



ECONOMIC PLANNING UNIT
DEPARTMENT OF THE PREMIER OF SARAWAK

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93502 KUCHING,
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FINAL REPORT

SRI AMAN MASTER PLAN

2020 - 2030

BACKGROUND & ANALYSIS

A

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SRI AMAN MASTER PLAN

2020 - 2030 BACKGROUND
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STEERING COMMITTEE

- State Secretary of Sarawak as Chairperson
- State Attorney-General's (SAG);
- State Financial Secretary's Office (SFS);
- Deputy State Secretary (Economic Planning and Development);
- Permanent Secretary, Ministry of Modernisation of Agriculture and Regional Development
- Permanent Secretary, Ministry of Natural Resource and Urban Development
- Permanent Secretary, Ministry of Education, Innovation and Talent Development Sarawak
- Permanent Secretary, Ministry of Public Health, Housing and Local Government Sarawak
- Permanent Secretary, Ministry of Youth, Sports and Entrepreneur Development Sarawak
- Permanent Secretary, Ministry of Infrastructure and Port Development Sarawak
- Permanent Secretary, Ministry of Utilities and Telecommunication Sarawak
- Permanent Secretary, Ministry of Welfare, Community Wellbeing, Women, Family and Childhood Development
- Permanent Secretary, Ministry of Tourism, Creative Industry and Performing Arts Sarawak
- Permanent Secretary, Ministry of International Trade, Industry and Investment Sarawak
- Permanent Secretary, Ministry of Transport Sarawak
- Sri Aman Resident;
- Other relevant Agencies to be invited based on needs.
- Economic Planning Unit as the Secretariat.

TECHNICAL COMMITTEE

- Economic Planning Unit Director as Chairperson
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- Permanent Secretary, Ministry of Natural Resource and Urban Development
- Permanent Secretary, Ministry of Public Health, Housing and Local Government Sarawak
- Permanent Secretary, Ministry of Infrastructure and Port Development Sarawak
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- Sri Aman Resident
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- Director, Department of Land and Survey
- Director, Department of Agriculture
- Director, Forest Department
- Director, Department of Irrigation and Drainage
- Director, Department of Sewerage Services
- Director, Rural Water Supply Department
- Controller, Natural Resources and Environmental Board (NREB)
- Controller, Sarawak Rivers Board
- Secretary, Lubok Antu District Council
- Secretary, Sri Aman District Council
- General Manager, Sarawak Land Consolidation and Rehabilitation Authority (SALCRA)
- General Manager, Land Custody and Rehabilitation Authority (LCDA)
- Chief Executive Officer, Housing Development Corporation (HDC)
- General Manager, Sarawak Tourism Board (STB)
- General Manager, Sarawak Multimedia Authority (SMA)

- Chief Executive Officer, Sarawak Biodiversity Centre (SBC)
- Chief Executive Officer, Sarawak Energy Berhad (SEB)
- Economic Planning Unit as the Secretariat.

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- I-Cats University College
- Sarawak Department of Labour
- Sarawak Museum Department
- Sarawak Craft Council
- IADA Batang Lupar
- Sarawak Disaster Management Committee
- Fire and Rescue Department Sarawak
- Sarawak RELA Office
- Sarawak Malaysian Civil Defence Force
- Sarawak Contingent Police Headquarters
- Giatmara
- Institut Latihan Perindustrian (ILP) Miri
- Institut Kemahiran Belia Negara Miri
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- Department of Marine Fisheries (Biosecurity Section)
- Inland Fisheries Branch, Department of Agriculture
- Batang Ai Ecofish Sdn. Bhd.
- Supreme Cold Storage Sdn. Bhd.
- Persatuan Nelayan Kawasan Sebuyau
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A full-page background image showing a sunset over a calm body of water. Two people are in a blue kayak in the middle ground. The sky is filled with colorful clouds in shades of orange, yellow, and blue. The water reflects the sky and the kayak.

PART 1 INTRODUCTION

The Sri Aman Master Plan Study 2020-2030 (SAMP) was commissioned to guide the development planning of the Sri Aman Division. To this end, the SAMP was expected to make recommendations on strategic direction and focus areas to accelerate and achieve sustainable as well as balanced spatial and socio-economic development for the Sri Aman Division within the span of ten years.

This volume provides an overview of the SAMP. Primarily, it presents the historical and current context for the planned development proposals. It consolidates the available relevant data related to Sri Aman and provides data analysis for application in developing targeted proposals. In particular, it includes the broad ranging socio-economic survey and the findings from that exercise.

To achieve the intended outcomes, the SAMP study was undertaken with the following as its major milestones and measures of achievement.



Source: UNIMAS Holdings, Daya Rancang and Frost & Sullivan, 2021

SECTION I.I STUDY APPROACH: SURVEYS AND OTHER BASELINE DATA

Based on the expected output of the SAMP study, baseline data and findings gathered from the field research and surveys conducted were analysed to benchmark and develop key performance indicators (KPI). At the outset, there was a need to define the economic drivers to help direct Sri Aman's economic, social and environmental development as well as formulate strategies to accelerate the growth of human capital development and productivity in the region. In this regard, it is critically important to consider strategic positioning in the formulation of economic and spatial development plans that adhere to the time frame. Additionally, there must also be financial and feasibility studies for each project and programme that are to be implemented.

