a range of other vital support services to the paddy and rice industry. Increased allocations for rice subsidies and incentives demonstrate the government's unwavering commitment to enhancing rice industry as mentioned by Boon (2025), Sarawak government will allocate RM1 billion for rice production over the next two years, with half going to rice irrigation next year and the other RM500 million for 2026. In addition to that, DOA (2024) highlighted the Sarawak government has allocated RM50 million aids to the Tanjung Purun Paddy Scheme. According to DOA (2024), farmers receive a subsidy through coupons for every kilogram of paddy sold. These coupons can be cashed at the nearest Persatuan Peladang Kawasan. Fertilizers and pesticides are also common subsidies provided to farmers each season, with the quantity determined by the size of the farming land.

1.3 Problem Statement

Sustainability of rice is very important to cater the nation demand for food as well as to ensure the sustainability of farmer's livelihood. The relationship between food security and rice production has always sparks an interest among researchers. There are few studies that examine the relationship between external factors such as climate variability, land and labour towards the sustainability of rice production by adding a number of significant factors

that affecting the production of rice (Najim, Lee, Haque & Esham., 2007; Roy, Chan & Xenarios, 2015). There are various factors that contribute to the sustainable of rice production such as climate variability, shortage of manpower, high production cost and plant diseases. Moreover, political and governance factors are included because rice is an important commodity in Malaysia and by law it is protected through price control, subsidies and tariffs. The government agencies such as Department of Agriculture need to play an important role as a middle-man to help the government channel aids such as subsidies, agricultural training and hold dialogues with the farmers related to rice crops.

Besides, the livelihood of the farmers in rice sectors is also important in order to achieve the sustainable rice production other than improving the life of the farmers. A sustainable livelihood comprises the capabilities, assets and activities required for a means of living (Chambers & Conway, 1991). Sustainable rice production and sustainable livelihood have a significant relationship and this relationship affects the farmers in many aspects of life. Nowadays, many villages in Sarawak are left abandoned with increasing of aging population, while the young population leave to city. This resulted in incapability to farm among the elderly. Therefore, many farming land were left abandoned. The rice sector in Malaysia especially in Sarawak is dominated by elderly population due to the migration of young population to city to work in off-farm sector. This human capital issue is common in Malaysia although young population have a positive insight about agriculture; only few of them are directly involved in this field (Abdullah, Samah & Othman, 2012).

One of the reasons why young people choose to work in the city is because of stability of income compared to when working on farms. It is supported by dayakdaily, (2023) saying that currently, the average income for local Sarawakian farmers is between RM1,500 to

RM2,000 per month. Income from agricultural produce is sometimes facing uncertainty especially if the season is plagued by disease which resulted in decreasing of total harvest compared to previous season. According to Malay mail (2023), a national audit report stated that the net income of paddy farmers per hectare of rice production is RM629.76 per month hence, to overcome the national poverty line income of RM2,208, paddy farmers need to cultivate at least 3.6 hectares of paddy land. However, farm productivity in Sarawak is the lowest in Malaysia, with only 1.79 tons per hectare (Abidin & Dardak, 2023).

Studies on land use conversion show that landowners with incomes below RM1,000 per month are less likely to convert their paddy land, as it is a significant source of household income passed down through generations. Majority of these farmers are elderly, valuing their traditional lifestyle and recognizing the importance of rice production for domestic food security (Wan Ismail & Ngadiman, 2017).

However, unless the expected income from farming is higher than the current profession, they might consider leaving their position and take over the farm. The highly educated farmers are more exposed and skilful in the use of machines for agriculture especially for planting and cultivation. This statement is supported by Kőmíves, Pilishegyi, Novák, and Kőrősparti (2019) emphasizes the importance of agricultural education is crucial for developing farmers skills and knowledge to fulfill the demands of precision agriculture and include the latest technical innovations into the farming activities. It also emphasizes the importance of lifelong learning systems in providing agricultural personnel and farmers with the information needed to keep up with rapidly evolving technologies.

This causes their income to be higher for each season compared to farmers who still practicing traditional methods, thus creating an income gap between them. The introduction

to machinery at the planting and harvesting stage is still at a low level among farmers, especially farmers who cultivate rice only for their own consumption and not for commercial purposes. Besides, the price of renting machines is different depending on if the farmer participates in contract farming or not. The price of renting machines for farmers who participate in contract farming is lower than the farmers who do not participate.

On the other hand, not all farmers own transportation to sell their agricultural produce to town, especially farmers from Miri division. Most of these farmers live in rural areas that take around 3 to 5 hours journey to Miri city. Another alternative is by hiring transportation man to bring their local produce to the city, but usually the cost is high due to the long distances and bad condition of rural road. Konrad-Adenauer-Stiftung [KAS] (2022), also stated that Bario which located at the northern rural of Sarawak has a great potential for a good potential of agriculture products. However, due to its location at the highlands has become big challenges because the logging road that connecting Bario to the main city, Miri is with poor road accessibility and very far in distance from the city. Therefore, the last resort is to send the agriculture output via airplane in which required for the high cost incurred.

Due to the high cost of transportation farmers choose to sell the agricultural produce within the village or nearby villages where they sell at a cheaper price than if selling in the city and the amount of profit is also not much for each sale. Their monthly income or profit is just enough to cover daily expenses and almost nothing to save. Therefore, the farmers thought that if the government could set up a facility for gathering and distributing agricultural products, it would support and motivate farmers to grow more fruits and vegetables and meet the demand for their goods at the large market (KAS, 2022). Moreover, the agricultural association commonly known as “*Persatuan Peladang*” and the village’s

cooperatives are less active in bringing the voice of farmers to the authorities. This can result in many farmers not getting proper agricultural assistance. This is supported by Sharon and Junaidi (2024) stated that the success of any policy is largely dependent on the implementation process itself, with villagers frequently relying on a group of informal policy implementers simply referred to as secondary change agents, also known as informal 'officials' who may or may not be appointed by the government to perform these roles. These are the persons who directly communicate with the target groups about government policies and initiatives. They are well-known community leaders such as village headmen, religious leaders, and respected seniors in the village. In addition, those who have a connection with the village head or Jawatankuasa Kemajuan dan Keselamatan Kampung (JKKK) are most likely to get the information regarding the agriculture assistance faster than others. Ibil, Syed Jamaludin, Ikau, and Wahi (2021) also found that the JKKK is vital and is an entity that can mobilize energy, fostering resource development and influencing community attitudes at the village level to enhance overall productivity, therefore JKKK should be thorough in term of providing the information. Therefore, the village's association and cooperative need to play an important role to ensure all farmers acquire the information at the same time.

The climate variability affects the timing and length of crop seasons where it requires farmers to adjust the sowing dates which directly affecting planting and harvesting season. Drought and flood linked to climate variability are some of challenges that affect rice production. Therefore, farmers need coping strategies to ensure they are able to overcome this condition.

There is a need of focusing on the issues of paddy cultivation in rural area to ensure that it is balance with the industrialization process in Sarawak. Last but not least, there are

limited studies dedicated in study the factors that contribute to the sustainability of rice production and the livelihood of the farmers in Sarawak. Therefore, the main concern of this study is to assess the factors that affect rice production and livelihood of paddy farmers in Sarawak particularly the landowners, as well as the potential strategies that can be implemented to minimize the effects.

1.4 Research Question

The research questions are as follows:

1. What are the factors that contribute to the sustainable rice production?
2. How does sustainable rice production important to the livelihood of the farmers?
3. What are the potential strategies that can be implemented in enhancing the rice production and livelihood of the farmers?

1.5 Objectives of the Study

1.5.1 General Objective

This study attempts to assess the livelihood outcome of the rice production in Sarawak from the perspective of economic, social and environment.

1.5.2 Specific Objectives

The specific objectives are as follows:

1. To assess factors that contributes to the sustainable rice production.

2. To examine the relationship between rice production with the farmer's sustainable livelihood outcome.
3. To indicate the potential strategies that can be implemented in enhancing the sustainable rice production and livelihood of the farmers.

1.6 Significance of the Study

. This study will contribute beneficial information for the future development of sustainable rice production and farmers livelihood in Malaysia, especially in Sarawak. Rice is staple food and important to the community in Sarawak, therefore, this study will help to bridging the potentials strategies to achieve the SDGs. The SDGs are important to advocate and raising awareness about farmer's condition as well as to strengthen the community.

Majority of poor people lives in rural areas and farming is the main economic activity, therefore large agricultural investment is needed to support the raise of income of the farmers as well as increase the supply of food. The study on farmer's livelihood can raise awareness especially in government and related agencies on issues connected to rice sector and hence solutions can be identified to solve the issues.

This study targeted small and local farmers in Sarawak. There are only few research that study on the issues and challenges faced by paddy farmers in Sarawak. Echoh et al., (2017) discussed the issues and problems faced by rice farmers in Kuala Tatau, Sarawak particularly the Iban farmers. Besides, Omar et al., (2018) carried out a research on the difficulties and challenges faced by smallholders in paddy farming in the rural area particularly in Bario, Sarawak. Therefore, the study on livelihood of the farmers will provide

more details plans and target for the development of rice sector in Sarawak that focusing on smallholders.

Moreover, this study will provide a better view of the relationship between the sustainability of rice production with sustainable livelihood in the long-run which expected can improve the quality of life of the farmers. Besides, the result of this study will give extra information on how to identify the socioeconomic status of the paddy farmers especially the smallholder with limited resources in their hand and those who are more vulnerable to risks and challenges. This would allow the government and related authorities to give a proper aids needed to minimize the burdens of the paddy farmers.

Therefore, challenges faced by farmers can be identified with the purpose of discover better potentials and strategies available to help in sustaining the rice production in Malaysia especially in Sarawak. On the other hand, this study hopes to educate people on how important the sustainable rice production to the livelihood.

1.7 Organization of the Chapters

This report contains five chapters. All chapters comprise view that conveys the study objectives. The chapters are organized as follows:

Chapter 1 This chapter covers introduction, background of the study, problem statement, research questions, objectives of the study, significance of the study and organization of the chapters.

- Chapter 2 This chapter discuss more detailed on the theoretical parts, approaches and conceptual framework that defend the research objectives including conclusions.
- Chapter 3 This chapter discuss on the research methodology, research design, data descriptions and different methods used in gathering and analysing the data.
- Chapter 4 This chapter discuss on the research findings from the research method and data analysing.
- Chapter 5 This chapter will summarize all the findings of this study, highlights the policy implication and indicate the limitation and potential strategy in future.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

There are many past studies and research that emphasize on the relationship between sustainable rice production and livelihood of the farmers, including the potential strategies in enhancing the rice development. This chapter will discuss on the relevant literature and theories relations between production of rice and livelihood and its sustainability in term of economics, social and environmental, as well as the strategies needed to confront the risks.

2.2 Theoretical Framework

This chapter provides the theoretical linkages between the factors that affect the sustainability of rice production and livelihood; and potential adaptations that can reduce or help farmers to handle the risks. This chapter will discuss on four theories which consist of theory of production, theory of entitlement, the sustainability theory and lastly the sustainable livelihood approach (SLA). These theories will be used to emphasize and link the relevant findings that fit the study.

2.2.1 Theory of Production

A characteristic feature of industrial economies is that commodities are produced through commodities. This idea is popular amongst Austrian economists, Carl Menger, Eugen von Böhm- Bawerk, Friedrich August von Hayek in which production can be considered as a one-way path of limited extension leading from the services of primary

factors of production, labour and land, through a series of intermediate products, or capital goods, to consumer goods that cannot be sustained other than in exceptionally special cases (Kurz & Salvadori, 2000). Production is usually likened to moving in the form of a circle rather than linear or one-way. This is because one of the special features of the economy is that production requires capital to stay circulating.

Traditional neoclassical conception has two different sides. According to Harris (1981), the first one is the idea of monotonic inverse relation between the quantity of capital and the rate of profit, then, the second side of the concept is the presumption that saving is related to time preferences on the part of individuals. This is because the capital acts as a period of production, as the time taken to acquire output from the labour used in production, or simply as an amount of "waiting," is a dimension expressed by Bohm-Bawerk and in this case, the profit rate falls as the production process is changed by extending the period of production. Thus, if the individual is willing to sacrifice the present consumption for future consumption, he or she must compensate for that sacrifice.

The theory and practice of economy of scale has been greatly snowballed since the last industrial revolution. It has been the basic of efficiency and growth in industrial production. The government is also working to solve the problem of unemployment and production through scale and technology. Productivity needs to be maintained consistently in the various aspects involved in paddy production as it is important to increase efficiency and sustainability. In general, productivity is defined as the optimal use of resources to maximize profits. Farm efficiency is an important element in rice production, and is related to economics, the size of the farm, technological adaptations, and the overall levels of input usage in the agricultural sector. Alias (1982, as cited in Najim et al., 2007) states that the

limitation to maximize the production are small and non-economical size holdings, shortage of capital, lack of irrigation and drainage facilities, non-proper cropping and intensities, inaccessibility to markets, less exposure towards information and technological innovations.

Production important inputs are natural resources and it linked with environmental cost or effects which are the costs of degradation of natural assets due to economic activities. According to Garcia and Mairnar (2009), there are environmental effects obtained from different production sectors and institutions in order to fulfil the demand consumption of households. Besides, agricultural sector is one of the sectors that contribute negative impacts on environment. Crosson and Anderson (1994) mentioned that among the problems involving environmental costs are pesticides. Pesticides are designed to kill insects, diseases and fungi. Over the past four decades, pesticides have makes a huge contribution in term of increasing world food production and also to human health. Pesticides have been used to control the population of malaria-bought mosquitos. However, pesticides are still dangerous and bring harm to human health, wildlife, and the rest of the ecological system.

Opening new vast land for agriculture not only cause deforestation but also cause harm to the sources of genetic of plants and animals. McNeely (1990, as cited in Crosson and Anderson 1994) says that without trying to calculate quantitative estimates of the loss of biodiversity, with many indications, the world is already experiencing an extinction rate with a greater scale and impact than at any previous time in the history of the earth. Therefore, poor environmental quality control affects economic growth and well-being due to diminished quantity and quality of resources or due to health issue.

2.2.2 Theory of Production: Optimizing Inputs for Output

The theory of production is a fundamental concept in economics, exploring the intricate relationship between the resources a business employs (inputs) and the resulting goods or services it creates (outputs) (LibreTexts, 2024). Kleyn, Arashi, Bekker, and Millard (2017) state that this theory is about efficiency how can businesses strategically utilize resources to maximize their production capabilities. A key element in understanding this relationship is the production function.

The production function is a mathematical representation of how inputs are transformed into output and it provides a framework for analyzing the impact of various inputs on the quantity of goods or services produced. A simple production function might be expressed as $Q = K + L$, where Q represents the quantity of output, K is the amount of capital used, and L is the amount of labor (Shekhat, n.d.). This equation suggests a direct, additive relationship between inputs and output. However, more sophisticated models capture the complexities of real-world production. Another model is the Cobb-Douglas production function, often expressed as $Q = K^{0.5} * L^{0.5}$ and this function illustrates a more nuanced relationship, suggesting that a firm achieves optimal production when its inputs are relatively balanced (Shekhat, n.d.).

Furthermore, the concept of marginal product is crucial in production theory. Marginal product refers to the additional output gained by adding one more unit of a specific input, while holding all other inputs constant (Kleyn et al., 2017) Then, returns to scale examines the impact of proportionally increasing all inputs (Shekhat, n.d.). This concept explaining how a company's production changes when it alters its inputs like labor and capital over the long term.

Sekeris and Siqueira (2023) state that constant returns to scale (CRS) describe a scenario where output increases at the same rate as input. While increasing returns to scale (IRS), on the other hand, occur when output grows at a faster rate than inputs. Finally, decreasing returns to scale (DRS) are observed when output grows at a slower rate than inputs. Therefore, returns to scale provide a simplified framework for understanding the relationship between input and output in production. By recognizing whether an organization experiences constant, increasing, or decreasing returns to scale, businesses can make informed decisions about their scale of operations.

2.2.3 Theory of Endowment

Endowment theory suggests that merely owning something causes people to value it more than they would if they did not own it (Klass & Zeiler, 2013). Besides, this leads to the "endowment effect," where people demand more to give up an object than they would be willing to pay to acquire it (Achtayi, Ashby, Brown, Walasek, & Yechiam, 2020)

According to Klass and Zeiler (2013), this theory rose to prominence in legal studies in the early 1990s, affecting how scholars predict the consequences of legal entitlements on expressed valuations. Furthermore, Endowment theory is frequently linked to prospect theory and loss aversion, with the concept being that ownership sets a reference point, and selling an object is regarded as a loss, which people are more sensitive to than an equivalent gain. Furthermore, Eli Heckscher and Bertil Ohlin established the factor of endowment theory, often known as the Heckscher-Ohlin model, which is a crucial idea in international trade economics (Leamer, 1995). This model describes how countries export items that use abundant factors of production while importing those that require limited factors. Leamer

(1995) adds essential assumptions to this model, namely that all countries have different factor endowments, such as labour, capital, and land. Besides, goods require different proportions of these factors to be produced and there is perfect competition and no transportation costs in trade.

2.2.4 Theory of Entitlement

Food production, food availability, supply and demand and is directly connected to poverty and starvation. According to Tilly (1983), food security and its sustainability can be measured by the ability of the people to command for food in term of own or purchase an agricultural land to grow sufficient food, employment to bring in wages to buy food, socio-political right, government subsidized welfare or social security rights.

Earlier, Malthus introduced the idea of food supply that highly correlated to food security and famines. Malthus stated that food security and famines are caused by the lack of food supply due to lack of production; growth of population that creates more demand of food and decreasing of land for agriculture as an impact of rapid population (Kurniawan, 2016). However, the great idea of Malthusian comes to an end when the approach of entitlement by Amartya Sen being recognized widely. The entitlement approach was introduced by Amartya Sen and was used widely in economics to examine about famine and poverty. Sen stressed that the main problem of food security is food access and not food supply (Kurniawan, 2016). Food availability decline is not the important factor in explaining how famine occurs, instead, famine cause by lack of access to food (Ringen, 1985; Rubin 2009).