SECTION 1.2 DEVELOPMENT FRAMEWORK

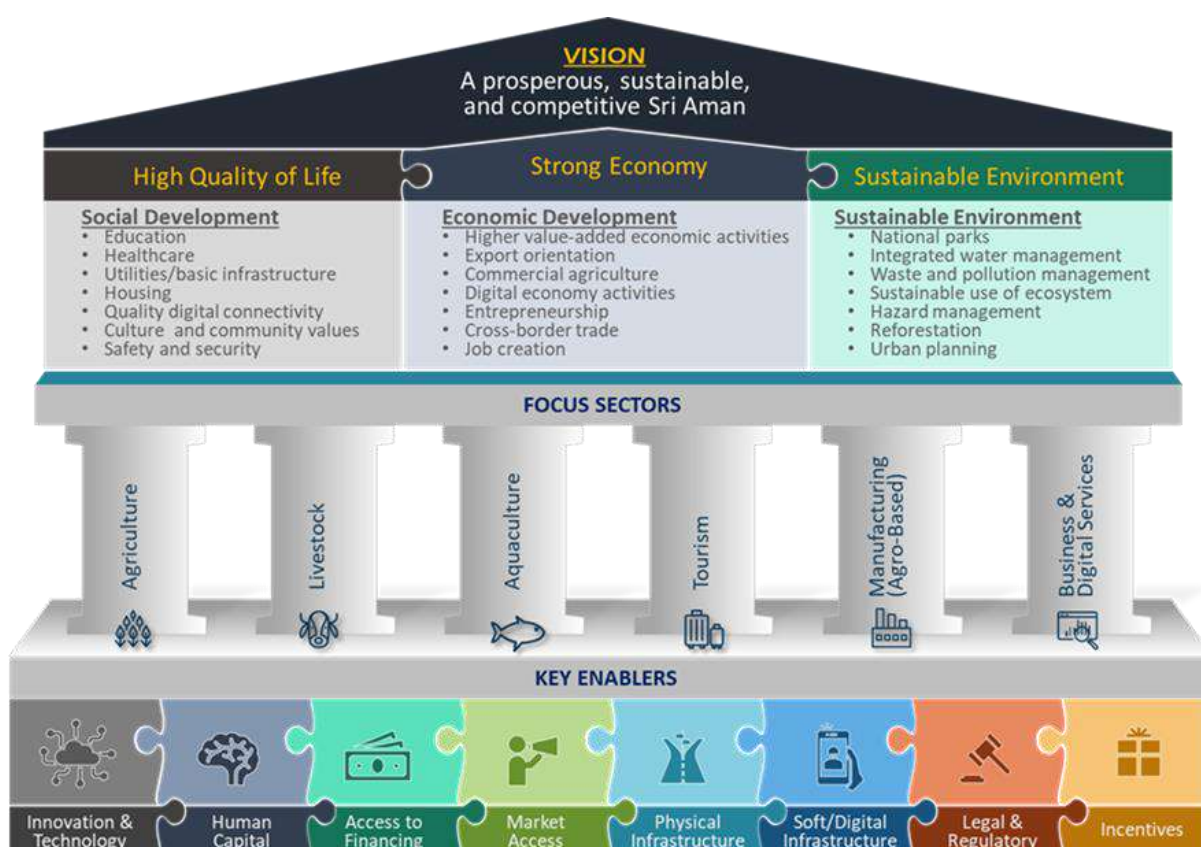
1.2.1 A Prosperous, Sustainable, and Competitive Sri Aman

The development framework of the SAMP study was designed for a systematic inter-sectoral analysis, which has enabled the setting of strategic direction and establishment of focus areas for the SAMP.

The exercise began with an overall vision: “A prosperous, sustainable, and competitive Sri Aman”. Moving on from this vision, three development goals were established, each focusing on the economy, quality of life and the environment. Both the continued development of a strong economy and the assurance of the well-being of the population will need to acknowledge environmentally sensitive areas. Development in such areas could negate expected improvement in socio-economic condition and the quality of life of the people.

1.2.2 Key enablers

Key enablers which needed to be enhanced and, in some cases, needed to be introduced were identified in order to move forward strategic initiatives based on economic, social, sustainable and environmental factors. All of the above have implications for six economic sectors in the Sri Aman Division, with agriculture, aquaculture, and tourism as the sectors that need to be reinvigorated in particular. The potential of manufacturing, business and digital services were assessed to inject new additional economic development impetus in the division.



Source: UNIMAS Holdings, Daya Rancang and Frost & Sullivan, 2021

This development framework took serious consideration of the fact that development plans for Sri Aman must proceed while acknowledging current and emerging challenges over the immediate, medium- and long-term. Development outlook and policy shifts and thrusts, at both the national and, in particular the state level, were translated into possible strategic policy directions with strategic focus areas at the Sri Aman Division level.

Overall, the objective was to find a method to best achieve as many of the intended outcomes with the resources available while taking into consideration current and future development proposals of various ministries and state agencies, particularly the newly established Sri Aman Development Agency (SADA). Admittedly, these would necessitate the adoption and implementation of new business models/canvas.

SECTION 1.3 STRUCTURE OF THE REPORT: VOLUME A · B · C

The SAMP Study report is comprised of three volumes: Volume A - Background and Analysis, Volume B - Sri Aman Development Plan, and Volume C – Sri Aman Detailed Projects. The Executive Summary section serves to provide an overview, highlighting important findings and recommendations from these three volumes primarily to address the expected output of this SAMP Study as indicated earlier. The following table serves to indicate the connection between the expected output of the SAMP Study and the relevant volumes of the Final Report.

Expected Output of the SAMP Study	Relevant Volumes of the Final Report
(i) Overview of Baseline Data	Volume A
(ii) Strategic positioning and Socio-Economic Development Plan	Volume B
(iii) Strategies for human capital development	Volume B
(iv) (iv)A GIS-based concept plan to articulate the development of transportation and logistics system, infrastructure and utilities, land use zoning as well as conceptual master plans for towns and important settlements	Volume B Appendix (Maps)
(v) Maps showing the general land use, land titles but not land ownership	Volume B Appendix (Maps)
(vi) Implementation plan of programmes and projects according to time frame	Volume B
(vii) Pre-feasibility studies and commercial viability of proposed projects and its sub-components for the purpose of funding by private sectors	Volume B
(viii) Sri Aman Detailed Projects	Volume C

Additionally, each volume of the Sri Aman Master Plan Study is not independent of each other and will require a reading of volumes A, B and C in their entirety to have a proper understanding of this report.

1.3.1 Introduction for Volume A

Volume A covers the ‘Background and Analysis’ of the report. This study has considered the various development plans in the region and used data collected from several agencies, including critical input from SADA. The baseline data is essential as it provides a comprehensive background and description of the past and current situation of the Sri Aman Division as well as providing a clear understanding of Sri Aman within a regional context. The information also helps with understanding the circumstances surrounding the various sectors and industries within and around Sri Aman. It also provides an understanding of the socio-economic trends affecting the region. These inputs facilitate our formulation of strategies for the development of the Masterplan.

1.3.2 Introduction for Volume B

Volume B provides an in-depth analysis and description of the “Sri Aman Development Plan.” It focuses on defining the various frameworks to be implemented throughout the development of this Masterplan from its conceptual inception to the eventual implementation of the projects to fulfil the goals set for the Sri Aman Division. It highlights different aspects of the developmental plan, including the economic framework, sustainable development framework, prioritize key projects, financial analysis, and economic assessment. This volume guides how various strategies and frameworks conceptualized for this master plan help reinvigorate the Sri Aman Division and transform the living standard of her people while ensuring sustainability.

1.3.3 Introduction for Volume C

Volume C provides a detailed list of projects proposed for the Sri Aman division. This volume of the Masterplan explains in greater detail the purpose of every project proposed and how they will impact their respective sectors in the Sri Aman Division. It will also help inform how the various projects will need to be implemented within each sector and how each project is prioritized within the Sri Aman Masterplan.

SECTION 1.4 REGIONAL ECONOMIC OUTLOOK

Located on the Island of Borneo, the region of Sarawak is the largest geographical entity in the federation of Malaysia, with land area spanning 124,450 square kilometers and it is the fourth most populous with an estimated population of 2.81 million (Malaysia @ a Glance - Sarawak, n.d.). It is strategically located with Brunei in the north, Sabah in the northeast, Indonesia in the south and the South China Sea in the west.

Sarawak has abundant resources available within 12 administrative divisions and 45 districts.

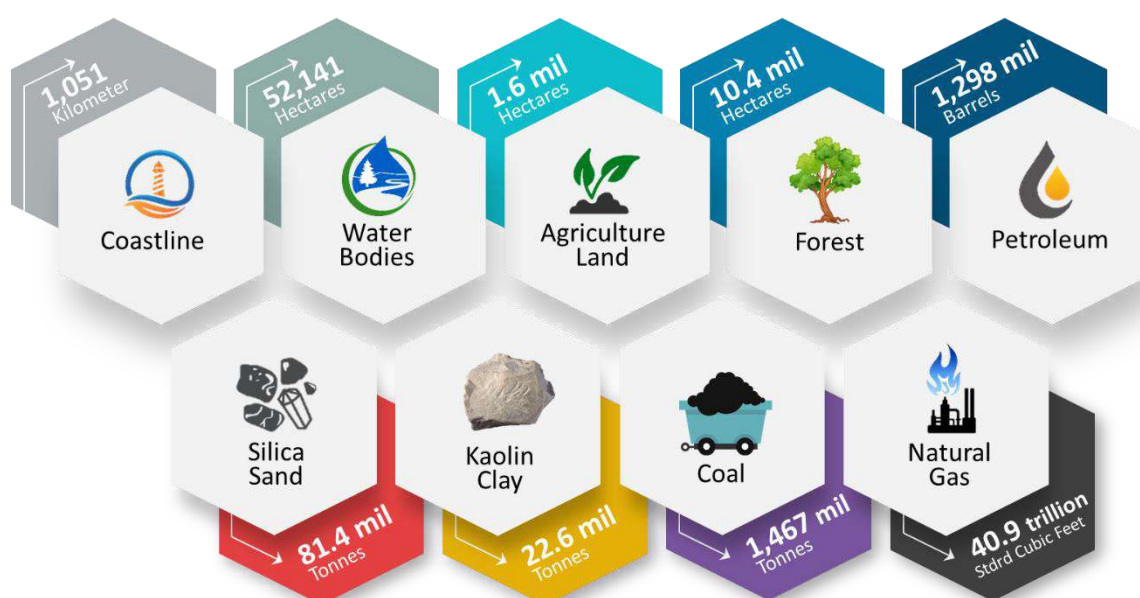


Figure 1-1: Key Resource Indicators of Sarawak

Source: Frost & Sullivan, State Economic Planning Unit¹

1.4.1 Economic Overview

This section provides an overview of Sarawak's selected economic indicators vis-a-vis Malaysia. The objective of this section is to highlight the merits and challenges of the overall macro-economic environment and subsequently its possible implications on the Sri Aman Division.