The entitlement approach consists of two categories; endowments and entitlements. Endowment refers the control of assets and resources including labour power, while entitlement refers to the set of substitute commodity bundles that a person can command in a society using the entirety of right and opportunities given (Sen, 1984, p.497, as cited in Devereux, 2001).

The entitlement approach mainly about starvation and famine that includes the ability of people to command food through the permissible resources available in the society, including the use of production possibilities, trade opportunities, powers of the state and other methods of getting food (Sen, 1977). Moreover, Sen (1977) introduced ‘food availability approach’, (FAD) in which a sudden increase of food reduction in the food supply in any geographic locality will result in widespread hunger and famine. Hence, FAD works better if the food supply consumed by a family is acquired through their own crops without being acquired through exchanges.

‘Entitlement’ is not restricted only to the material possessions but also includes the economic entitlements of the individual or the household but is extended to incorporate the individual’s skills, education and the productive ability (Tiwari, 2007). Besides, according to Rubin (2009), Sen’s entitlement approach describes famines as socioeconomic problems rather than food availability problems and the approach focus mainly on the set of alternative commodity bundles that can be acquired through legal channels of acquirement. Tollen (2003) made an assumption that increase of access or entitlement to capital assets is important to maintain a sustainable livelihood.

Pawlak and Kołodziejczak (2020) explained the entitlement approach developed by Sen is represented by indicators related to agricultural farm endowments and foreign trade

entitlement. In addition, Pawlak and Kołodziejczak (2020) also stated that increasing the purchasing power of households in poorly developed countries as a way to eliminate poverty and improve food security.

2.2.5 The Sustainability Theory

Sustainable development (SD) is an important concept for contemporary society, economy, development and environment (Kociszewski, 2018; Yasar, Siwar & Firdaus, 2016). SD is a development that meets the present needs without negotiating the ability of future generations to meet their needs (Najim et al., 2007). Kociszewski (2018) explained that the three important dimensions of SD (economy, social and environmental) are important to portray the welfare, food security and environmental protection of people.

Yasar et al. (2016) defined SD as a system that is ecologically healthy, economically valuable and socially equitable. Munasinahe (1993 Yasar et al. (2016)) as cited in Yasar et al., (2016) shared the same view which he stated that it is similar to the ‘triple P’ concept. The three concepts of P’s are known as economic development, social development and environmental protection and these elements will influence each other to create a balance. Nuramalina (2008) mentioned that there are five dimensions of SD that consists of ecology/environmental, economy, socio-cultural, institution and technology. Besides, sustainability of rice are affected by seven factors that includes production, productivity, land conversion, land suitability, rice field construction, consumption per capita and population growth.

2.2.6 The Sustainable Livelihood Approach (SLA)

In the mid of 1980s, Robert Chambers developed the idea of “Sustainable Livelihoods” with the purpose to improve the development of the community. Chamber’s concepts constitute the fundamentals for the sustainable livelihood approach that was developed by the British Department for International Development (DFID) in year 1999. A livelihood can be considered as sustainable when it is strong enough to face the external shocks and stress without depending on external support, when it is capable to maintain the long-term productivity of natural resources and when it does not weaken the livelihood choices of others (Kollmair & Gamper, 2002). Therefore, rather than focusing only on development activity either at the macro or micro level, sustainable livelihood approach bridges the gap by linking the two levels. Applying the sustainable livelihood framework can help to understand how the system of household’s livelihood interact with the outside context, environment and institutional (Food and Agriculture Organization [FAO], 2005). Figure 2.1 shows the sustainable livelihood framework (SLF).

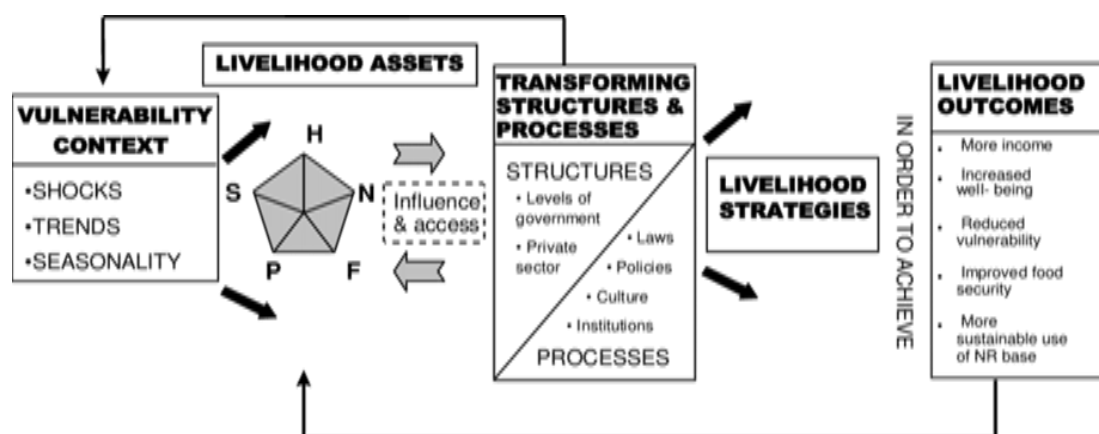


Figure 2.1: Sustainable Livelihood Framework

Sources: DFID, (2001)

The SLF in Figure 2.1 provides conceptual model to assess the sustainable livelihood outcome of the households (DFID, 2001). This framework serves as a core of the Sustainable Livelihood Approach. The livelihood approach place people as first and foremost. The strength of people is identified as assets or capital. Asset or capital is a crucial element that can provide positive outcomes to the livelihood of people. The sustainable livelihood approach is an approach of thinking about the objectives, scope, and priorities for development activities.

From the left section of the diagram, shows how the vulnerability context functions, within which it have an access to the assets. The vulnerability context forms the external environment in which people exist and gain something through direct impacts upon status of the assets (Kollmair & Gamper, 2002). It consists of shocks, trends and seasonality. Not all trend and seasonality can be considered as negative. For example, trends in new technologies or seasonality of prices could be used as opportunities to enhance livelihoods. Besides, livelihood assets are regulated by the policies, institutions, and processes. The livelihood strategies of different categories of households are formed by their asset base and also by the policies and institutional context in where they live. The livelihood outcomes of different categories of households are influence by the vulnerability context, where people will face unexpected shocks, trends and seasonality. Therefore, their dependency to their asset base may help them to withstand the shocks and negative trends and seasonality (Raja, 2015).

This approach is based on progressing thinking about the way of the poor and vulnerable people live their lives and the importance of policies and institutions (Serrat, 2008). The sustainable livelihood approach provides several resources that are used to find

the level of vulnerability as well as a tool for the lasting livelihood achievement. Chambers and Conway (1991) defined four important aspects of livelihood which first aspect comprise of people capabilities and their means of living, including food, income and assets; second aspect comprise of tangible and intangible assets in which the resources that can be claims and access; third aspect comprise of environmental sustainability which means it maintain and improve local and global assets where life depends, and have a net benefit effect on other lives; fourth aspect comprise social sustainability which means the ability of coping with and recover from stress and shocks, and ability to provide sustained livelihood for future generations. Besides, people or a household may gain sustainable livelihood security in many ways such as through stable employment with sufficient salary, through ownership of land, livestock and rights to hunt and gathering.

Sari, Falatehan, Irawan, Sedana and Rahin (2018) also mentioned that sustainable livelihood can be declared if it used by the people to diminish and restore the condition of various shocks and stresses, to maintain or even develop the capital assets that they own or control, and the lastly livelihoods do not cause a threat to the sustainability of the surrounding natural resources. On the other hand, Guo, Liu, Wei, Xu, Li and Su (2019) defined livelihood as a way of making a living such as holds the capabilities, capital and activities. The strategy of livelihood refers to the combination of the activities and choices made by households to make use of their existing capital to achieve their livelihood goals. The sustainable livelihood approach places the community at the centre of the development and seeks to identify the most significant obstacles faced by the human, and the most favourable opportunity for the community regardless of where the sources of opportunity comes. Sari et al., (2018) added that the sustainable livelihood capital, the ability to pursue the livelihood can be found differently depending on the social policy and the strength of each resource owned by the

family or individual. According to Lekshmi, 2024, livelihood assets are the resources that individuals, households, or communities utilize to build their means of living. These assets are essential for securing necessities like food, water, shelter, and clothing, and for enabling people to live in a sustainable manner. Referring to this study, paddy farming in Sarawak is deeply connected to the concept of livelihood assets serving as a crucial means of living for many rural families especially the smallholder farmers.

This study only covers the part of framework that focus on the impact of climate variability, as in vulnerability context; farmer's capital and asset, as in economic and social aspect, and including the strategy for potential livelihood by farmers in paddy farming activities. Therefore, this study will focus solely on a group of paddy farmers in Sarawak.

Sustainable livelihood approach emphasize on the vulnerability context in which people are vulnerable to the external environment impacts that may affect their asset status. Vulnerability comprises of shocks that explains a sudden, unpleasant and unexpected experience. Economic shocks, health shocks, natural hazard and conflict or wars are the example of shocks that causing emotional and physical reaction. Seasonality is a cycle of economy or business that changes depending on the seasons and it is not under control of the stakeholder. Seasonality of products, prices and employment are the seasonality events that occur at specific season or time. Trend is a general change or development in a situation that involves trends of demographic or trends of governance. In agricultural sector, farmers facing seasonally weather shocks that resulting in climate variability that affects the production of agricultural products.

Therefore, sustainable livelihood approach provides better understanding on the vulnerability impact of climate variability towards agricultural sector. Farmer's life can be

considered as sustainable when manage to overcome and anticipate the circumstance of the vulnerability available that is adapting with changes or uncertainty, can overcome stress and shocks and anticipate season variability that could take place, as well as to maintain existing capabilities and resources or to further improve it for now and the future without damaging it.

Climate change as well as economy and social vulnerability influence the production of rice and livelihood of farmers. According to Siwar, Yasar, Ghazali and Idris (2013) the increasing trend of plant destroyed affect the rice production the most due to the climatic vulnerability, that demand the innovation and good management of irrigation as adaptation strategies to ensure the sustainable food security. Besides, the increase of inputs cost influence led to the economic vulnerability among farmers which cause heavily dependency on subsidies by government.

This study will examine five aspects of livelihood assets which are human capital, social capital, natural capital, financial capital and physical capital. Human capital covers the skills, knowledge, ability and experience of the paddy farmers. Social capital covers the social resources such as networking and connections that used to gain people's trust in the community. Natural capital covers stock of natural resources which resources that flows and useful for livelihood. Financial capital indicates the resources of financial that the farmers use to achieve their livelihood objectives such as income. Lastly, physical capital covers basic infrastructure and farmers good needed to support livelihood such as safe shelter, affordable transportation and clean water supply.

The strategies for livelihood provide various range and combination of choices that people embark on in order to achieve their livelihood goals. For this research, adaptation

approach and building resilience at individual farmer or farm level then followed by policy level are considered as the livelihood strategies. Climate change is a continuous and long term process therefore, adaptation is very essential for long run agricultural sustainability (Alam et al., 2011).

2.3 Empirical Studies

2.3.1 Rice Production Contributions and its Challenges to the Local Farmers

Rice is one of the most important crops to people worldwide and one of the important crops grown in Asian countries that provide livelihoods for millions of farmers. Rice production industry is source of income to farmers across the world. For most Asian people, rice has shaped the cultures, dietary routines and economies of many people. Rice is major staple food for rural population and food security to many low-income countries and mainly cultivated by many smallholders farmers with less than one hectare of land (FAO, 2021).

Agricultural sector as well as rice production industry in Malaysia plays a vital role since 1960s in term of providing food supplies to cater the growing population, provide job employment, as source of income and provide raw materials for other related industry. Paddy sector in Malaysia is highly protected by the government especially the granary areas and receive various support programmes that helps supported the livelihoods of paddy farmers. Besides, policies on rice in Malaysia are mainly related with poverty alleviation due to the current stigma that relate rural and poverty with agriculture and the policies aim to transform the sector into commercially viable sector with high returns which benefits the farmers livelihood.

According to Jamaludin, Amer and Hasan (2010), government actively provide fertilizer subsidy, support price and price subsidy to the rice farmers to ensure a good yield

and consistent income for the farmers, especially the lower income group. This makes the rice industry greatly depend on government support and incentives. Government support also includes farming infrastructure such as irrigation systems and dams, set up the price controls, subsidies and tariffs that certainly contribute to the livelihood sustainability of farmers (Rahmat et al., 2019).

Agricultural sector plays a vital role as one of the main economic activities in Sarawak especially paddy farming activity. Due to the contribution of rice production in Sarawak to the local farmers and community, Sarawak government established SCORE that purposely to benefit the rural people especially the farmers through infrastructure and socioeconomic projects. Sarawak is well known of its unique variety of rice that has greater qualities in term of taste, texture, and the fragrance. Some examples is Bario rice that is sold for its premium grade and it is profitable. This activity benefited the smallholder community of farmers in Bario by increasing the income (Omar et al., 2018). Therefore, rice production is important because it provides livelihood for thousands of smallholder farmers.

Although paddy cultivation benefits the farmers in various ways, there are still farmers who are living below the poverty line. Poverty level is often the main criteria in the assessment of livelihood outcomes (Scoones, 1998). According to Raja (2015), a community that resource-dependent is faced with challenges to social and economic stability as a result of the reliability on certain natural resource for income and employment. Besides, climatic change also associated with the socioeconomic and productivity of the farmers. According to few previous studies by (Takama et al., 2014; Hasanthika, Edirisinghe & Rajapakshe, 2013; Saptomo, Setiawan & Yuge, 2009) climate change or climate variability give huge impacts to paddy production. Agriculture sector especially paddy is vulnerable to climate

change. According to Intergovernmental Panel on Climate Change [IPCC], “vulnerability is the point to which a system is disposed to, and unable to deal with, adverse effects of climate change, including climate variability and extremes” as cited in Takama et al., (2014). Thus, climatic and socioeconomic vulnerability may worsen the difficulty of poor farmers who majority lives in rural areas and this condition will continue to put them to be vulnerable to social and weather changes in the future.

Climate change is a global phenomenon that brings negative impacts to humankind and more severe to the poor countries that depending more on natural resources and has limited capacity in coping with extreme climate variability. Besides, farmers with low income suffer massive losses from floods and drought. A study by Silva and Kawasaki (2018) found that low-income households that depend fully on natural resources for their livelihood are exposed to more frequent disasters and most vulnerable to financial losses incurred through floods and droughts. Smallholder farmers are important part of agricultural community especially for the community in rural areas and are greatly vulnerable to poverty especially when it comes to total income from paddy cultivation and production. According to John and Fielding (2014) mentioned that smallholders and the vulnerable group need be prioritized by the national and international research bodies in order to reduce poverty and promote the food security status.

On the other hand, paddy cultivation and production sector also face declining number of labours. A study by Reddy and Venkatanarayana (2013) mentioned that there is a fast decline in labour use in rice cultivation due to most of the work is depending on machines. This statement is extended by FAO (2017) where food systems are becoming more capital-intensive that cause it only concentrated in fewer hands and it is happening

from input provisioning to food distribution. Therefore, small-scale farmers and landless households are the first to lose out and desperately seek employment opportunities outside of agriculture sector in which it increases migration flows especially of male members of rural households and cause shortage of labour force in paddy farming and production. Saisema and Pagdee (2015) mentioned that many youths who choose greater wealth opportunities from city jobs, leaving the future of family rice farming in danger. In addition, paddy farmers face income inequality whether it is on-farm or off-farm income, especially for farmers who lived in rural areas that far from industrial factories.

According to Terano and Mohamed (2011) based on study among paddy farmers in the granary areas in Malaysia, since most of the development is focused on the West Coast, the East Coast has been left behind from industrial development. Hence the opportunity for East Coast farmers to seek part-time jobs to earn an off-farm income as a factory worker is not freely available. This led to a widening of income inequality among the farmers. This is supported by a study from Alam, Siwar, Molla, Toriman and Talib (2010) there is a high degree of income inequality among the paddy farmers. In addition, farmers notice that paddy cultivation is no longer profitable due to low productivity as a result of climatic changes.

2.3.1.1 Impacts of Climate Variability on Sustainability of Rice Production

Ajetomobi, Abiodun & Hassan (2011) examined the potential impact of climate change on rice production and found that increase in temperature will reduce net revenue for dry land rice farms while net revenue rises with increase in temperature for irrigated rice farms and increase in precipitation will cause reduction in revenue for dry land rice farms whereas it will cause increase in revenue for irrigated farms. Agricultural sector is prone and

sensitive towards climate variability. A study by Deressa, Hassan and Poonyth (2005) stated that climate variability has significant nonlinear impacts on profits of sugarcane in South Africa with higher sensitivity to future increases in temperature than precipitation and irrigation did not prove to provide an effective option for reducing the impact of climate change towards sugarcane crop. This study is supported by Al-Amin, Azam, Yeasmin & Kari (2010) where the finding of the study indicate that climate change has reduced Malaysian agriculture production and yearly profits especially for specific major agriculture products such as rice. This study is mainly focusing on the vulnerability of climate variability on agriculture in Malaysia.

Next, temperature rise would make the age of rice the shorter and decrease the rice yields and this pointed out that irrigated farm having less impact from temperature rise compared with rain-fed farming which had the decreasing of rice yield (Yuliawan & Handoko, 2015). The irrigated paddy farming that receives constant water supply from the irrigation system and rainfall, this is why the water supply is always available during the planting period in which make it easier to cope with climate variability. Previous research conducted by Masud, Rahman, Al-Amin, Kari and Filho (2012) stated that temperature, rainfall, farm size, educational knowledge, land area and value of labour input have an impact on rice production per hectare which indicates the of impact of climate variability on Malaysian agriculture. Cost of labour contrary related to net of income of the farmers in which increase of labour used causes net of income to decrease. Increase in labour will cause increase in production cost.