1.4.1.1 Sarawak Land Use

The physical land area of Sarawak in 2018 was about 12,402,600 hectares, of which, 2,036,300 hectares were used for agriculture i.e. about 16.4 percent of the total area (Figure 1-2). Forest and swamp land occupy about 10,081,300 hectares or about 81.3 percent of the physical area of Sarawak.

¹ Sarawak Development: Opportunities and challenges in BIMP-EAGA, Presentation by State EPU: http://bigconnectivity.org/beta/sites/default/files/2018-10/Module2_Session5_Topic5.1_Briefing%20to%20ADB%20%2814%20July%202018%29.pdf

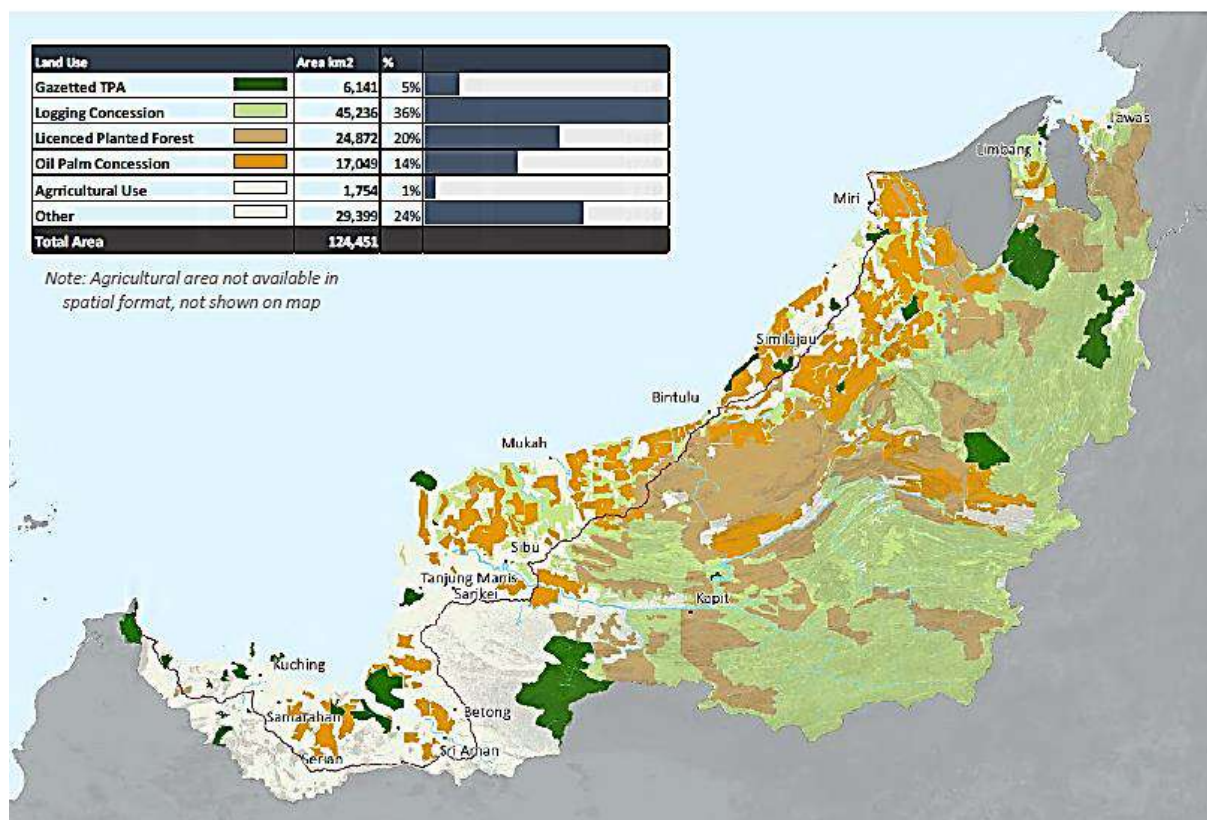


Figure 1-2: Map of Existing Land Use of Sarawak 2018

Source: Land & Survey Dept Sarawak

1.4.1.2 GDP Performance

From an economy dominated by the production of primary natural resources, including tin and rubber in the 1960s, Malaysia's economy has since evolved to become one that has greatly diversified to include robust manufacturing activities and a vibrant services sector.

Malaysia's Gross Domestic Product (GDP) grew at a Compound annual growth rate (CAGR) of 4.8% between 2015 and 2019 to reach RM1,421.45 billion in 2019 with the services and manufacturing sectors collectively contributing to over 79%. The economy reported a 4.3% growth in 2019 amid a slowdown in the global economy. In 2018, the services sector reported the highest growth of 6.8%, followed by manufacturing at 5.0%, and construction at 4.2%. The agriculture sector saw less than 1% increase while mining and quarrying witnessed negative growth of -2.6% (Malaysia, 2020).

In terms of contribution, the services sector was the highest contributor to the Malaysian economy. In 2019, the value-added of the services sector was an estimated RM820.07 billion, contributing 57.7% to the national GDP. Selangor and WP Kuala Lumpur contributed close to 41% of Malaysia's GDP followed by Sarawak, the third-largest contributor contributing close to 10% of Malaysia's in 2019. In terms of growth between 2015 and 2019, Malaysian GDP grew at 4.8%. However, Sarawak saw only 2.9% growth which was the lowest among the other states.