Meanwhile, the farm size shows negative relationship with land usage for rice production. Besides, revenue increased during main seasons as the result of slight increase

in the temperature while the revenue decreased during off season which is planting season for farmers and an increase in precipitation levels during dry season caused decrease in revenue as this will encourage diseases and crop pests. During off season, rainfall increased the revenue of yield and during the main season it reduced revenue of yield in which high level of rainfall may result in flooding and damage to the rice field.

2.3.1.2 Impacts of Land Conversions on Sustainability of Rice Production

Other than climate variability, agricultural sector also faces risk of the conversion of agricultural land to non-agricultural land due to rapid of development and urbanisation. Malaysian government had established various types of policies to improve the agriculture sector especially for paddy production to achieve maximum SSL. Therefore, land conversion brings many negative impacts to food security in Malaysia. This is supported by study from Yasar and Siwar (2016), stated that for the past 15 years has shown diminishing patterns of the size of paddy land in Peninsular Malaysia whether according to the states or granary areas in which can affect the SSL in Malaysia. Therefore, one of the initiatives under government is to identify eight major granaries area in Peninsular Malaysia because paddy land control according to granary is better compared to states.

The literature review by Ismail and Ngadiman (2017) stated that the conversion of land from agricultural land to non-agricultural land results to the reduction of paddy land and reduced the rice productivity. Therefore, it is discovered that most of paddy land owners chose to remain planting paddy and sustaining the paddy land area. There is a change of land use pattern due to high demand of residential area (Azizan & Hussin, 2015).

Paddy sector face challenge of land conversion from agricultural land to industrial land. According to Alam et al., (2011) land use for the agricultural activities in Malaysia is declining due to the land conversion for development. In most situation many land areas once used to grow crops are now be used for housing, business, and industrial purposes for sake of economy development. Saisema and Pagdee (2015) stated that soil salinity reduced the rice productivity despite the application of organic fertilizer therefore farmers that produced high percentage of saline paddies bear more cost especially on cost of maintenance.

Moreover, young generations prefer to work in other field rather than involved in agricultural sector despite of incentives and subsidies given by the government. The old rice fields will not transfer from registered landowner to heir. Therefore, if the owner dies, a disagreement arises in the family because there would be that possibility any family member will claim the right to separate land. Therefore, to avoid family conflict regarding land ownership, the rice fields will be sold and the money will be distributed between family members. The land usually been sold for housing development if it is in urban area. In addition, Terano and Fujimoto (2009) stated that most of the agricultural land being sold due to the death of the owner and lack of successors to continue farming in the area. Nurliani and Rosada (2015) examine the influences that affect rice sustainability, the study conducted to identify causal factors of the rice field conversion. Moreover, rice conversion happens when farmers assumed that their rice-fields are no longer economically profitable. In some cases, at Pangkep Regency, South Sulawesi where the research is conducted, rice field conversion occurred due to low quality of rice-field as a result of sea water pollution.

This is supported by a study from Azulaidin and Yusnawati (2017), a case study of land conversion of paddy field becomes palm oil at Helvetia Regency, Medan, in which by converting the land, farmers expect the price of the new farming commodity to have a high and stable selling price, so that the farmer have an increase of income, thus it makes it more easily to manage and utilize the income he receives. On similar research conducted by Alamsyar, Basir and Damayantri (2018) stated that land shifting mainly occurs in paddy field that switches the function of its use into housing area, shops, and other infrastructure facilities. Besides, agricultural land conversion is carried out directly by the landowner such as making a house for his family or warehouse for storage. On the other hand, agricultural land conversion happens with land acquisition in which farm owners sell their land to others who will use it for non-agricultural purposes.

2.3.1.3 Socio-economics of the Farmers

Socioeconomic status is a way to classify an individual or group that usually measured as a combination of education, income, and occupation. Issues that often associated with socioeconomic status are inequalities, in term of access to resources and privilege. According to Silva and Kawasaki (2018), socioeconomic issue is related to poverty where low - income people have the inability to obtain the basic goods and services necessary for survival with dignity. Poverty also includes low level of education and healthcare, poor access to proper clean water, no privilege to speak up and less opportunity given to have a better life. In addition, Idris, Siwar, Talib and Berma (2013) mentioned that high poverty rate among rural people resulted from the refusal of the rural community itself to accept change and reform in term of micro and macro levels. However, other factors that

contributes to poverty such as lack of asset ownership and employment, size of family, lack of marketing strategy and instability in crop prices that are the cause of this poverty crisis.

According to Sen (1977), entitlement approach defines famines as socioeconomic problems due to lack of power on the access of food. People who have a high socioeconomic status and access to capital assets tends to be less vulnerable in life because they can convert the assets into positive outcome of the livelihood. Socioeconomic status of paddy farmers can be measure by using the context of capital assets in sustainable livelihood. Assets can be used to escape from poverty by combining few assets together. For example, level of education can be used to gain something valuable such as skills and knowledge. Farmers with good education background usually have an easy access to knowledge, especially about farm management and machinery. Therefore, these farmers may apply the knowledge in adapting new technology into their farm. Applying new innovation helps to improve agricultural productivity as well as increase the income of the farmers.

On the other hand, easy access to financial capital which consists of the availability of cash or equivalent is important and it is the best capital as it can be converted into other types of capital as well. Financial capital can be used to purchase food to reduce food insecurity, can be used to purchase machinery to increase productivity and can be used to purchase a land. Therefore, a livelihood strategy encompasses combination of choices and activities that people choose to have a better socioeconomic status.

2.3.1.4 Price Mechanism and Middleman Intervention

Even though the sector contributes less than 1% of Malaysia's GDP, rice is a significant crop in the country. Since rice is the primary staple food for the majority of the

population, the government has put in place a number of protective measures in response to the national interest in food security, agricultural income protection, and guaranteeing an adequate supply of rice (Vengedasalam, Harris, & MacAulay, 2011). Mirimo and Shamsudin (2018) discuss that the government has the power to either stabilize and absorb the price differential or allow the domestic rice market to be impacted by the discrepancy between the indicated price and the stock's initial value. The World Bank noted that Malaysia's price control mechanisms have led to lower supplies of food staples, resulting in higher prices (Sheng, 2025).

Arshad (2023) stated that the paddy and rice industries in Malaysia are distorted by protectionist laws and monopolies, which result in ineffective resource allocation that impedes progress. On the other hand, in a study conducted by Othman, Yusop, and Malek (2019) in Kelantan, they stated that the farmers in Kelantan require middlemen, particularly when it comes to giving them access to sophisticated machinery, equipment, and transportation that can lower their manufacturing costs. Although they typically engage in large-scale production, the middleman is also a paddy farmer. Compared to small-scale farmers, they have sufficient funds to purchase sophisticated equipment. According to Arshad (2025), demand for local rice has driven up prices for farmers to RM1,800 pmt, beyond the minimum price of RM1,300 pmt that is guaranteed. Price control encourages participant misbehavior at the expense of customers since it is unable to adapt to market conditions. This situation brings huge impact to the smallholder farmers.

Besides, the other challenge is due to the paddy and rice market in Malaysia was thought to be inherently inefficient because of a lack of integration, dishonest middlemen, a poor information flow, and inadequate infrastructure Arshad (2023). Dardak, Zakaria, Rusli,

Suhaimee, Nazmi, and Ab Halim (2015) stated that in January 2014, the agriculture minister initiated the "war" against the modified middlemen program (JMOT) through the Ministry of Agriculture and Agro-Based Industry. The government believes that intermediaries have been manipulating farmers and fishermen when they purchase agricultural products from them, which is why this scheme has gained attention. Farmers and fishermen rely too heavily on intermediaries, particularly when it comes to obtaining funding to purchase agricultural inputs. The financial aid is occasionally given for private purposes, such purchasing household goods, scheduling payment for a new car, or covering children's tuition.

The government responded to these problems by implementing a three-way policy that would guarantee a high price for paddy farmers, reach a desired level of rice self-sufficiency, and guarantee consumers consistent and good-quality rice prices which included the need for a state trading enterprise (STE), price control (farm and retail), subsidization of input, and numerous market regulations (Arshad, 2023).

2.3.1.5 Potential Strategies to Enhance Rice Production and Farmers Livelihood

Rice is the staple food for about half of the world's population and mostly cultivated in Asia as the main source of rice production. Since rice is the main staple food and food crop to the country, there is an urgent need to implement potential strategies or improve existing strategies and remedies to enhance the rice production and farmers livelihood.

Climate change is known as the biggest threat to agricultural sector across the world. Climate variability in Malaysia has greatly affecting agricultural productivity as well as farmer's well-being that increase the vulnerability to risk and uncertainty. Since climate change is unpredictable and uncontrollable, adaptation strategy is needed to cope with the

changing nature. Adaptation strategy at the local level is essential to the farmers especially the smallholder. Alam et al., (2012) farmers need adequate training and support from the government and international agencies to make them capable of adapting to the climatic vulnerability and prevent any adverse effect on their socioeconomic sustainability and national food security. The agricultural adaptations options need to be consisted of technological developments, government programs, farm production practices, and farm financial management to ensure it is effective in enhancing the farmers livelihood.

Adaptation in technology usage in paddy production is synonym with Malaysia and it is reasonably advanced compared to few years back. The field operations such as sowing, manuring and chemical spraying in granary areas mostly are performed using machine that increase the efficiency of the field work. Rahmat et al., (2019) agreed that mechanization is an effective way that is practical in lowering production cost, increasing labour and improving land productivity. Therefore, farmers need to adapt to the technology of machinery and moving forward through it for a sustainable rice production and livelihood.

Food crisis happened in 2008 shows the importance of giving attention to the issues and problems that have overwhelmed the rice production sector through policy actions (International Rice Research Institute, 2008). Echoh et al (2017) suggests that it is important to maintain the life of the local people in a positive traditional way to ensure paddy cultivation and the local knowledge on it to be well-preserved in the pursuit for industrialization and urbanization. Social and economic problems mostly related with urbanization and rapid industrialization due to the inequality of income distribution hence to solve this household strategies and diversification of rural livelihood need to be adopted. Income and cost of living are the main reason farmers participating in off-farm employment.

Idris and Siwar (2015) stated that diversification of income is essential in term of farmers adaptation to vulnerability factors such as insufficient aids provided by government and climate variability that might threaten farmers livelihood. On the other hand, Echoh et al., (2017) once again stated that diversification of activities that can sustain and enhancing farmer's social capabilities; cultural practices that is connected with paddy cultivation can be continued; thus, allowing the farmers to withstand market pressures

2.4 Conceptual Framework

Conceptual framework provides the conceptual linkages between challenges in maintaining the sustainable rice production and its potentials to the local community. This framework conceptualizes on two main theories which consist of the entitlement and sustainable livelihood approach (SLA).

Sen (1977) introduced the entitlement approach that emphasized on the famine and poverty. According to Sen (1977), each person in the society can be thought of as having an “entitlement” if he has the access to all possible combinations of the goods and services. Therefore, people are less vulnerable if they have capabilities and asset to support the livelihood. Meanwhile, Tollens (2003) agreed that increasing entitlement to capital or assets is crucial to maintain the sustainable livelihood. This study is based on the Sustainable Livelihood Approach model by British Department for International Development [DFID] in year 1999 that originated from Chambers and Conway (1991). The approach aims to enhance the efficiency of development cooperation.

Nurmalina (2008) from a study of rice availability in Indonesia agrees that economy, socio-cultural and ecology affects sustainability of rice production. Previous study from Yasar et al. (2016) indicates that economy, social, ecology, institutional and technology is the positive factors that determined the level of sustainability. Besides, a study by Chavez, Nadolnyak and Saravia (2013) mentioned that there is a positive increment in income from agricultural production, but the social and environmental impacts are not positive which may affect the sustainability of development in that area. This can lead to the greater falling into poverty traps. On the other hand, Najim et al. (2007) relate sustainability of rice production with economic, political, environmental, and social conditions. Mustapha (1997) expressed the sustainability of rice industry is related with many driven factors including the environmental degradation and growth of population. Figure 2.2 shows the conceptual framework of this study.

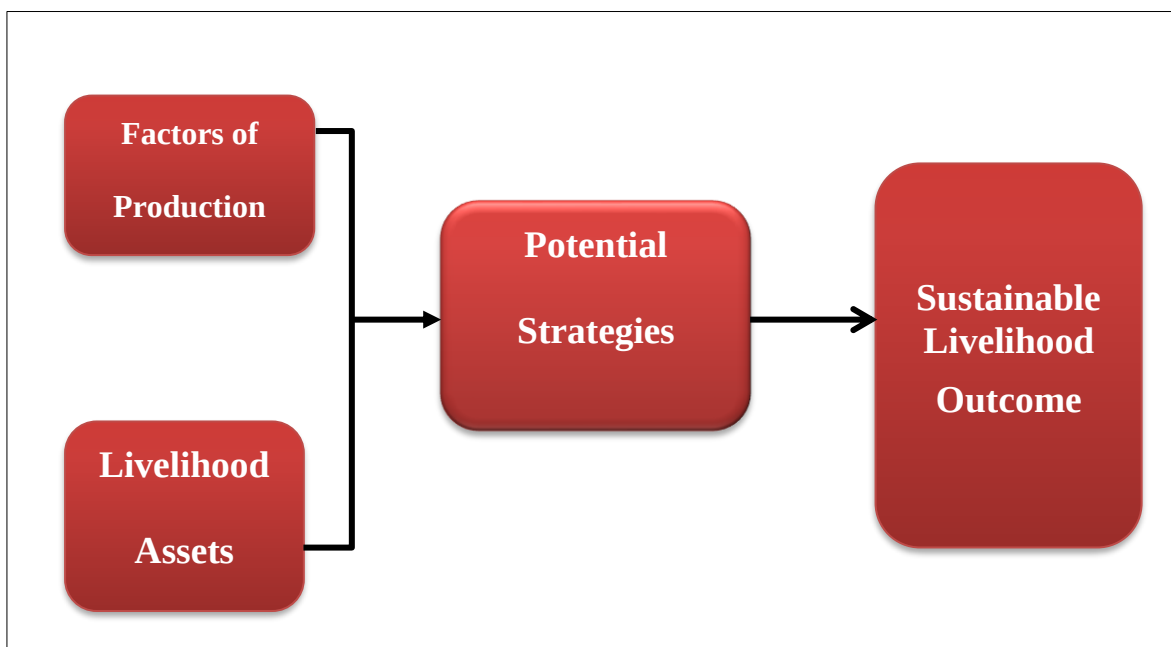


Figure 2.2: Conceptual Framework Sustainability of Rice Production and Livelihood

Note: Adapted from Sustainable Livelihood Framework (DFID, 2001)

Figure 2.2 shows the relationship between factors of production; capital assets and potential strategies with sustainable livelihood outcome. The figure shows the direct link between the dependent variables and independent variable. Factors of production consist of land, capital and labour while capital asset indicators of SLA model are based on the sustainable livelihood framework (DFID, 2001). Potential strategies are consisting of adaptation and coping strategies. This figure was adapted from the sustainable livelihood framework of DFID (2001) to assess the vulnerability context and the livelihood outcome of the farmers. Hence, the SLF framework asset-based approach, human capital, physical capital, social capital, financial capital and natural capital can help to identify assets as alternatives to the indicators (DFID, 2001). Based on the diagram, the assessment on the factors of production and capital asset that influence the livelihood outcomes of the farmer is expected to answer the second objective of the study. This framework is expected to recognize the importance of capabilities and assets to support living of the farmers.

2.4.1 Summary of Literature Gap

Sarawak's pursuit of self-sufficiency in rice production necessitates a comprehensive understanding of the factors influencing sustainable rice production and the livelihoods of farmers in the region. While existing literature provides a foundation through various theories such as the Theory of Production, Theory of Entitlement, Sustainability Theory, and the Sustainable Livelihood Approach, several gaps remain that need to be addressed for a more nuanced and effective approach.

Sarawak's rice farmers face unique challenges and opportunities due to their specific local conditions (Abidin & Dardak, 2023). Understanding the social, economic,

environmental, and cultural factors that affect how they grow rice and make a living is key. The existing literature review also has a climate variability focus, but the impact of climate change has been widely known.

Another area for improvement is the limited emphasis on institutional factors. While the Sustainable Livelihood Approach acknowledges the role of policies and institutions, more in-depth analysis of specific policies, governance structures, and institutional arrangements in Sarawak is needed. This analysis should examine how these factors affect rice production, farmer livelihoods, and the overall sustainability of the rice farming sector.

The environmental aspect of the literature review should be more in depth including the effects of hybrid rice and modern agricultural techniques. Addressing these gaps will require a more integrated, context-specific, and empirically grounded approach to understanding sustainable rice production and farmer livelihoods in Sarawak. By bridging these gaps, researchers and policymakers can develop more effective strategies to enhance food security, improve farmer livelihoods, and promote the long-term sustainability of the rice farming sector in Sarawak.

2.5 Concluding Remark

This chapter concluded all the theories that related to the potential and challenges in sustaining the livelihood of the farmers. This chapter highlights on the vulnerability context and the importance of sustaining the rice production to maintain the sustainable livelihood of the farmers.

This chapter includes four main theories that are the foundation of this study. The theories consist of theory of production, theory of entitlement, the sustainable theory and

lastly sustainable livelihood approach (SLA). The conceptual framework of this study is supported by two main theories which are theory of entitlement and sustainable livelihood approach. These theories will help to link the potentials, challenges and strategies altogether its relationship with the sustainable rice production.

This chapter also includes relevant literature reviews that based on the research objectives. This study has reviewed on the past literature on the sustainable rice production and livelihood, contribution, and challenges. The theories used in this chapter will helps to support the empirical findings of this study.