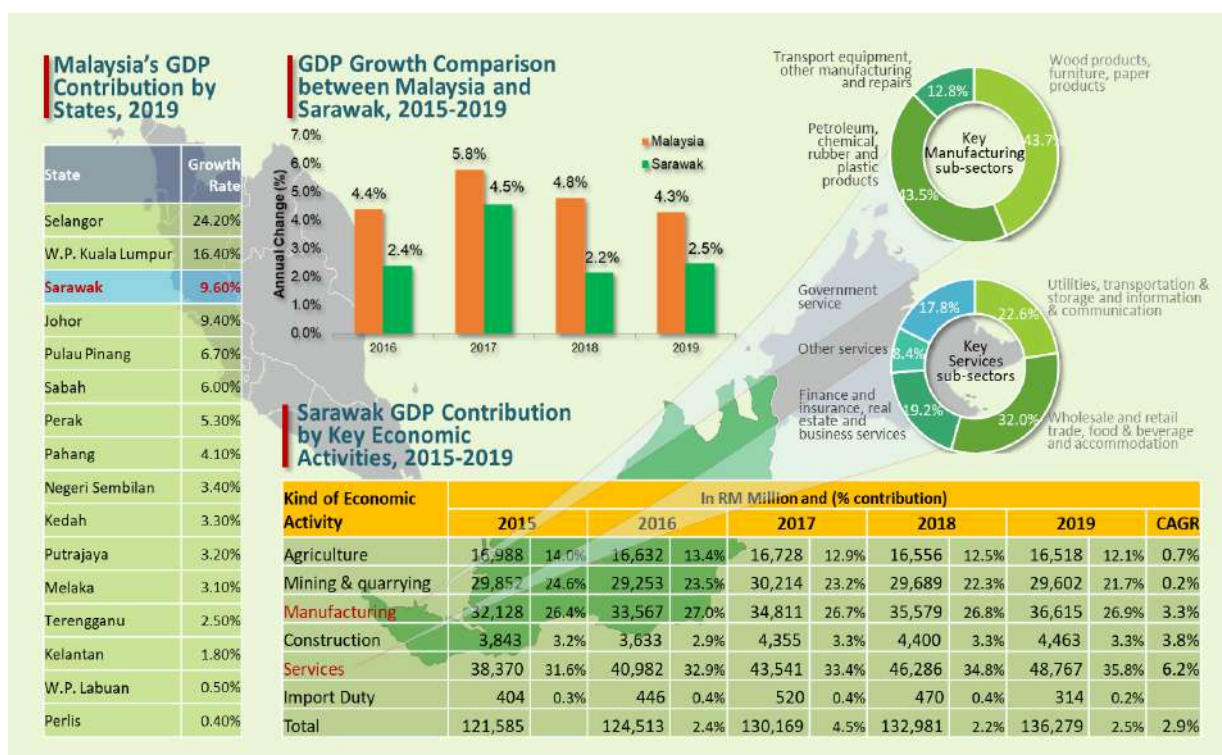


Figure 1-3: Malaysia and Sarawak GDP Performance, 2015 - 2019

Source: Frost & Sullivan Analysis, UNIMAS Holdings, and DOSM

After witnessing impressive growth in the economy in 2017, GDP growth has slowed down both at a state and nation-wide level, which was contributed by a change in the political scene since 2018 as well as a slowdown in the global economy. This is further expected to reduce further in 2020 due to the ongoing Covid-19 pandemic which has affected local demand and also triggered by a weak global outlook.

1.4.1.3 Sarawak GDP Performance

Sarawak's economy is primarily driven by exports which represents close to 75% of the state's GDP. In recent times, the government has been making efforts to move Sarawak away from its traditional reliance on mining, agriculture, and forestry to high-tech industries and renewable energy sources to create 1.5 million jobs and long-term economic prosperity by 2030 (About Overview of Sarawak, n.d.).

Services and manufacturing sectors account for more than 62% of Sarawak's economy, followed by mining and quarrying representing 21.7% (DOSM, 2020). The fastest-growing sector between 2015 and 2016 was the services sector which grew at a CAGR of 6.2% while during the same period, the agriculture and the mining and quarrying sectors witnessed a negative growth of -0.7% and -0.2% respectively. Wood products, furniture, paper products are the main category under the manufacturing sector in Sarawak while wholesale and retail trade, food & beverage and accommodation represents close to one-third of the service sector. Within services sector, wholesale and retail trade contributed 32% to services GDP followed by utilities, transportation & storage and information & communication.

1.4.1.4 Trade Performance

Malaysia is a trade surplus (positive net exports) nation. Between 2015 and 2019 the trade surplus witnessed a strong CAGR of 12.3% triggered by higher export volume. In 2019, Malaysian trade suffered a sharp decline owing to the ongoing trade tension between the US and China which affected electrical and electronics trading.

On the other hand, Sarawak too enjoys a trade surplus and continued to see a double-digit export growth of 10.1% in 2019 driven by demand for liquefied natural gas and crude petroleum. In 2019, 41.9% of the imports were machinery and transport equipment, of which 28.9% were electrical and electronic products, followed by manufactured goods imports, which contributed 11.7% of the imports mainly, refined petroleum products (DOSM, 2020). Similar to imports, machinery, and transport equipment is the main exporting category representing 43.6% of the total exports, driven by electrical and electronic products exports, which constituted 37.8% of Malaysia's exports in 2019.