Table 2.1: Summary of Literature Review

Author (s)	Year	Methodology	Findings
Kurz & Salvadori (2000)	2000	• General framework analysis	Commodities are produced by means of commodities and fixed capital goods play an important part in the production process.
Harris (1981)	1981	• Critical analytical approach	The importance of income distribution and challenges the notion that profits are solely determined by productivity.
Amartya Sen	1977	• Theoretical analysis empirical case studies	People with high socioeconomic status and access to capital assets are generally less vulnerable in life.
Kociszewski (2018)	2018	• Conceptual systematization • Comparative analysis	Sustainable development three key dimensions economy, society, and environment are essential for people well-being, food security, and environmental protection.
Chambers & Conway (1991)	1991	• Conceptual and Analytical approach	Livelihood as comprising the capabilities, assets (stores, resources, claims, and access), and activities required for a means of living.
Yasar, Siwar & Firdaus (2016)	2016	• Qualitative analysis and structural equation modelling	Technological advancement is the most crucial element for achieving sustainability in the Malaysian paddy sector, although its ecological impacts must be carefully considered, alongside other positive factors such as economy, society, and institutions.

Table 2.1 continued

Rahmat, Firdaus, Shaharudin & Lim (2019)	2019	• Qualitative analysis	The Malaysian paddy sector is protected by means of a high level of government intervention.
Omar, Jasmin & Tumin (2018)	2018	• Quantitative analysis • Comparative analysis	Sarawak is known for its high-quality rice, such as Bario rice, which has a distinct taste, texture, and fragrance. Sold as a premium product, it provides profitable opportunities for smallholder farmers, boosting their income.
Najim, Lee, Haque & Esham (2007)	2017	• Quantitative analysis • Case study analysis • Exploratory research	Empowering small farmers and modernizing traditional farming practices are important to achieving sustainability in the agriculture sector.
Abidin & Dardak (2023)	2023	• Quantitative analysis • Case study analysis	Farm monitoring and maintenance contributed to farm productivity. Capital and infrastructure, human factors are crucial in determining paddy production.
Echoh, Md Nor, Salfarina, & Masron, (2017)	2017	• Qualitative analysis • Content analysis	Decline in farmer numbers, a weak subsidy distribution system, and village-specific challenges like inadequate land and irrigation issues, influenced by their distance from urban areas.
Jamaludin, Amer & Hasan (2010)	2010	• Correlation analysis	The government provides fertilizer subsidies, support prices, and price subsidies to help rice farmers, ensuring good yields and stable incomes, especially for low-income farmers.
Siwar, Yasar, Ghazali & Idris (2013)	2013	• Quantitative analysis • Secondary and primary data • SPSS	Climate change, economic pressures like rising input costs, and social factors all contribute to vulnerabilities in Malaysian rice production, necessitating innovative adaptation strategies such as improved irrigation.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outline the research method, the research approach, the type of data analysis and the overall research process involves in this study. It explains how the methodologies were applies, approaches and specific data-gathering techniques used in the application of the study of the sustainable livelihood of the farmers. Due to the limitation of data availability, the primary data had been collected to further support and details the outcome of the study. The sections in this chapter will provide answers to the objectives of the study.

Livelihood outcomes are the consequences or accomplishments that households obtain through their livelihood strategies. These outcomes represent the household's socioeconomic condition and can include better income, better well-being, greater equity, improved food and water security, and more sustainable use of natural resources (Lekshmi, 2024). In contrast, unsuccessful consequences include food and income insecurity, vulnerability to shocks, asset loss, and hardship.

3.2 Research Method

The research methodology is an important aspect in finding the result and solution to the problem statement and achieving the objectives of the study. In order to gather the related information and results for objectives of the study, the in-depth interview was applied. The details of the methodology are as follows.

3.2.1 The Selection of Respondents

The non-probability sampling was used to select the respondents. The sampling of interviewees was carried out through purposive sampling. Purposive sampling or also known as judgmental sampling is used in situations in which an expert uses judgment in selecting cases with a specific purpose in mind (Neuman, 2003). It is often used in exploratory research or in field research that are relevant to this study. The rule of thumb of this analysis is to select participants based on their specific knowledge or experience relevant to the research question. The goal is to gain in-depth understanding from individuals who can provide right and detailed information. In this case, farmers from different villages in northern and southern of Sarawak were chosen because they could offer insights into the sustainable livelihood of paddy farmers and the sustainability of rice production. In addition, the basis of choosing the income of the respondent is based on the advice from DOA to measure their rice production, since rice farming is a significant source of profit for farmers. This income directly affects their living standards, allowing them to afford necessities like food, healthcare, and education.

Therefore, the purposive sampling appeared to be suitable for this study as the sampling strategy in choosing respondents since the study area is limited, and only a specific focus group of individuals can respond to the interview questions regarding the sustainable livelihood of the farmers and the sustainability of rice production in Sarawak. Purposive sampling technique is selected to study and understands the livelihood of the paddy farmers from different villages in northern and southern parts of Sarawak. One of the advantages of using purposive sampling techniques is it can provide the validation to make generalizations from the sample that is being studied (Sharma, 2017).

The interviews were carried out with the focus group respondents that were identified and nominated from the assistance of the Agriculture Department of Sarawak. The interviews involved ten (30) farmers which is from a few villages that located in Miri and Kuching divisions. The list of location and numbers of respondents are as shown in Table 3.1.

Table 3.1: List of Location and Numbers of Respondents

Category	Number
Location	
Bario	6
Long Seridan	1
Kota Samarahan	1
Siburan	7
Simunjan	2
Tebakang	2
Lundu	5
Saratok	3
Sri Aman	3
Gender	
Male	20
Female	10
Age (<i>years old</i>)	
30 - 40	1
41 - 50	8
51 - 60	14
61 - 70	6
71 - 80	1
Types of Paddy Cultivation	
Single Cropping (1 season)	22
Double Cropping (2 seasons)	8
Income Range (<i>monthly</i>) (RM)	
RM 300 – RM500	5
RM500 – RM1000	10
RM1000 – RM2000	7
RM2000 – RM3000	8

3.2.2 Data Collection Technique

This study needed primary data for the research this study had applied the qualitative data collection techniques. Since it involved qualitative data, the interview method was used for obtaining the data. This is because the methods planned for data collection should be related to the type of information sought (Marshall & Rossman, 1995).

Since this study needed the information on the socioeconomic status of the farmers in Sarawak that affects the sustainable livelihood of the farmers and the sustainability of rice production in Sarawak, hence the best method of data gathering is interviewing informants because it is the most efficient ways in obtaining the data. The total respondents involved for survey are 30 in which covers the Northern and Southern parts of Sarawak. For in-depth face-to-face interview, open-ended question was asked to the farmers.

Before the interview sessions, the author has identified the potential areas through own research of in which areas that have many and well-known paddy fields in the northern and southern parts of Sarawak. Therefore, 8 main areas that is famous for rice cultivation have been identified. Before that, the author also consulted with officials from the Department of Agriculture Sarawak regarding which areas in Sarawak still have farmers who are actively planting rice. For Bario area which is located at the northern part, the author has requested cooperation from the officials from the district Department of Agriculture Sarawak to arrange time to meet with the farmers. Therefore, a list of names of the farmers who are still actively planting rice in Bario has been confirmed to be interviewed. For other areas, the author went to those areas and randomly chose to interview farmers found while they were planting rice. After the author had set the dates to conducts the interviews according to the locations, the interview sessions were conducted. The whole interview

process took about six to nine months to complete including the transcribing of the recording into a well-written information.

During the interview sessions, this study had applied the semi-structured interview forms to facilitate data gathering where each interview session was conducted based on a set of questions. The aim was to have more flexibility than with structured interviews, although this method intended that answers were not always consistent among interviews. All the interviews were recorded via the recorder to ensure that all the information produced during the sessions will not be missed. In-depth interview sessions were conducted, recorded, and transcribed. In order to maintain the confidentiality of the interviewees, the names and dates of the interviews are not revealed. The steps involved in the process of transcription are as follows: (1) In-depth interviews are recorded by researcher; (2) Audio recording was transcribed by the researcher.

A set of predetermined questions was designed to guide the whole interviewing process. The design of the set of questions is considering the independent variables and factors that influence the dependent variables. One set of interview questions were designed for this purpose. The set of questions are divided into four parts (A, B, C and D). All these questions are designed to enable in depth discussion with the farmers on their farming activities. Table 3.2 shows the summary of the items included in the set of questions.

Table 3.2 Indication of the set of questions for the in-depth interview

Part	Indication
Part A	Demographic information
Part B	Basic information of production activities of the farmers
Part C	Asset and standard of living information of the farmers
Part D	Strategies and challenges faced by the farmers

Part A consist to questions regarding the demographic information of the respondents, Part B consist of the basic information of production activities of the farmers, Part C consist of the information of the asset and standard of living of the farmers and Part D consist of the information about strategies and challenges faced by the farmers.

Part A covers demographic characteristics that includes age, gender, ethnicity, marital status, education qualification, number of family members, number of dependents, duration of residence in the village, major economic activities. The questions consist of closed-ended question.

Part B covers the basic information on production activities that includes the production area, harvesting method, amount of paddy crop area, method of harvesting, type of irrigation, amount of rice products, types of subsidy scheme, subsidy source and cost of rice production.

Part C comprises information on asset that categorized into three; natural and environmental asset, physical asset, and financial asset. Then information on estimated expenditure and standard of living of farmers and information on food security of farmers also included in this section.

Part D covers the questions related on the identification of challenges faced by farmers and the current or potential strategies used in managing the paddy farm. The questions on strategies and challenges are related to farm management, external factors and internal factors that involved to set feedback on how the farmers tackle the problems based on their experience. For this section, there are 5 questions that cover on the practice of mechanization in paddy farming.

3.2.3 Research Instrument

The instrument used for the interviews was the semi-structured interview questions. The formation of questions was based on information related to the socioeconomic status of the farmers in Sarawak that affects the sustainable livelihood of the farmers and the sustainability of rice production in Sarawak while using the descriptive approach. The feedback gathered has enabled the comparison of the collective responds of farmers from two different regions in Sarawak. The respondents were asked about their responds on the factors that contributes to the sustainable rice production that affect their livelihood outcomes. In this study, qualitative data was analysed manually, without the use of specialized software. Data collection involved recording interviews to ensure accuracy and entirety. These recordings were then transcribed by maintaining the integrity of the original responses. Transcription facilitated a detailed understanding of the data.

Thematic analysis was employed for data analysis. This involved initial familiarization with the transcripts through repeated reading to identify recurring ideas and key insights. Subsequently, codes were manually classified to relevant segments of text as well as grouping into similar concepts. These codes were then organized into broader themes representing the underlying messages within the data. The themes were carefully reviewed and refined to ensure they were distinct, meaningful, and well-supported by the data.

Finally, these themes were interpreted in relation to the research questions, drawing conclusions based on the responses of participants. The decision to use a manual approach was intentional, allowing for a more in-depth engagement with the data. The chosen methodology allowed for contextual consideration of each response, enabling a detailed and comprehensive interpretation of the data.

3.3 Empirical Technique

The empirical technique is extensively utilised in communication studies that employ systematic observation as evidence in order to obtain consistent findings (Dan, 2017).

Qualitative method is used to study and understand the belief, experiences, attitudes, behavior and interactions of people (Pathak, Jena & Kaira, 2013; Palmer & Bolerston, 2006). Qualitative method generates non-numerical data. According to Palmer and Bolerston (2006), qualitative research reports are usually abundant with description and the best choice if the reader wants to understand better because this method provided information in the form in which they usually experience it. Moreover, Bearman (2019) discusses that the rule of thumb of this analysis is to promote thorough answers and examine the viewpoint of participant in their own words by using open-ended questions. The interviewer should be adaptable and modify their questions according to the direction of the discussion to guarantee precise data collection, record interviews.

Jackson, Drummond and Camara (2007) adding that qualitative aims to understand the meaning of human action by describing the natural or essential characteristics of social objects or human experience. the author administered surveys using qualitative methods. Creswell (1994) suggests that the inductive process of qualitative methods permit.s a more in-depth comprehension of social human problems, as well as building a complex picture with words that provide rich detail and insights into participants experiences. Creswell (2009) had detailed the steps as shown in Figure 2.3.

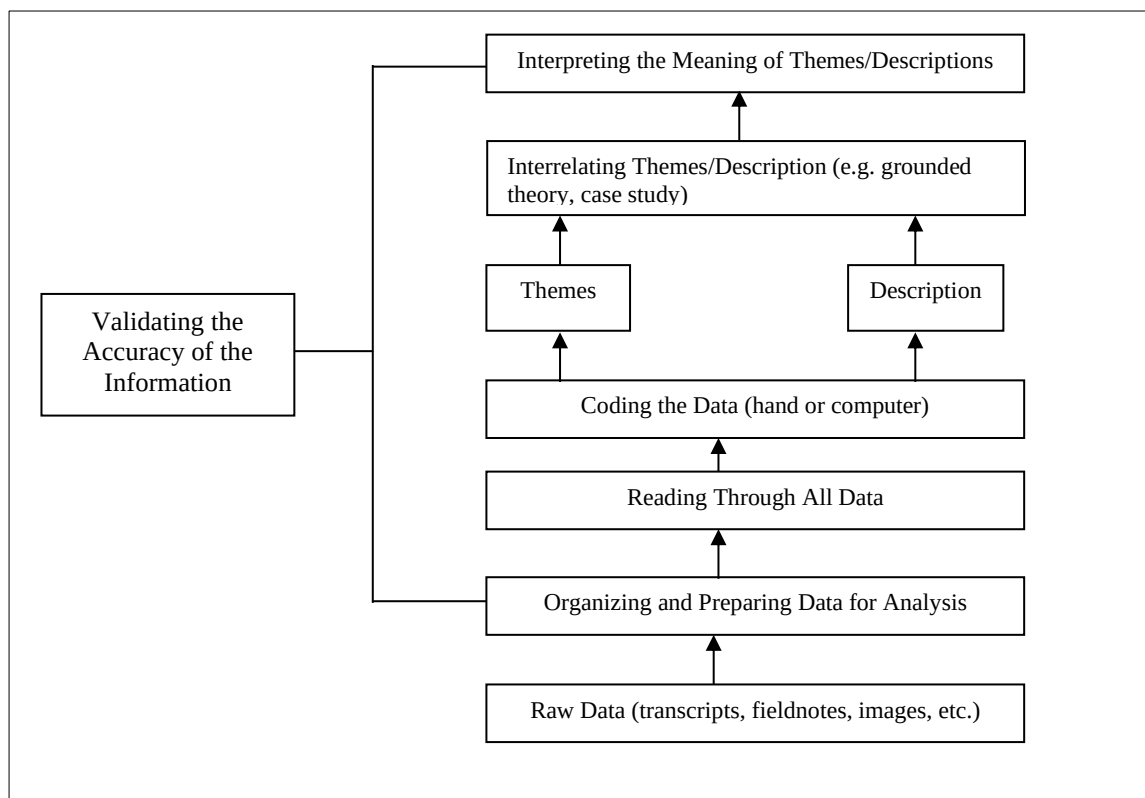


Figure 2.3: Data Analysis in Qualitative Research

Source: Creswell (2009)

In qualitative analysis, prior to the analysis, the obtained data must be coded and variable measurements need to be organized accordingly. Additionally, the study analyses were taken into consideration when creating the codes. It is created by highlighting the themes found in the unprocessed or raw data. In order to match the responses written in the interview questions with the voices captured during the interview sessions, the data was prepared by playing back the recordings.

Random purposeful sampling (Raja, 2015) of the residents of two regions was utilized to select interviewees for this study from all eight location across Sarawak. The data collected was analysed qualitatively by “working with data, organizing them, breaking them into manageable units, synthesizing them, searching for patterns, discovering what is important and what is to be leaned, and deciding what you will tell others” (Bogdan and Biklen, 1998:157).

3.3.1 Descriptive Analysis

Descriptive analysis is an easy method to be used to implement and interpret as it is a useful way to summarize the data and provide a description of the sample (Marshall & Jonker, 2010) and are the numbers that summarize the data with the purpose of describing what occurred in the sample (Thompson, 2009). It is also used to describe the characteristics and to test the assumptions of the sample (Pallant, 2016). Fávero and Belfiore (2019) explain that the general rule of this analysis is to use it as an overview of the data and a summary of the demographics sample and can be obtained by using descriptive statistics, such as means, frequencies, and percentages. This study attempts to assess the livelihood outcome of the rice production in Sarawak from the perspective of economic, social and environment, the analyses began by explaining the overall demographic profile of the respondents.

3.3.2 Thematic Analysis

Thematic analysis is a method to analyse qualitative data. It is applied to a set of texts or interview transcripts. The researcher will examine the data to identify the common themes topics, patterns, ideas or meaning that often being called up repeatedly. Dawadi (2020) describe the thematic analysis as a rigorous approach that can produce insightful and trustworthy findings. Braun and Clarke (2012) also mentioned that it is a method for systematically identifying, organising, and offering insight into, patterns of meaning (themes) across a dataset. Lochmiller (2021) discusses that the general rule of this analysis is to become well acquainted with the transcript's information. Search for the dataset for reoccurring themes, patterns, and meanings as well as sort the codes into more general themes that are connected to the study topics after methodically coding the data. Make sure

the themes are clear, significant, and backed up by the data by reviewing and refining them. Through focusing on meaning across a dataset, Thematic analysis allows the researcher to see and make sense of collective or shared meanings and experiences. Identifying unique and idiosyncratic meanings and experiences found only within a single data item is not the focus of Thematic analysis. This method, then, is a way of identifying what is common to the way a topic is talked or written about, and of making sense of those commonalities. The purpose of this analysis is to identify those relevant to answering a particular research question. For instance, in researching the sustainability livelihood of the paddy farmers in Sarawak, a set of questions regarding the farming and production activities will be asked. A question will be asked on what is the motivation behind paddy farming, if it is classified as a hereditary culture among the farmers, then this would be the pattern of the data although it seems not to be the important point. However, if most of them reported that they preferred to plant their own rice due to not used to the taste of rice they bought from the nearby supermarket, then this could be a meaningful pattern.

Thematic analysis is a flexible method that allows the researcher to focus on the data in many ways. Thematic analysis allows to focus on analysing meaning across the entire dataset, or enable the researcher to examine one aspects of a phenomenon in depth. Researcher can report the obvious or semantic meanings in the data, or you can interrogate the latent meanings, the assumptions and ideas that lie behind what is explicitly stated (Braun & Clarke, 2012). The many forms thematic analysis can take means that it suits a wide variety of research questions and research topics. Figure 2.4 shows the Thematic Analysis Chart.

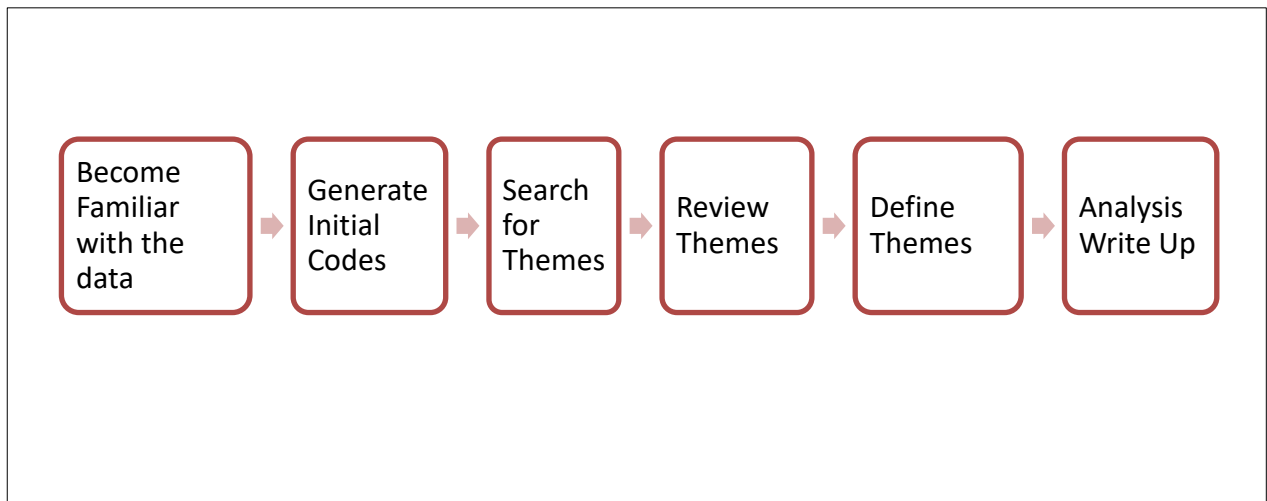


Figure 2.4: Thematic Analysis Chart

Source: Maguire & Delahunt (2017)

Based on Figure 2.4, there are six basic steps in thematic analysis. The first step is to familiarize with the unorganized data by reading the transcripts carefully and repeatedly to understand the transcribed data. Secondly, start organizing the data by assigning short meaningful labels or creating codes to segments of text. These codes should relate to the research questions and objectives. Next, look for patterns among the codes, especially the repetitive ones. Group related codes together to form broader "themes" that capture the significant ideas of the data. Then, examine the themes critically to ensure the themes are correct and supported by the data. Refine or combine the themes as needed. Create a sub-theme to relate to the main theme, especially for certain small topics inside transcripts that are related to the main theme. Lastly, an analysis will be written to present the data that the analysis has revealed and use evidence from the qualitative data to support the themes.

This study utilizing the thematic strategies or analysis based on the responds by the paddy farmers. To outline the finding from in-depth interview, we conducted thematic

analysis. Thematic analysis was conducted to categorize all the collected information from the in-depth interviews to analyze the potential strategies that can be adapted by the farmers in term of managing the farm.

3.4 Concluding Remark

Livelihood outcomes refer to the results achieved by individuals or households through their livelihood strategies (Seetha Lekshmi, 2024). Therefore, the main target respondents for this study are the farmers in northern and southern parts of Sarawak who owns a paddy field either it is for income-generated activities or for own consumption. The research methodology used for data collection in this study was structured around the sustainable livelihood framework in order to gather information on the various types of livelihood capitals that could be analysed following this model. This chapter has described the techniques for conducting the in-depth interviews with the paddy farmers, and has explained how these were adapted to the particular circumstances and limitations in eight locations at the time of the visits. Descriptive analysis was applied to describe the results obtained from the interview sessions. The following stage is the development of the legal framework based on the findings of the study. To ensure the findings are valid, evaluations and validations by experts in the land matters are needed. Next, purposive sampling technique is chosen to collect data on the socioeconomic status of the farmers in order to study the sustainable livelihood outcome of the farmers in Sarawak as well as using in-depth interview to find out the potential strategies to enhance the rice production sector in Sarawak.

CHAPTER 4

FINDINGS

4.1 Introduction

This study aimed to assess the livelihood outcome of the rice production in Sarawak from the perspective of economic, social and environment. This chapter provides the results of the descriptive and thematic analysis from the data collected during the research. It will outline findings and analysis from the data collection phases. The findings in this chapter discussed into deeper on the demographic profile of the respondents, factors that contribute to the sustainable rice production, farmer's income, potential strategies to be implemented and the challenges.

The first section will be discussed on the descriptive analysis results, then followed by the thematic analysis in the following section. This chapter provides important key findings regarding the relationship between the livelihood of the farmers in rice sectors to achieve the sustainable rice production other than improving the life of the farmers. Although the findings also illustrate some of the main limitations in adapting the sustainable livelihood of rice production in a long term, this allows reflection on many challenges and issues of the actual context face by the farmers for further findings and improvement planning.

4.2 Descriptive Findings

This study employs a qualitative methodology, utilising descriptive and thematic analysis to conduct an in-depth examination of the gathered data. The recorded interviews are transcribed into a cohesive set of information that is readily legible and comprehensible. The interviews were conducted to understand more information regarding the socioeconomic status of the farmers in Sarawak that affects the sustainable livelihood of the farmers and the sustainability of rice production in Sarawak. The interviews focus on the farmers from two parts of Sarawak, which consist of the Northern and Southern parts. The interviews have provided valuable insights and knowledge that can be used to identify viable methods for improving sustainable rice production and the livelihoods of farmers. Figure 2.5 shows the locations of data collection from northern and southern parts of Sarawak.



Figure 2.5: Locations of Data Collection

This study involved seven districts located in southern and northern parts of Sarawak and the focus is on small and local farmers in Sarawak to address the limited study on the

issues they face. By targeting smallholders, the study acknowledges the economic importance of farming in rural areas, particularly for poorer populations. The southern part locations that involved are Saratok, Sri Aman, Simunjan, Serian and Lundu. Meanwhile, the northern part consists of Bario and Long Seridan.

The findings were derived from data analysis collected from 30 participants engaged in individual paddy farming. The analysis of the results will initially prioritize the descriptive examination. This section aims to provide a clear and concise description of the demographic characteristics of the participants from the two research regions.

4.2.1 Demographic Profile of Respondents

Based on the summary of the demographic profile of the respondents in Table 4.1 shows that this study involved 30 respondents which consist of 20 male and 10 female respondents. Among of the numbers, 3.33% were between 30 to 40 years old, 26.67% were between 41 to 50 years old, 46.67% were between 51 to 60 years old, 20% were between 61 to 70 years old and 3.33% were between 71 to 80 years old. The majority of the interview respondents (26) were from Bumiputera groups, such as Iban, Bidayuh and Kelabit whereas Malay and Chinese shared the same number which were 2 respondents for each respective group.

In terms of educational background, three respondents (3) (10%) possessed tertiary education (degree, diploma, or certificate). Four (4) (13.33%) get a formal education and completed the upper secondary school while majority of the respondents (12 (40%)) had completed lower secondary school. Besides, five (5) (16.67%) never receive any formal education and six (6) (20%) received primary education.

Table 4.1 Demographic Profile of Respondents

Variable	Category	Frequency	Percentage
Gender	Male	20	90%
	Female	10	10%
	Total	30	
Age	30 – 40 years	1	3.33%
	41 – 50 years	8	26.67%
	51 – 60 years	14	46.67%
	61 – 70 years	6	20%
	71– 80 years	1	3.33%
Ethnicity	Malay	2	6.67%
	Chinese	2	6.67%
	Bumiputera	26	86.67%
Education	Not School	5	16.67%
	Primary School	6	20%
	Lower Secondary School	12	40%
	Upper Secondary School	4	13.33%
	Tertiary Education	3	10%
	(Degree/Diploma/Certificate)		
Paddy Farming Season	1 Season	22	73.33%
	2 Season	8	26.67%
Paddy Production Income	≤ RM500	8	26.67%
	RM500.10 – RM1000	9	30%
	RM1000.10 – RM2000	5	16.67%
	RM2000.10 – RM3000	8	26.67%
Other Income	≤ RM300	7	23.33%
	RM300.10 – RM1000	11	36.67%
	RM1000.10 – RM2000	6	20%
	RM2000.10 – RM3000	6	20%

Based on the study, the paddy cropping seasons involves two seasons. Among 30 respondents, majority of the respondents (22 (73.33%)) planted rice once in one cycle of cropping seasons annually. Therefore eight (8) (26.67%) planted rice twice in cropping seasons annually. The paddy farming income was the approximate annual income received from the sales of rice and paddy products. Eight (8) respondents (26.67%) had an income less than or equivalent to RM500 whereas three had no income (RM0) because their paddy

production was used for personal consumption. Nine (9) farmers (30%) earned income between RM500.10 to RM1000. Five (5) farmers (16.67%) received an income of between RM1000.10 to RM2000. The highest paddy production income category, RM2000.10 to RM3000 and above was received by 8 farmers that equivalent to 26.67% of the respondents.

Furthermore, some farmers also earned additional income from off-farm paddy farming activities. There are farmers who were government servants or worked with private companies and some of them were full time business owner or entrepreneurs. Some of the farmers were involved in other agricultural activities such as rubber and oil palms plantations, some of them were involved in cash crop in which they plant and sell corn, vegetables, or chillies. There are also farmers who worked as fisherman. The majority of the respondents were pensioners and most of them worked full time in paddy farming activity and depended solely on the revenue from paddy farming. The descriptive results showed that 7 farmers (23.33%) had off-farm income less than or equivalent to RM300. Eleven (11) farmers (36.67%) had an annual income of RM300.10 to RM1000 whereas 2 were full-time workers in paddy farming production and were not involved in any off-farm paddy farming activity. Six (6) farmers (20%) had off-farm income of RM1000.10 – RM2000 while another six (6) (20%) farmers earned RM2000.10 – RM3000 which is the highest off-farm income category.

As mentioned in the Chapter 3, the interviews were carried out with the focus group respondents that were identified and nominated from the assistance of the Agriculture Department of Sarawak. Besides, majority of the respondents were selected randomly during the field study. The interviews involved thirty (30) farmers which were from a few villages

that located in Miri (northern) and Kuching (southern) divisions. The list respondents were classified according to the code, region and location of paddy field as shown in Table 4.2.

Table 4.2 List of Respondents

Code	Region	Location of Paddy Field
R1	Northern	Bario
R2	Northern	Bario
R3	Northern	Bario
R4	Northern	Bario
R5	Northern	Bario
R6	Northern	Bario
R7	Northern	Long Seridan
R8	Southern	Kampung Rembus
R9	Southern	Kampung Skuduk, Siburan
R10	Southern	Kampung Skuduk, Siburan
R11	Southern	Kampung Skuduk, Siburan
R12	Southern	Kampung Skuduk, Siburan
R13	Southern	Kampung Skuduk, Siburan
R14	Southern	Kampung Skuduk, Siburan
R15	Southern	Kampung Skuduk, Siburan
R16	Southern	Kampung Bengang, Lundu
R17	Southern	Kampung Bengang, Lundu
R18	Southern	Kampung Bengang, Lundu
R19	Southern	Kampung Bengang, Lundu
R20	Southern	Kampung Pueh, Lundu
R21	Southern	Kampung Tebuan, Simunjan
R22	Southern	Kampung Tebuan, Simunjan
R23	Southern	Kampung Perepat, Kabong
R24	Southern	Kampung Lubok Nibong, Kabong
R25	Southern	Kampung Rh. Galing. Lubuk Nibong Kabong
R26	Southern	Kampung Stumbin B, Sri Aman
R27	Southern	Kampung Stumbin B, Sri Aman
R28	Southern	Kampung Stumbin B, Sri Aman
R29	Southern	Kampung Tubih Mawang, Skim Paya Payang Serian
R30	Southern	Kampung Tubih Mawang, Skim Paya Payang Serian

4.3 Factors Affecting the Sustainable Rice Production

There are few factors that affecting the sustainable rice production in Sarawak. It will examine the factors, namely physical and production factors, and socioeconomic and environmental factors. This chapter also discusses the condition of rice farming in northern and southern parts of Sarawak as well as the potential practices in maintaining and enhancing the sustainability of rice production to ensure the sustainability of farmer's livelihood.

4.3.1 Physical and Production Factors

Combination of several important inputs in rice production activity will generate the ideal level of output for each field (Rahim, Engku Ariff, Sobri and Abdul Wahab, 2020). As such, in general inputs that involved included land, seeds, fertilisers, pesticides, labour and capital. These production factors are considered as variable inputs where according to (Rahim et al., 2020) an increase in one input results in an increase in output at a reduced rate and finally, a negative effect will occur if the number of certain inputs continues to increase.

The following Table 4.3 summarizes the physical and production factors based on interviews with rice farmers in northern and southern Sarawak in which highlighting variations in practices in the respective regions.

Table 4.3 Physical and Production Factors

Factors	Description
Labour	• Most farmers not hiring permanent workers especially those cultivating for own consumption. • Additional labour is hired during planting and harvesting. • Many respondents informed that their children are not involved in rice cultivation, as they pursue other job opportunities.

Table 4.3 continued

Seeds or Rice Type Selection	Northern Sarawak (Bario): • Primarily Adan rice (Bario rice) is planted, which is known for its premium quality and geographical indication (GI). Southern Sarawak: • Common planted rice types include Blackberry, Bajong, and white rice (MR269, MR76). • Blackberry rice is valued for its texture and taste and its commercial value. • Some farmers use rice types passed down through generations with different names in different regions.
Schemes, Projects, and Irrigation System	Northern Sarawak (Bario): • Contract with Ceria company for machinery (harvesters, plows, transplanters). • Eligible farmers receive harvesting subsidies according to size of farming areas. Southern Sarawak: • Water irrigation system by DID. • Machine assistance managed by Persatuan Peladang Kawasan.
Cultivation Tasks	• Single cropping is done once a year, starting from September to March. • Double cropping is done twice a year, with the second season from April to September. • Transplanting is generally used by farmers in both northern and southern areas. • Broadcasting is also used due to time saving.

Source: Field Collection (2021-2022)

Based on the interview results, in terms of land ownership, majority of respondents inherited agricultural land in the village from their parents or grandparents. Therefore, rice cultivation is often associated with rural population and traditional farmers (Jamaludin, Amer & Abu Hasan, 2010). Most of the respondents informed that the agricultural land that they are using now is the land that their parents gave to them to cultivate and that the land has indeed been a site for planting rice in the past. There are also respondents who preferred to retire early from their respective careers to focus on commercial rice cultivation. Rice

cultivation has had commercial value for the past 30 years in Malaysia which contributes to the main source of income (Jamaludin et al., 2010). Majority of the respondents did have experience growing rice since childhood when they followed their parents to work in the rice fields. Therefore, all respondents preferred to be involved in this sector because of their interest and they have skills in rice cultivation. R1 stated that she decided to quit her job and return to the village to take over her parent's farmland in 2008. R1 also added that life in Bario was quite difficult in terms of generating income, therefore she decided to venture into agriculture business where she commercializes Adan rice, which is well-known for its premium quality and grows another cash crop, pineapple. R14 also stated that she quit her job in 2009 after her father-in-law gave a paddy field to her to cultivate.

R14 took the opportunity and was determined to be involved in rice cultivation for the purpose of being marketed outside. Unlike R24 where she stated that she bought land from his brother for the purpose of planting rice. While R16 stated that she chose to rent land from the villagers for the purpose of growing rice. R16 also added that the rent was paid using rice where every season she would give 70kg of rice to the landlord as rent. According to R17, he also rented the land from the Malays from the next village. The method of paying rent is according to the area of the land which is 30kg of rice for 1.1 acres or equivalent to RM150. According to R17, the method of payment varies each season according to the needs of the landlord, which is through giving rice or money.

In term of selection of seeds or types of rice, the interview findings stated that in general respondents from northern part especially Bario would choose to plant Adan rice. Beras Adan or also known as "Bario rice" is known for its premium quality and was registered with the Malaysian Intellectual Property Organization (WIPO, 2008) that makes

it as a product with the Geographical Indication (GI). Besides, according to R2, they chose to plant Adan rice because this type of rice has been planted by their parents for a long time and since then Adan rice is often used as wrapped rice which known as “*nuba laya*” in Kelabit, where the rice is wrapped using leaves. Since the tradition is still held until now, it is also a factor in the selection of the type of rice planted. R1 also stated that the majority chose to grow Adan rice due to the high price factor if marketed outside. In southern part, according to R9 and R10 the types of rice that are commonly planted known as Blackberry, Bajong and white rice (MR269) and (MR76). According to them as well, the Blackberry rice can be sold at a high price due to the texture and taste. According to R15, he decided to become a full-time paddy farmer after pension to commit with the paddy farming because he knows the commercial value of Blackberry rice. While for the other respondents, they choose to plant the type of rice that is inherited from generation to generation hence the name of the seed is also different and unique according to the region. In most of the locations in southern part, the name of the rice is different hence it difficult to know the originality of the rice.