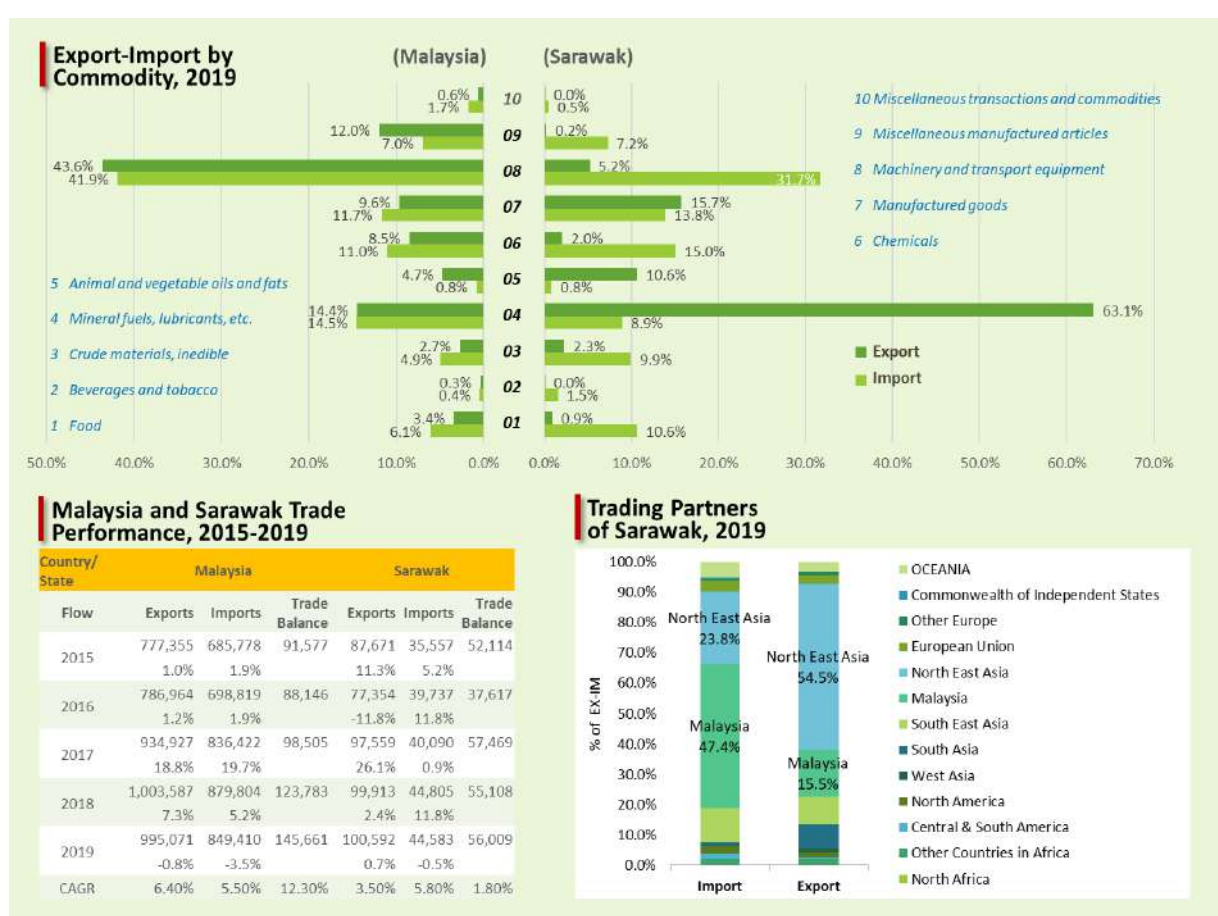


Figure 1-4: Malaysia and Sarawak Trade Performance, 2015 - 2019

Source: Frost & Sullivan Analysis, UNIMAS Holdings, and DOSM

Sarawak's main import items are machinery and transport equipment (31.7%), followed by chemicals (15%) and manufactured goods. The state's infrastructure development projects necessitate higher demand for machinery and transport equipment, which are used for construction purposes. Exports receipts from mineral fuels, lubricants comprising of liquefied natural gas (48.3%) and crude petroleum (11.1%) is the largest contributor for Sarawak in 2019. The North-East Asian market, mainly Japan and the rest of Malaysia, are Sarawak's two main trading partners representing more than 70% of the exports and imports in 2019.

1.4.1.5 Local Enablers

Traditionally the main activities of the 12 divisions in Sarawak are natural resources based. Hydrocarbon (petroleum and natural gas) based activities are found in Miri and Bintulu. Malaysia's first hydrocarbons were found in Miri in 1910 (Stern, 2020). Since then, Miri and Bintulu are now two of the main suppliers of petroleum / natural gas.

Tourism is one of the most important economic activities for Sarawak. Due to its vast rainforest, wildlife, and a multitude of ethnic groups, tourists are provided a less conventional experience, namely culture, adventure and nature based (CAN). As part of CAN tourism, Sarawak is home to the world's oldest rainforest exotic flora and fauna, national parks, giant caves beside rivers, and waterfalls.

Meetings, incentives, conferencing, exhibitions (MICE) tourism is also promoted, along with iconic events. One such event is the "Rainforest World Music Festival", held on the grounds of the Sarawak Cultural Village nestled against the base of Mount Santubong, about 35 kilometers north of Kuching since 1998. The ethnic music played mainly by the Kayan and Kenyah people of Sarawak, was considered to be the inspiration for starting the music festival.

Agriculture is the main focus for the Sri Aman Division and the surrounding divisions namely Samarahan and Betong.