In term of scheme or any related project, R2 and R3 from Bario, the northern part informed that have a contract with Ceria company. Ceria Group formed a joint venture company, Bario Ceria Sdn. Bhd in the purpose of to modernize and mechanize the paddy farming in Bario highland (Raja, 2015). According to R2 and R3, they have a joint venture with Bario Ceria in terms of using services from the company, especially for the machinery. R2 and R3 use harvester, plow, and transplanter services from the Ceria. R2 also stated that all farmers registered under the Department of Agriculture in Bario are eligible for harvesting subsidies, therefore R2 and R3 benefit from the use of the harvesting machines provided. In addition, the Ceria company also provides milling services at their factory, but

according to R1, R2 and R3 all the villages in the Bario area have their own mill machines, therefore they rarely use the milling service provided by the Ceria company. As for southern area, according to the respondents there is no scheme or project related to paddy in their area. R9 stated that the current project is a water irrigation system by Department of Irrigation and Drainage Sarawak (DID) to channel water to all the paddy fields. However, the facility of machine assistance such as harvesting and plowing machines is also provided for farmers managed by the Persatuan Peladang Kawasan (PPK). R19 mentioned that he preferred to harvest manually by using sickles to reduce the cost of renting a harvesting machine.

Respondents from southern part, Siburan implemented double cropping systems and majority of the respondents involved in single cropping system of rice cultivation. According to the respondents, the main season or the first season began in September or early October and the second season will began on early October when the selection of the seeds and nursery were done. Table 4.4 is resulted from the information obtained from the respondents.

In term of labour, majority of the respondents does not hire any permanent worker due to some of them involved in paddy cultivation for own consumption. Most of them will only hire additional labor during the planting season, which is to transfer the seedlings to the plot and also during the harvest season if necessary. Majority respondents also stated that their children or the current generation do not know about rice cultivation. However, this is also due to the majority of respondents thinking that they do not want their children to inherit paddy production from them because they know their children can get better jobs in the city. According to R13 where she was the only respondent who told that one of his children works regularly with her to manage their paddy fields. Due to R13 health problems, his son is

responsible for poisoning and fertilizing the paddy field. According to R13, the salary given is based on the daily salary which is RM50 to RM80 a day because her son also lives with the respondent.

Table 4.4: Preparation of Rice Cultivation Tasks for single and double cropping

Single cropping	
Month	Activity
September - October	Seed preparation at the nursery. The seeds will be soaked until the sprouting are visible.
End October - November	Transplanting the rice seedlings onto the field according to the batch.
December - January	Weed and pest control process.
February - March	Harvesting for the first season.
Double cropping	
Month	Activity
First Season	
Early October	Seed preparation at the nursery. The seeds will be soaked until the sprouting are visible.
November	Transplanting the rice seedlings onto the field according to the batch.
December - January	Weed and pest control process.
February - March	Harvesting for the first season.
Second Season	
Early April	Clearing activity starts. Seed preparation starts again at the nursery and seeds will be soaked until it sprouting.
May	Transplanting the rice seedlings onto the field according to the batch.
July	Weed and pest control process.
August - September	Harvesting for the second season.

Source: Field Collection (2021-2022)

Based on the interview results, all the preparation activities are same in all locations. According to the respondents, before the main season began, they will start clearing the field by weeding out and remove the excess tress or branches. Then, they will prepare the seeds as they will select the best seeds that have been selected from the previous season to be

replanted in the next season. This cycle usually repeats itself every season and respondents usually use the same type of seed to ensure the originality and purity of the rice.

Transplant method was used hence the chosen seeds will be soaked for about 2 to 3 weeks until the sprouting is visible. Among the respondents, only R3 was not using the transplant method, whereas R3 was using broadcast seeding method. According to R3, he preferred to use the broadcast seeding method over the fact that he has an extensive planting area of 2.7 hectares. The transplant method is costly because respondents need to hire people to sow seeds in nursery and transfer the sprouting seeds to the paddy plot. However, if R3 chooses the transplant method, the time it takes to prepare the seeds and move the sprouting seed to the paddy plot will take a long time hence the cost of hiring people will also increase.

Therefore, R3 preferred the method of broadcast seeding instead of transplant over factors to save time, energy and minimize the cost of production. Besides, according to R2, the majority of farmers in the Bario area preferred the transplant method rather than broadcast because of the broadcast method requires a large amount of seed while the transplant method does not require a large number of seeds due to when sowing the seed in the nursery, the respondents themselves will divide the seeds to be sowed according to the size of the plot of the paddy field. According to the interview result, majority of the respondents from the northern and southern parts were using transplant method. Usually, the transferring method from the nursery to the plot field will takes around two weeks to three weeks or even four weeks, depending on the labor power. For respondents of R3 who used the broadcast seedlings method, he only takes one to two days to sow the seeds using the broadcaster machine.

Once they are done with the planting of the paddy, the respondents will monitor the growth of their paddy and it is between December to January for the first season and for double cropping it is on July. During this period, precautions are taken against pests and diseases. Normally it will take three months for the optimum time for the paddy to be harvested. For the first season of single cropping, the ideal time to harvest the paddy was on February to March and for the second season of double cropping the ideal time to harvest was on August to September. All the respondents agreed that they need to harvest on time to avoid the grain would fallen out of its husk if they harvest later than the ideal period.

4.3.2 Socioeconomic and Environmental Factor

A further analysis was conducted to indicate the details of the contribution of socioeconomic and environmental factors towards the sustainable of rice production in northern and southern parts of Sarawak. The vulnerability of environmental factors considers rainfall variations by time and place as well as seasonal temperature variations while the socioeconomic vulnerability discusses farmers dependency on government and external support, changes in income sources, changes in the household income sources, poverty in paddy sector, economic vulnerability and changes of farmers occupation (Alam, Siwar & Ekhwan, 2010).

The following Table 4.5 summarizes the socioeconomic and environmental factors based on interviews with rice farmers in northern and southern Sarawak in which highlighting variations in practices in the respective regions.

Table 4.5: Socioeconomic and Environmental Factors

Factors	Description
Climate Change	• Most respondents indicates that climate change does not significantly affect rice cultivation. Northern area: • The temperature in Bario is getting warmer but did not have a significant effect on rice crops. • The good irrigation system contributes to the paddy fields surviving throughout the drought season.
Income	• Farmers plant rice for sale (main income) or own consumption. • Average gross income from selling rice is RM2000-RM3000 monthly. • Rice is sold at RM15.00-RM17.00 per kilo (controlled price). • Some respondents grow rice as a side income, while some stock up harvested paddy for consumption until the next season. • Some respondents make rice cultivation their main job after retirement.
Other Crops planting	• Some farmers diversify by planting other crops (corn, vegetables) next to paddy fields to increase income. • Some farmers utilize their land to plant cash crops after harvesting the paddy. • Diversifying the crops helps farmers to increase their income.
COVID-19 Impact	• Majority respondents informed that the pandemic had no impact on their agricultural operations due to the rice harvest being completed before its start. • Despite travel limits, individuals were permitted to go out to the rice fields.

Source: Field Collection (2021-2022)

In term of climate change factor, majority of respondents think that climate change does not affect their rice cultivation. R20 and R22 mentioned that floods or droughts does affect the growth of the rice. According to R22, his paddy field can survive the drought season due to a good irrigation system in his area and it is sufficient to irrigate the rice fields

during the drought season. R4, on the other hand, informed that the current weather conditions are not the same as before where he stated that the temperature in Bario is getting warmer compared to 4 to 5 years ago. However, the change in weather did not have a significant effect on his rice crops.

According to R1 and R2, majority of the farmers here planting rice to sell and make it as their main source of income. The average gross income from selling rice is around RM2000 to RM3000 monthly. The price of rice is sold at around RM15.00 to RM17.00 per kilo and it is a control price by the JKKK. According to R4, he involved in paddy farming for own consumption to support the family needs. There are also those who make rice cultivation as their main job after retirement as according to R3. R8 from southern part stated that she made rice cultivation as a side income as most of the time she is available during the day and his father had given her the land for paddy cultivation purposes.

Next, according to R9 and R11, they involved in rice cultivation as a full time and it is the main source of income for them. Income from selling rice per year reaches RM8000 for two seasons depending on the condition of the grain. R10 stated that he grows rice for his family own consumption and he has a permanent job as a government servant as well so he added that he only sells if there is a demand. R10 also mentioned that the harvested paddy can be stock up an enough for their consumption until the next cropping season. For R23, he made rice cultivation a side income in order for him not to buy rice from the supermarket. But he also sells rice and paddy if there is demand from customers. As for R19 and R22, they plant rice solely for their own consumption and they never sell the rice even if there is a surplus.

In addition, according to R13, the income from rice cultivation has helped her a lot in terms of medical costs. R13 added that every time she finished selling paddy and paid all the costs of using the machine, she would save approximately RM3000 to RM4000 for medical purposes. R13 stated that rice cultivation helps her a lot to cover medical costs because she only knows how to plant rice. R24 added that she also plants other crop such as corn and vegetable next to the paddy field. According to her, she bought the land initially to only plant the rice but later she found out that the land has some space to be utilize so she decided to plant the cash crop beside the paddy field. She also mentioned that after harvesting the paddy, she will plant the corn again to substitute the paddy. By diversifying her crops, she can increase her revenue by selling more produce alongside the rice she sells at the market.

In term of other factor such as COVID-19 pandemic, majority respondents informed that the pandemic does not bring that it had no impact on their agricultural operations. This was mostly because the majority of respondents had already completed their rice harvest by the time the pandemic began. Nevertheless, despite the imposition of travel limits, individuals are permitted to go out to the rice fields as most of the rice fields are located not far from home. Furthermore, it is imperative to comply with the regulations of limiting social gatherings to a maximum of two individuals and maintaining social distance protocols, even when visiting the rice fields.

4.4 Rice Farming in Northern and Southern Parts of Sarawak: Subsidies, Incentives, and Distribution Network

As for subsidies for input, farmers get RM200/hectare for purchasing pesticides. Besides, farmers also receive 240 kg/ha of compound fertilizer and 80 kg/ha of urea fertilizer per hectare, and 100 kg/ha of organic fertilizer for cultivated rice (Dorairaj & Govender, 2023). However, based on the interview findings, the aid and subsidies are not standardized by region. For R2 and R3 as mentioned in previous subtopic, they have harvesting subsidy in which they can use it whenever they utilize the services provided by Bario Ceria company.

Besides, they also receive fertilizer subsidy given every year according to the land size and the farmers needs to register themselves with the Department of Agriculture. Although R1, R2, R3, R5 and R6 lives far from the main city Miri, the farmers' welfare is well taken care of and they have good access to machinery and other services related to paddy farming. In addition to that, there is also a rice mill factory belonging to the Ceria company. While R7 does not received any subsidies or any aid for her paddy field. Fertilizers and pesticides must be purchased by the farmer themselves. Even though R7 relatively from the same region with respondents from Bario, the provision of aid and subsidies is not uniform as it supposed to be.

Moving to southern part, for Siburan area, majority of the respondents mentioned that they received assistance in term of fertilizers, pesticides, and harvesting subsidy as well as subsidy for every kg of paddy that is harvested. Farmers receive a subsidy of RM248.10 for every tons of paddy that is harvested, in addition to another RM650 per metric tons, granted as a revenue incentive with at least a 1 % yield increase from the base season (Siwar et al., 2014). R9, R12 and R13 sell paddy to the middle vendor from a private company

namely Antares Ventures Sdn. Bhd. Antares Ventures is a rice-related social enterprises based in Kuching. According to R9, R12 and R13 they received the subsidy for selling paddy (unhusked rice grain) in which for specific type of paddy namely “Blackberry”, the selling price is RM1.80/ kg and subsidy given by BERNAS is RM0.30/kg, so the total profit of selling “Blackberry” paddy is RM2.10/kg. The subsidy will be transferred to the farmer’s account based on the record, therefore the farmers need to registered themselves under BERNAS in order to receive the subsidy.

According to R9, R12 and R13, the price is low and somewhat not profitable as the cost of production is around 30% to 40% of the profit. KRI report (2019) also mentioned that the cost of land rental and machinery is more than 30% of the total input cost which significantly affects the cost of production. According to R12, after harvesting, she usually gets a harvest of 100 sacks which is about 5 tons for one season. After that she will separate 30 to 35 sacks of rice to be sold immediately. This is because according to R12 she needs to immediately pay for the harvesting machine service. Therefore, she sold paddy only to pay for the service of using the harvester. R9, R12 and R13 prioritize selling paddy and only selling rice if there is demand or when they need money for daily use.

According to R26 from Sri Aman, he also selling paddy to the same company, Antares Ventures Sdn Bhd. The amount of subsidy received for selling paddy from BERNAS is similar, which is RM0.30/kg. Besides, according to R26 and R27 they received assistance in term of fertilizers and pesticide yearly as long they registered with the Persatuan Peladang. However, R26, R27, R24 and R25 mentioned that they did not receive the herbicide, which considered more important for them aside from pesticide. Hence, they must buy the herbicide own their own and majority spent RM1000 to RM2000 each season for

that purpose. Hence, usually the number of fertilizers and pesticides given is not enough for each season. R26 agreed that subsidy distribution is fair for all farmers in the area and farmers need to be registered as Peladang members and information need to be updated every year.

In term of easy access to the subsidy and government aid, R9, R10, R11, R12, R13, R14 and R15 have the advantages due to the location area is located at the suburbs which has easy access to road, transportation, and related government agencies. For product marketing, according to R1 they need help in terms of an effective distribution network in their area. Bario's remote position in the interior and limited land and air transport access and long distances make it quite difficult for farmers to market their products abroad. Therefore, they hope that there will be an initiative to help them market their rice products more efficiently. R26 from the southern part which is Sri Aman also voiced the same opinion where he thinks they need a one stop center to be a place to sell the rice to the surrounding communities as well as became a center for farmers to sell their agriculture products. He also thinks that planting rice in a large quantity is not worth it if there is no center to sell the crops. For now, he sells rice around Sri Aman or send the rice to Kuching by bus to be sold by relatives and this method is quite unprofitable because the freight charge to bring rice to Kuching is quite expensive.

4.5 Potential Strategies for Sustainable Rice Production in Sarawak

There are some similarities and differences in the practice of rice cultivation in the two selected divisions which consist of the northern part, Miri division and southern part,

Kuching division. The paddy farming practices in the ten locations were overall difference despite some of the locations located at suburban area.

4.5.1 Good Agricultural Practice in Rice Production

According to R1 from Bario, she is aware of the Malaysian Good Agriculture Practices (MyGap). The introduction of the good agricultural practices standards in Malaysia began in year 2002. This scheme began with the introduction of the Farm Accreditation Scheme by the Ministry of Agriculture and Agro-Based Industry (Mohamed, Terano, Shamsudin & Abd Latif, 2016). The purpose of the Farm Accreditation Scheme is to give a credit to the farms and farmers that implement Malaysian Good Agriculture Practice (MyGAP). The main rule of to become certified or credited is the farm required to operate in a friendly way of sustainable and environmentally and yield good quality products that are safe according to the three main aspects of the MyGAP Farm Accreditation Scheme.

According to R1, he has been working for four years to obtain MyGap certification. R1 stated that the application requirements are very tough and many criteria must be considered, especially regarding the quality of paddy and rice. Among the main conditions is that the type of rice or rice must be pure and not mixed with other rice. In addition, care since nursery is emphasized in evaluation and research on chemical content, rice storage and packaging. R1 was also given packaging from the Department of Agriculture for use, that is why she mentioned that MyGap is a good agriculture practice starting from the very beginning until sold. All the things must be recorded for audit purposes and in fact during that time R1 mentioned they are at the final phase of auditing and prepare all the documentation needed. The MyGap certification is valid for 2 years according to R1.

The advantages about this certificate are the competitiveness level over the rest of the farmers in which when people see the certificate and they can sell it with a higher price due to the quality assurance after get certified. Even though to maintain the quality is the toughest part, but R1 can sell it to Brunei and Singapore as well.

4.5.2 Land and Seeds Preparation

Paddy production begins with land preparation for every season. At this stage, the use of machine such as tractors and human labour are needed for ploughing and land leveling.

In most of the locations in the northern and southern regions, the respondents will prepare the land by clearing the weeds and the straws from the last paddy crop. They preferred to use the compost made from burning straw or weeds instead of using chemical fertilizers. Majority of the respondents recycled the rice straws by combined them into the soil during the preparation of the farming land. According to R24, since after planting rice she will plant the corn while waiting for the next planting season, the remaining corn straw will be spread on the ground to prevent the weeds and grass to grow taller and as additional fertilizer. R24 also mentioned that she acquired knowledge about the practice of crop rotation. This technique involves alternating the types of crops grown at same place every year to prevent the depletion of nutrients in the soil. By continuously cultivating the same plant in the same location, the soil's nutrient content diminishes. However, by rotating crops, the strain on the soil is reduced. Once the corn was harvested, let the straw rot, and sit in the soil over a month then plow it later once it is time to prepare the land to plant rice, and this

helps to replace the nutrients. This method can be done with other crop too such vegetables and chili.

The seeds preparation is also important. According to the interviews, all respondents agreed that the selection of seeds for the next season is very important. They will go down to the field to manually select and choose the healthy, plump, and solid grain to be used in the next season before harvesting activities are carried out. The selection of these seeds is important to ensure that the next season's rice yield is healthy and of good quality. In addition, the seeds will be selected according to the rice variety based on the plots to ensure that the seeds are not mixed with other types of varieties. According to R11, when seeds from different varieties of rice are mixed and planted, the rice will be prone to disease. Majority of the respondents will use the right amount of seeds for to be planted to avoid wastage and shortage of seeds. All respondents informed that usually they will store seeds in an estimate of 1kg to 2kg for the next season and based on the land size. The amount that they stored are most of the time accurate and enough. The selection of amount of seed used are recommended to the farmers to avoid dense planting or sparse planting that can result in disease, shortage of nitrogen, or other likely problems (Mohamed et.al, 2016).