Though timber processing activities are carried out through the state, most predominantly it is found along the north of Sarawak namely Sibu, Mukah, Bintulu, Miri, and Limbang.

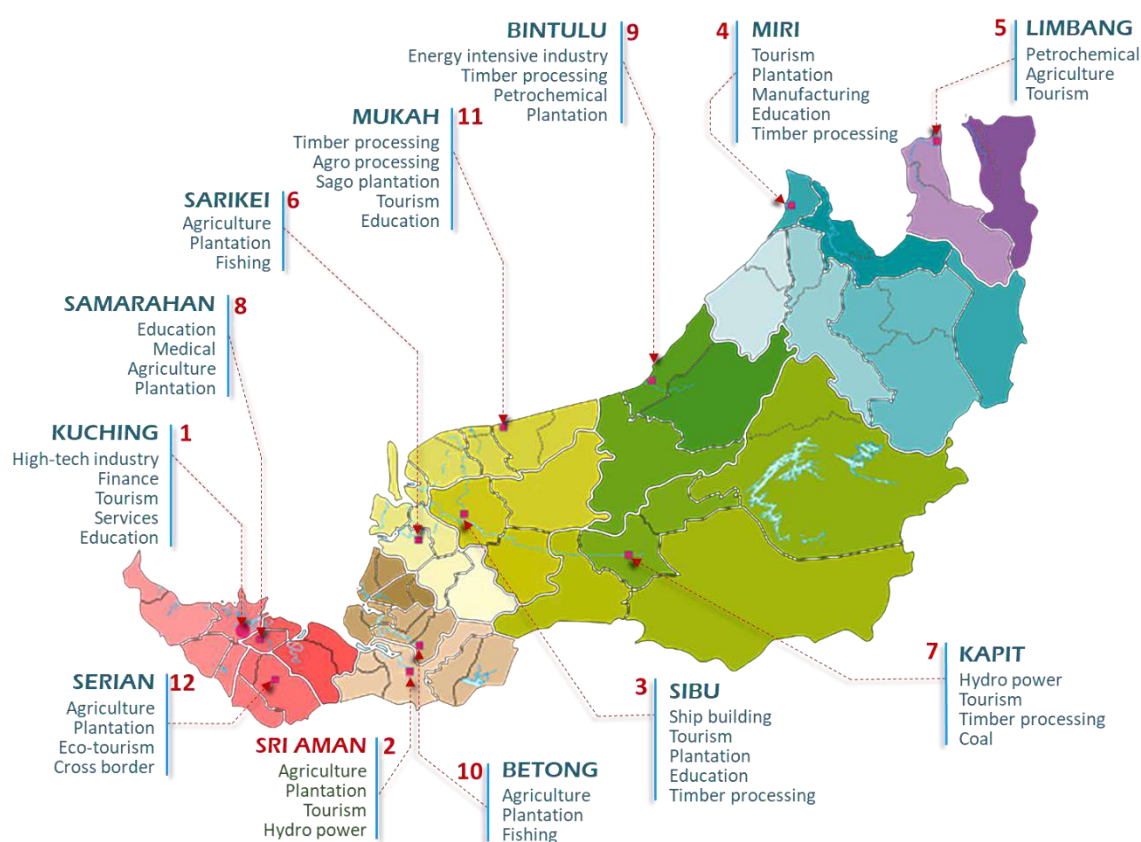


Figure 1-5: Key Economic Activities of Major Divisions in Sarawak

Source: MINTRED, UNIMAS Holdings and Frost & Sullivan Analysis

I.4.2 Review of National and State Developmental Plans

The review of the state developmental plans aims to establish a strategic alignment of the Sri Aman Division with the overall state economic development goals. The plans and strategies for the Sri Aman Division will be in line with the state's future aspiration as well as national level plans, which specifically mention Sarawak and the Sri Aman Division.

Sarawak's vision ensures that the state makes a rapid transformation from an underdeveloped resource-based production centre to a knowledge-based economy, powered by a growing and diverse manufacturing industry. Following the vision, the plans and strategies in recent years will change the sector and industry focus areas. Shown in the Figure 1-6 below are the two waves of development between 1981 and 2030.