4.5.3 Water Irrigation System

For the irrigation system and source of water to the crops majority respondents informed that the paddy was rain fed. In addition, according to R1, R2 and R3, they also use water sources from nearby stream. They themselves will control the amount of water that enters their paddy fields. R9, R10 and R11 also stated that in the scheme area in their paddy fields, the DID is responsible for controlling water entering the paddy fields. The DID will

pump water to the paddy fields according to the schedule, which is every Monday to Friday to avoid water wastage and avoid flooding.

Therefore, for the farmers who have access to the proper irrigation system, this technique enabled them to control the quantity of water that enters their paddy field.

4.5.4 Chemical Fertilizers, Pesticides and Herbicides

The process of using the chemical fertilizer and pesticide usually will be carried out after the planting process was done. According to Othman, Muhammad and Abu Bakar (2010), the use of pesticides needs to follow the concept of “Integrated Pests Managements” (IPM), in which it includes the comprehensive practices of biological pest control. Majority of the respondents were aware of how to use fertilizers and Pesticides in a correct method. The pesticides were used when the pest attack was severe and the use of fertilizer only when the rice is less fertile. R1 stated that she only used poison during the seedling stage in the nursery because during that time the rice shoots were exposed to pest attacks. R1 also stated that for spraying pesticides, she will seek advice from the Department of Agriculture Sarawak on the appropriate type of pesticides and the required quantity. R2 also stated that he only uses fertilizers and pesticides if the situation is urgent. R2 stated that he rarely uses fertilizers and pesticides, when there is a pest attack, he will seek for the services of the Ceria company to spray the pesticides on his behalf.

Majority of respondents indicates that they want to minimize the use of poisons to ensure that rice is not exposed to many chemicals residues and to save production costs.

4.5.5 Harvesting Activity

Generally, the optimal period for harvesting paddy is within a range of 110 to 120 days. Regarding the harvesting activity, the study findings indicate that some respondents continue to employ traditional methods, while others adopt sustainable ones. In the northern region, R4, R5, R6, and R7 continue to employ traditional or manual techniques, which entail the utilisation of equipment like sickles to gather the paddy crop. They chose to go with the traditional approach due to the small quantity of paddy, which made it not cost-effective to invest in using a machine. Therefore, they desire to conserve the funds in order to cover the expenses of the machine's services for other essential purposes. R1, R2, and R3 utilise machine services for rice harvesting, as the rice crop field is extensive. Consequently, people require the assistance of machines to facilitate tasks and conserve time. An advantage of utilising a harvester machine is the automatic separation of rice grains from the stalks within the machine. R2 further stated that the utilisation of harvesting equipment is advantageous due to its efficient and standardised harvesting technique. The harvesting machine moves equally from one plot to another, efficiently cleaning the rice stalks and levelling the field in a single pass. This approach prevents waste by allowing farmers to easily identify regions that have not been harvested. R2 and R3 are required to utilise the harvester service in order to be eligible for claiming the harvest subsidy from the Department of Agriculture. All responders in suburban areas, specifically Siburan in the southern section, namely R9, R10, R11, R12, R13, R14, and R15, have both access to harvest machinery and eligibility for harvest subsidies. R17, R18, R26, and R27 employ harvester equipment for grain harvesting as well. For R28, he employs a dual approach. Initially, he manually harvests using a sickle, and subsequently utilises a machine to remove the rice grain from the stalk. Nevertheless, a significant proportion of individuals in the southern region continue to choose for traditional

manual techniques for rice harvesting. Respondents who do not utilise a harvesting machine typically employ the threshing technique to extract the rice grain from the stalk.

4.5.6 Pest and Disease Management

In terms of pest and disease management, R1 stated that there is one natural way to control or avoid sparrow attacks on his paddy fields. According to R1 based on his experience, farmers who cultivate rice fields in the same area will agree to plant rice at the same time. R1 also stated that if anyone plants earlier than others, that person's rice will be attacked by spiders, but if you plant later than others, your rice will also be attacked. This is because, if your rice ripens earlier than others, sparrows will attack your rice but if you plant late and at that time only your rice is ripening, sparrows will attack your rice too. So R1 and nearby farmers will choose a date to start sowing the seeds and transfer the rice seedlings to the plot at approximately the same time each season.

In addition, R9 also stated how to control the population of golden *siput gondang emas* (Pomacea snail) in his paddy area. According to R9, the *siput gondang emas* is the main pest of rice plants, especially in rice seedlings less than 40 days old.

R9 mentioned:

"When the water level is lowered, this *siput gondang emas* will rise to the ground, when the water is removed poison will be sown and left for 2 to 3 days before the water level is raised again. This *siput gondang emas* will go back to the place where there is water and has been sprinkled with poison just now, where there is water that is where they will gather".

Majority of the respondents implement pest control methods that is according to the requirements where frequency of application, timing, variety of pesticide, and the amount of applied herbicide and pesticide were considered. According to them, the seedling stage in the nursery and the first week after the seedlings are transferred to the plot is a crucial time and the rice needs to be taken care of carefully to prevent the rice seedlings from dying from diseases and pests.

4.6 Concluding Remark

Based on the study, the state of rice cultivation in the northern and southern part has quite significant differences. In terms of physical and production factors, farmers in the northern part have advantages in terms of access to machinery, adequate subsidy assistance and facilities such as rice mills. In addition, there is a private company called Bario Ceria that provides services to farmers at a reasonable payment rate. However, in terms of marketing or methods to market the agricultural products such as rice, farmers in the northern areas, especially in Bario, experience difficulties because access to external markets is quite limited due to the distance and geographical factors. Access to exit of Bario is by car which is approximately 16 hours journey to the nearest city of Miri or by air using twin otter aircraft and only Maswings as the sole provider of this service. According to respondents, it is quite difficult to send rice by flight due to the fact that the aircraft has a load limit that needs to be adhered to, therefore farmers and respondents are usually able to send rice to be marketed out in small quantities. In addition, they only sell in the nearby weekend market or depend on the arrival of tourists who enter Bario.

As for the southern part, the area located in the suburbs, namely Siburan, has advantages in terms of access to various facilities, especially machines, subsidy assistance and product marketing. Other areas in the southern part such as Lundu and Sri Aman have moderate access to the use of machines because there are not many farmers who grow rice for commercial purposes. In Saratok, although respondents live not far from the main town, they are a bit behind in terms of access to harvesting machine facilities and so on, and subsidy assistance is also often insufficient according to R26. This is because the majority of farmers in Saratok grow rice for their own use and will only sell if there is a surplus. Overall, areas that have access to good facilities are usually areas that have been identified as the main source of rice production in the state such as in Bario, Lundu, Sri Aman and Siburan.

CHAPTER 5

CONCLUSION

5.1 Summary of Findings

This study is an assessment to study the sustainable livelihood outcome of the rice sector development in Sarawak. This study had three objectives: To assess factors that contributes to the sustainable rice production; to examine the relationship between rice production with the sustainable livelihood outcome; and to indicate the potential strategies that can be implemented in enhancing the sustainable rice production and livelihood of the farmers. Findings are presented to address these three objectives, based on economic approach. A qualitative analysis was employed to achieve the study objectives.

Rice is the basis of the community's heritage in Sarawak. Sarawak has its own specialty or heirloom rice that refers to the traditional rice cultivation. Paddy cultivation has been a main agricultural practice that were inherited from generation to generation. Paddy farmers in Sarawak are mainly older generation in their 40's to 70's. The participation of young people in rice and paddy cultivation in Sarawak is low. As of the farmers aged from 60 and above, majority of them does not have proper education hence they preferred the traditional style of rice cultivation.

The study of physical and production factors encompasses the elements of production that contribute to the sustainable level of rice production in Sarawak, including land size, utilisation of machinery, climatic change, labour, and capital. The results suggests that the utilisation of machinery, climate change, and labour do not have a substantial impact on rice production and the overall well-being of farmers. Nevertheless, the utilisation of machinery

and labour continues to have a favourable impact on the amount of rice production. Land size and capital have been proven to have a substantial correlation with rice production output and the livelihood outcome of farmers. This indicates that these factors play a substantial role in the percentage of rice production and the overall well-being of the farmers. Furthermore, the factors of land size and capital are positively correlated with both production of rice as well as the livelihood of the farmers. Hence, it can be inferred that the crucial factors of land size and capital must be recognised in order to enhance rice production and the well-being of farmers. The other factor of production in this study also can be considered such the utilisation of machinery and labour. Labour can contribute to an increase in production levels, while the effective implementation of machinery by farmers in Peninsular Malaysia, as well as other countries, can be adopted to maximise rice production.

Although these factors may not be the primary drivers of rice production or farmer livelihoods, they still contribute positively to production levels. While their impact may not be statistically significant, they still play a supportive role in maintaining or slightly improving rice yields. The utilization of machinery can reduce the physical burden on farmers and improve efficiency, even if it does not drastically increase production. In that sense, in some of the study areas mainly with smallholder farmers that cultivate paddy for their own consumption, they still prefer using traditional methods without machinery to cultivate their paddy. While climate variability does not affect the rice yield or the rice production at all. Similarly, while labour availability may not directly correlate with higher yields, having sufficient labor can ensure that farming activities are carried out effectively. Based on this study, most farmers rarely hire labour to help cultivate the paddy. They usually work with their family members. They only hire hourly-wage labour when they are behind the schedule to cultivate the paddy. Therefore, it is recommended that further research and

agricultural policies focus on optimizing these factors to maximize farmer's positive contributions. For instance, encouraging investment in modern machinery can enhance efficiency and reduce the reliance on manual labour. Besides, providing training programs for farmers on efficiency of machinery use can improve productivity. Additionally, strategies to adapt to climate variability, such as introducing resilient rice varieties or implementing good water irrigation techniques can help mitigate potential risks.

The study proposes that the provision of help in the form of subsidies and incentives to farmers can lead to increased rice production and improved sustainable livelihood outcomes. In addition, an improved distribution channel and effective marketing strategies are also seen as crucial factors. Continuous and targeted provision of subsidies and incentives to farmers is essential to sustain their welfare and serve as a catalyst for increasing rice output. Based on this study findings, majority of the farmers, except farmers in Bario, who mostly do organic farming, agreed that aid in terms of pesticides and herbicides should be increased from 2 bottles to 4 bottles every season to cope with the rising chemical price in the market. Moreover, subsidies should be given to all farmers as long as they are involved in paddy farming. Persatuan Peladang Kawasan should play an important role here in identifying those farmers because some of them did not have the chance to register due to the far distance from their village to the nearest PPK. When farmers understand how to use inputs effectively, prepare their land and seeds, and apply fertilizers and pesticides safely, they can significantly improve their farming practices. By combining traditional methods with modern techniques, these farmers can maintain their cultural heritage while also becoming more efficient. Their knowledge of managing pests and diseases, which includes both traditional methods and organized strategies, helps them control these issues more sustainably. This balanced approach not only increases productivity but also supports the

sustainability of their farming systems. In order to maintain control over the price of herbicides, pesticides, fertilisers, and other agricultural commodities, it is crucial to continue efforts to prevent any increase in production costs that could potentially impact the productivity of farmers.

The potential solutions for achieving sustainable rice production in Sarawak emphasise the importance of implementing sustainable practices. It is essential to adopt effective agricultural practices in rice production that consider the economic, social, and environmental aspects of sustainability. The study indicates that certain farmers possess knowledge of effective agricultural practices and have been implementing these methods in their farming operations for a considerable period. The introduction of a programme called MyGap provides an excellent opportunity for farmers to enhance their knowledge and adopt effective and sustainable practices in paddy cultivation. Furthermore, in terms of farm management, the majority of the respondents possess the knowledge and understanding of using inputs in a proficient and effective manner. Besides, in term of farm management majority of the respondents have the knowledge on how to use the inputs in a good and efficient ways. Majority of the respondents emphasized that they have the knowledge on how to prepare the land and seeds for rice cultivation. The respondents reported that they acquired knowledge regarding the appropriate timing, method, and frequency of applying fertilisers, herbicides, and pesticides to ensure the safety of the rice for consumption. The majority of respondents continue to rely on rain, nearby streams, and dams as their primary sources of water for the paddy field. The responders employ various methods to harvest the paddy crop. There are some respondents who continued to keep to traditional farming methods due to the lack of machinery on their farms and majority of respondents opt for modern techniques to enhance harvesting efficiency. Several respondents continue to

employ traditional methods for pest and disease control, while also implementing a well-structured strategy to manage pests in their paddy fields. Therefore, using effective and optimal farming techniques in paddy cultivation will have a significant impact on the sector's growth potential, leading to increased agricultural output and improved welfare for farmers. That being said, when farmers have access to good machinery, sufficient labour, quality seeds, and assistance with pesticides and fertilizers, this will indirectly help to increase their rice production while also maintaining sustainable livelihoods and paddy farming.

Lastly, Sarawak had been aiming to boost its rice production and become self-sufficient even with the potential to export. Therefore, the government is already on board, promoting hybrid rice and using modern farming (UPM, 2024). A detailed study can help policymakers make even smarter choices. For example, instead of just upgrading irrigation generally, they can pinpoint the best systems for Sarawak's land (dayakdaily, 2024). The study can also help choose the right hybrid seeds for each area so farmers can increase the rice yield and can also guide farmers to farm in a sustainable manner. Furthermore, the study will allow the government to know what technology works in Sarawak and help small farmers get the support they need.

5.2 Policy Recommendations

The government has introduced and implemented many policies for the development of the rice industry in Malaysia. The agricultural policy in Malaysia has been formulated before the Independence period (1948-1957) and after Independence (1957 – 2020) (Abu Dardak, 2015).

KRI report (2019), middle players such as brokers, manufacturers and wholesalers play a vital role in this industry. Hence, it is important that no restrictions opposed to their business operations in order to protect the farmers and consumers because this groups will be disadvantaged as a result of weak supply chains. Contrary to the common perception of middlemen and brokers as detrimental, this study reveal that middlemen and brokers play a crucial role to market the rice in Sarawak, particularly in suburban areas such as Siburan, Sri Aman, and Lundu. According to farmers, there are currently no restrictions imposed on them by the government. Therefore, farmers hope for a new system and strict monitoring from the government that can ensure transparent transactions between them and the middlemen as well as brokers. Furthermore, a regulatory environment that promotes the growth and success of each segment of the supply chain is essential for the industry to grow. A possible solution that can be considered to increase trust between farmers and manufacturers is through technology that increases transparency such as the Open Ledger system or Blockchain. This system is a decentralized and a transparent system that is used to record transactions across many computers so that the record cannot be altered easily without permission. This system can be used in rice sales transactions to weigh and record the quality of rice without interference from any party. The system can provide information on farmers and source of plots as well as the further downstream journeys to wholesalers and retailers. Consumer will benefit in such that they can access the recorded data and determine the level of the quality of product, and if it is compliance with good agricultural practice (MyGap) on the farm and practicing a Good Manufacturing Practices.

Besides, the implementation of the standard Guaranteed Minimum Price (GMP) at RM1,200/MT, where the rate for GMP in Sarawak is fixed at RM750 per metric tonne. BERNAS however, purchases paddy from the local farmers ranging from RM750 to

RM1,500, hence there is a need to review the rate of GMP for Sarawak to make it at par with Peninsular Malaysia. The concern about the paddy agricultural land that is slowly disappearing and being replaced by other cash crops such as palm oil that are more profitable. There is a need to gazette the land specifically for paddy cultivation that is crucial in order to promote the large-scale paddy cultivation. It is important to consider that as long as the manufacturing segment remains limited and has a high barrier to entry, there will be a small opportunity for farmers to set up cooperatives and enter the segment. Demand for cooperation now is considered ineffective in empowering farmers. Possible intermediate or bridging solutions to this is to form a contract farming between middlemen and farmer. Such engagement has been done with promising results in Malaysia and it is a model worth considering KRI report (2019).

The national price increase of fertilisers and herbicide has a significant impact on farmers. Bernama (2021) reported that the effect of the sudden increase in the price of herbicides also caused the cost of production to increase sharply. Since most farmers only get fertilizer and insecticide subsidies, they have to buy herbicides themselves. However, the sudden increase in the price of herbicides is quite burdensome. Price control of fertilizers and poisons, especially herbicides, should be implemented to reduce the burden on farmers and reduce production costs. In addition, an introduction to bio-farming where an agricultural system that uses fertilizers of organic origin such as compost manure, green manure, and bone meal and places emphasis on techniques such as crop rotation and companion planting. This introduction to bio-farming is determined to reduce dependence on fertilizers and herbicide.

Lastly, Sarawak's unique geographical features, including its hilly terrain and terraced landscapes, present both challenges and opportunities for sustainable rice production. Given these characteristics, several sustainable practices can be implemented to enhance rice cultivation while preserving the environment and promoting local biodiversity.

One effective practice is terrace farming, which is particularly suited for hilly areas. This method involves creating flat platforms on slopes to reduce soil erosion and manage water runoff effectively. By constructing terraces, farmers can capture rainwater, allowing it to infiltrate the soil and sustain the rice crops during dry periods. This approach not only conserves water but also enhances soil fertility by preventing nutrient loss due to erosion (DOA, 2025).

Water management is another critical aspect of sustainable rice production in Sarawak. As many rice fields depend on rain-fed systems, implementing efficient irrigation systems is essential. Farmers can adopt techniques such as rainwater harvesting and drip irrigation to optimize water use. These methods help ensure that water resources are utilized efficiently, particularly in regions prone to droughts or irregular rainfall patterns (Mertz & Christensen, 1977).

Additionally, crop diversity plays a significant role in sustainability. Traditional farmers in Sarawak have maintained a rich genetic diversity of rice varieties, which helps mitigate risks associated with pests and diseases. By planting multiple rice varieties within the same field, farmers can reduce crop damage and enhance resilience against environmental uncertainties (DOA, 2025). This practice not only supports biodiversity but also contributes to food security by providing a variety of crops that can adapt to changing conditions. Therefore, sustainable rice production in Sarawak requires a multifaceted

approach that considers the region's unique geographical features. By implementing terrace farming, optimizing water management and promoting crop diversity Sarawak can enhance its rice production sustainably while preserving its rich biodiversity. These practices not only aim to improve agricultural output but also contribute to the long-term livelihoods of local communities.

5.3 Limitations of Study

The sustainable livelihood study could be improved in several ways. Firstly, this study was conducted during the COVID-19 pandemic, therefore there are some constraints to go to other locations to meet with the farmers to learn about the factors that affect their sustainable rice production. The feedback gathered from the respondents in terms of understanding the total cost of production or capital was limited due to most of the respondents did not have the records of the expenses. Besides, the information regarding the household income is hard to be figured out due to being considered as a sensitive information, hence the respondents will only state the range based on their monthly expenses. Another limitation is regarding the information of subsidies received by the respondents. The information given was sometimes not tallied throughout the conversation. Therefore, the approach to countering this matter is by asking the question again at the end of the interview.

In addition, due to the pandemic, this study has implemented face to face interview as the main data collection method due to the constraints and obstacles to implementing the survey method for large numbers of respondents. There are obstacles to meet the farmers in large numbers as well as traveling to many places to carry out research through the survey

method. Moreover, the period taken to conduct the interview is quite long due to the fact that there are areas that require an appointment to be made in advance with the respondent. Therefore, the appointment must be set first according to the respondent's free time and only then the interview can be conducted.

Lastly, the Malaysia Good Agricultural Practices (MyGAP) program represents a key governmental initiative aimed at supporting the agricultural sector through the promotion of standardized and sustainable farming practices. However, this study faced limitations in evaluating the program's effectiveness and adoption. In this study, only one respondent involved with MyGAP and she is from Bario, northern Sarawak. While farmers in other areas, such as Siburan in southern Sarawak, were aware of the MyGAP program the complicated and lengthy application process remained a major barrier to adoption. Farmers often identified limited access to financial capital, technical expertise and administrative support as key challenges in meeting the application requirements. The strict application requirements of MyGAP limit farmer participation causing a constraint to the study. Further research is needed to explore ways to simplify the process and improve access to MyGAP, especially for farmers with limited resources.

5.4 Recommendations for Future Study

This study is limited to Sarawak and only covered the northern and southern parts and future studies may involve similar valuations in the rice and paddy agricultural sector of other districts in Sarawak and other states. This will give a clear insight and awareness of the vulnerability level of the national rice production and consumption to various types of risks that includes market distribution networks or marketing, soil fertility, price of fertilizers

and pesticide, farmer's lack of knowledge and awareness as well as the poor deployment of mechanization in rice and paddy farming. The more precise adaptation assessment to cope with such risks would support mitigation planning for future in the context of Malaysia.

Since most of the rice farmers in Sarawak are smallholders, modern cultivation methods, the introduction to the use of machines and the provision of incentives and subsidies has a significant impact on their lives. According to most respondents, the introduction of mechanization can help simplify the process of rice cultivation and save manpower. However, the introduction to the use of machines should be accompanied by the provision of incentives or subsidies for the use of machines per acre. Apart from that, a study on the importance of centralized rice collection and distribution centre in several key areas should be carried out to facilitate the farmers in the surrounding areas.

Majority of the respondents still depend on their income and earn their livelihood from non-agricultural activities because the sales of paddy or rice are not sufficient as the main source of income. Careful planning is still needed to achieve a level of machine literacy among rice farmers. Therefore, involvement and training workshops for farmers are important so that farmers can learn to use machinery in the most effective way in addition to benefiting from incentives or subsidies from the government to sustain a good daily life. Additionally, further research is needed to find ways to simplify the process and improve access to MyGAP, especially for farmers with limited resources, as it is one of the government's key programs designed to recognize and support qualified farmers in adopting good agricultural practices.

The following lessons can be learned from the experiences of the northern and southern regions:

1. Although the provision of fertilizer and poison subsidies from the government is mandatory every year, there are still farmers who are left out of receiving aid. There is a need to delve into this issue in more detail.
2. The need for a preliminary study to know and understand the socioeconomics of smallholder rice farmers in Sarawak to understand the need and the issues surrounding the ownership of paddy cultivation land.
3. The tendency of the youth and farmers to be interested in rice farming and the existing rice scheme needs to be improved because the youth are not interested in entering the field of rice farming and there are also rice farmers who are less interested in following the rice scheme due to the fact that the scheme system is less clear and less effective for them.
4. A future in-depth analysis by the authorities regarding the need for distribution channels or good marketing places especially for farmers to market their products.

Therefore, an assessment of the factors affecting the rice development sector, especially in Sarawak, is necessary to ensure the livelihood of rice farmers, especially smallholders, is guaranteed. In addition, the implementation of the rice scheme should be targeted and implemented correctly so as to help farmers increase productivity. Therefore, future planning to advance the rice farming sector should take into account the provision of proper subsidies and incentives, accurate marketing and product pricing methods and introduction to the use of machines in systematic agriculture. It is hoped that with this future planning, the rice development sector can help improve the standard of living of farmers as well as more young people are interested in venturing into the field of rice cultivation because rice growers have the potential to become business opportunities. Lastly, this study hopes for rice farming in Sarawak to create a sustainable livelihood, meaning a situation

where things are good for everyone involved for a long time. This means ensuring that Sarawak can grow enough rice to feed its people without relying too much on imports. It also means helping farmers earn a good income so they can support their families and improve their lives. Crucially, this involves protecting the environment by using farming methods that not harming the land and the goal is to empower local communities by giving them the skills and resources they need to thrive in rice farming.

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APPENDICES

Appendix 1: Interview Questions



INTERVIEW FORM
FACULTY ECONOMICS AND BUSINESS
UNIVERSITI MALAYSIA SARAWAK

**Assessing the Sustainable Livelihood Outcome of the Rice Sectors
Development in Sarawak**

Prepared by: Cik Sharon Hou Wan

Supervisor: Dr Rosita Binti Hamdan

PART A: BASIC FARMERS INFORMATION

Respondent background

Question: Can you introduce yourself?

1. Name:

2. Residential address:

3. Location of paddy fields:

4. Age:

5. Race:

6. Marriage Status:

7. Level of education:

8. Head of Household: YES NO

9. Number of Households:

10. Number of Dependents:

11. Duration of residence in this village:

12. Are the native residents or not? YES NO

Where are you from? _____

13. Main job:

14. Side jobs (Can be more than one):

15. Total monthly household income:

PART B: BASIC INFORMATION OF PRODUCTION ACTIVITIES

No.	History of Rice Cultivation	Indicator	Notes
1.	Since when did you start planting rice and what type of rice is planted? Can you tell me?	• What year? • Inherited from family or not? • How many times to plant a year • Types of rice plants: a) Fields b) Hill	
2.	The area of land planted with rice?	• How many acres/hectares • Land ownership • Under the project	

		• Maintenance costs (own or borne by the project)	
3.	Selection of rice types	• Farmer / random taste • Inherited / old seeds • Same type every year	

No.	Irrigation system	Indicator	Notes
4.	Paddy fields and hills	• Type of irrigation • Swamp land or plain land	
5.	Rice planting location	• How long to prepare the land	

No.	Rice Cultivation Process	Indicator	Notes
6.	Seed	• Source of the seeds • How many types are planted • Types of seeds • Mixed or not • Mardi seeds (if any) • How to care and stor • Storage of paddy	
7.	Site Preparation and Nursery	• Working together/hire people - Payment rate • Month when it starts • Site preparation methods • How long is the process of the first season to the second season • When to sow seeds and how? • Machine or traditional use • How many days the nursery was transferred to the site	

No.	Threat	Indicator	Notes
8.	Attack of disease	• Types of diseases	
9.	Climate change	• Weather changes • Flood • Drought	

10.	The impact of the pandemic on production and income	• Before and after Covid-19	
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No.	Expenses and Maintenance	Indicator	Notes
11.	Pesticide/herbicide spray	• Types of poison • How many times • Time when	
12.	Rice fertilization	• Fertilizer types • Frequency • Time of application	
13.	Organik farming	• Organic	
14.	How to maintain	• Paddy field • Hill rice	

No.	Rice Harvesting and Production Process	Indicator	Notes
15.	Harvesting Activities	• What month • Equipment and methods used • Seed separation method (stomping / crushing)	
16.	The harvest	• Total seasonal harvest (kg / sack size) • Difference between past and present harvest (how many sacks) • Difference factor	
16.	Processing paddy to rice	• How to process • Where and how to store rice • Rice drying method • Drying period	
18.	Rice Produce	• For sale • Saved for own consumption	

PART C: BASIC INFORMATION ON FARMERS ECONOMIC ACTIVITY AND STANDARD OF LIVING

No.	Production Outcomes	Indicator	Notes
19.	Income	• Main or side • Family expenses • Amount sold • Amount saved • Own needs	
20.	Primary Income	• Does it depend entirely on the yield of rice	
21.	Side income	• Savings and emergencies • Estimated sold	
22.	Estimated annual income	• Paddy • Rice	
23.	Living standards	• Become better/stable/hard?	

No.	Sales and Marketing	Indicator	Notes
24.	Outside marketing	• Government or private agencies	
25.	Selling price difference	• Middlemen (Ceria Group and Antares Ventures) • Wholesaler or own • Pricing method	
26.	Selling location	• Own selling	

No.	Engagement and Skills	Indicator	Notes
27.	Young Family Members	• Child • Skills level • Interest	

No.	External Engagement	Indicator	Notes
28.	Contract	• Clear content • Farmers' rights	

		• Advisor in negotiations	
29.	Project	• How's income is divided	

PART D: SOCIAL BASIC INFORMATION OF FARMERS

No.	Aids and Support	Indicator	Notes
30.	Courses, training and guidance	• Marketing and entrepreneurship • Government • Private	
31.	Associations and cooperatives?	• Village • District • State	
32.	Subsidy	• Types of subsidies • Subsidy arrangement	

No.	Tradition	Indicator	Notes
33.	Customs, rituals and beliefs	• Treating rice disease • Preservation of rice; a) Before planting b) After planting	

34. Do farmers know if rice in the Bario area is given a Geographical Indication certificate?
35. Is the barter system still be practiced? (For rice in exchange for kitchen items).
36. Is the rice crop enough to cover the household's expenses fully, partially or for self-sufficiency (rice source) of the household only?
37. What do farmers need to increase their crops?
38. What are the main problems in rice cultivation?
39. How to overcome the problem (strategy/measures)?
40. Hope for further development in rice production?

~Sekian, terima kasih~

Appendix 2: Validation Form



VALIDATION FORM
FACULTY ECONOMICS AND BUSINESS
UNIVERSITI MALAYSIA SARAWAK

**ASSESSING THE SUSTAINABLE LIVELIHOOD OUTCOME OF THE RICE
SECTORS DEVELOPMENT IN SARAWAK**

Researcher / MSc Candidate : Sharon Hou Wan

Supervisor : Dr Rosita Binti Hamdan

This research is done by the Department of Economics and Business, Faculty of Economics and Business, Universiti Malaysia Sarawak, for the Master of Science (MSc) program.

Rice is a staple food for over 50% of the global population, with Asian countries producing nearly 90% of the world's supply. However, only 7% of rice is exported, highlighting its role in food security. Sarawak ranks as the fifth-largest rice producer after Kedah, Perak, Kelantan, and Perlis. Unlike wet paddy farming, Sarawak, Peninsula Malaysia, and Sabah primarily rely on subsistence-based hill paddy cultivation. Grown in well-drained soils, hill paddy is vital for rural communities, ensuring their food supply. As rice is one of the main commodities to generate income in Sarawak, there is a purpose to identify the factors that affect the sustainable of rice production and livelihood outcomes of the farmers in Sarawak. Majority of the farmers in Sarawak are mainly smallholders farmers in which they mostly live in rural area. Therefore, this research is conducted focused on the paddy farmers from the northern and southern parts of Sarawak that involved ten locations in Miri and Kuching divisions respectively. The

outcomes of this study have revealed the factors that contribute to the rice production and livelihood of the farmers.

I would like to request your expertise and time to validate this research questions as part of the research requirements. Given your experience in the field of education, I believe your insights will help refine the research instrument to ensure the collection of valid and reliable data. I sincerely appreciate your cooperation and support in this intellectual endeavours.

Thank you

Validate by:


Dr Farah binti Zaini
Lecturer
Faculty of Social Sciences and Humanities
Universiti Malaysia Sarawak
94300 Kota Samarahan

Validate by:


Dr. Freddy Yeo Kuok San
Pensyarah
Fakulti Sains dan Teknologi Sumber
Universiti Malaysia Sarawak.

Associate Prof Dr Freddy Yeo Kuok San

The set of questions are divided into (4) parts (A, B, C and D). All these questions are designed to enable in depth discussion with the farmers on their farming activities to assess the factors that affect the sustainable of rice production and livelihood outcomes of the farmers in Sarawak.

PART A: BASIC FARMERS INFORMATION

Respondent background

Question: Can you introduce yourself?

1. Name:	
2. Residential address:	
3. Location of paddy fields:	
4. Age:	
5. Race:	
6. Marriage Status:	
7. Level of education:	
8. Head of Household: YES	☐ NO ☐
9. Number of Households:	
10. Number of Dependents:	
11. Duration of residence in this village:	
12. Are the native residents or not? YES	☐ NO ☐
Where are you from?	
13. Main job:	
14. Side jobs (Can be more than one):	

15. Total monthly household income:

PART B: BASIC INFORMATION OF PRODUCTION ACTIVITIES

No.	History of Rice Cultivation	Indicator	Notes
1.	Since when did you start planting rice and what type of rice is planted? Can you tell me?	• What year? • Inherited from family or not? • How many times to plant a year • Types of rice plants: a) Fields b) Hill	
2.	The area of land planted with rice?	• How many acres/hectares • Land ownership • Under the project • Maintenance costs (own or borne by the project)	
3.	Selection of rice types	• Farmer / random taste • Inherited / old seeds • Same type every year	

No.	Irrigation system	Indicator	Notes
4.	Paddy fields and hills	• Type of irrigation • Swamp land or plain land	
5.	Rice planting location	• How long to prepare the land	

No.	Rice Cultivation Process	Indicator	Notes
6.	Seed	• Source of the seeds • How many types are planted • Types of seeds • Mixed or not • Mardi seeds (if any) • How to care and stor • Storage of paddy	
7.	Site Preparation and Nursery	• Working together/hire people - Payment rate • Month when it starts • Site preparation methods • How long is the process of the first season to the second season • When to sow seeds and how? • Machine or traditional use	

		• How many days the nursery was transferred to the site	
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No.	Threat	Indicator	Notes
8.	Attack of disease	• Types of diseases	
9.	Climate change	• Weather changes • Flood • Drought	
10.	The impact of the pandemic on production and income	• Before and after Covid-19	

No.	Expenses and Maintenance	Indicator	Notes
11.	Pesticide/herbicide spray	• Types of poison • How many times • Time when	
12.	Rice fertilization	• Fertilizer types • Frequency • Time of application	
13.	Organik farming	• Organic	
14.	How to maintain	• Paddy field • Hill rice	

No.	Rice Harvesting and Production Process	Indicator	Notes
15.	Harvesting Activities	• What month • Equipment and methods used • Seed separation method (stomping / crushing)	
16.	The harvest	• Total seasonal harvest (kg / sack size) • Difference between past and present harvest (how many sacks) • Difference factor	
16.	Processing paddy to rice	• How to process • Where and how to store rice • Rice drying method • Drying period	
18.	Rice Produce	• For sale	

		• Saved for own consumption	
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PART C: BASIC INFORMATION ON FARMERS ECONOMIC ACTIVITY AND STANDARD OF LIVING

No.	Production Outcomes	Indicator	Notes
19.	Income	• Main or side • Family expenses • Amount sold • Amount saved • Own needs	
20.	Primary Income	• Does it depend entirely on the yield of rice	
21.	Side income	• Savings and emergencies • Estimated sold	
22.	Estimated annual income	• Paddy • Rice	
23.	Living standards	• Become better/stable/hard?	

No.	Sales and Marketing	Indicator	Notes
24.	Outside marketing	• Government or private agencies	
25.	Selling price difference	• Middlemen (Ceria Group and Antares Ventures) • Wholesaler or own • Pricing method	
26.	Selling location	• Own selling	

No.	Engagement and Skills	Indicator	Notes
27.	Young Family Members	• Child • Skills level • Interest	

No.	External Engagement	Indicator	Notes
28.	Contract	• Clear content • Farmers' rights • Advisor in negotiations	

29.	Project	• How's income is divided	
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PART D: SOCIAL BASIC INFORMATION OF FARMERS

No.	Aids and Support	Indicator	Notes
30.	Courses, training, and guidance	• Marketing and entrepreneurship • Government • Private	
31.	Associations and cooperatives?	• Village • District • State	
32.	Subsidy	• Types of subsidies • Subsidy arrangement	

No.	Tradition	Indicator	Notes
33.	Customs, rituals and beliefs	• Treating rice disease • Preservation of rice; a) Before planting b) After planting	

34. Do farmers know if rice in the Bario area is given a Geographical Indication certificate?
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36. Is the rice crop enough to cover the household's expenses fully, partially or for self-sufficiency (rice source) of the household only?
37. What do farmers need to increase their crops?
38. What are the main problems in rice cultivation?
39. How to overcome the problem (strategy/measures)?
40. Hope for further development in rice production?

~Thank you~