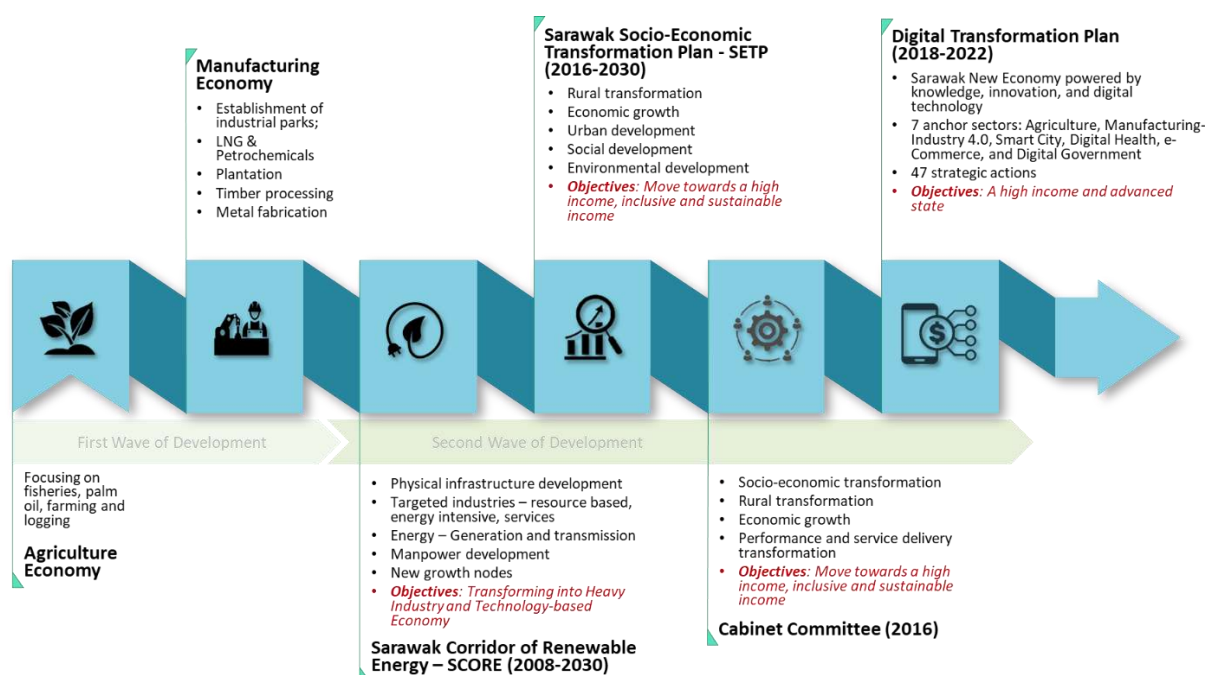


Figure 1-6: Overview of Key Sarawak Development Plans, 1981-2022

Source: Frost & Sullivan and UNIMAS Holdings. Adapted from State Planning Unit

I.4.3 Summary of Initiatives Under Second Wave of Development

1.4.3.1 Sarawak Corridor of Renewable Energy (SCORE)

Summary: SCORE is one of the economic regions and development corridors in Malaysia covering the central region of Sarawak.

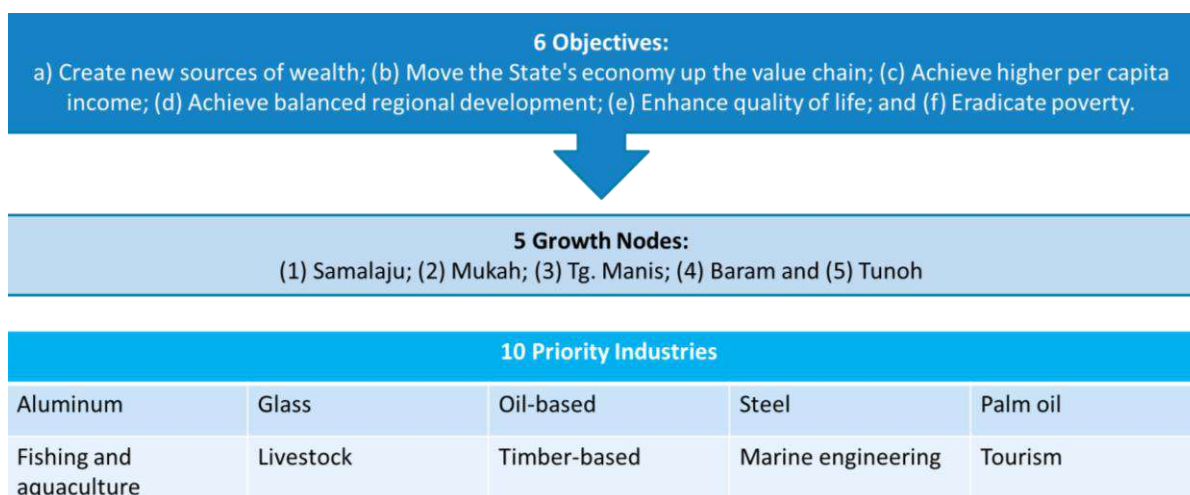


Figure 1-7: Overview of SCORE

Source: Frost & Sullivan Analysis, SCORE

SCORE was established to achieve the following six objectives a) to create new sources of wealth; (b) to move the State's economy up the value chain; (c) to achieve higher per capita income; (d) to achieve balanced regional development; (e) to enhance quality of life; and (f) to eradicate poverty.

Five growth nodes were identified namely (1) Samalaju (Heavy and Energy Intensive Industries); (2) Mukah (Smart City, Services Hub & R&D); (3) Tg. Manis (Halal Hub); (4) Baram (HEP, Oil Palm and Forest Plantation, Eco-Tourism) and (5) Tunoh (Oil Palm and Forest Plantation, Agriculture and Eco-Tourism).

1.4.3.2 Socio-Economic Transformation Plan (SETP)

Summary: The SETP is a comprehensive plan with the main objectives of accelerating income growth and reducing income disparity. The plan spans across a period between 2016 and 2025 and covers all the sectors. When the plan was launched, the state was projected to grow annually at 6.5% to achieve the status of high income by 2030.



Figure 1-8: SETP Overview

Source: Frost & Sullivan, State Planning Unit

1.4.3.3 Sarawak Digital Economy Strategy (2018-2022)

Summary: Sarawak, under the leadership of Datuk Patinggi Abang Johari Tun Openg as Premier of Sarawak, has been focusing on transforming the Sarawak economy into a strong digital economy. The expression of the digital economy does not only include business transactions but covers all aspects of day-to-day life of the Sarawak population. For this to happen, the industry needs to take a driver's role in integrating digital enabling technology into every relevant part of the value chain.

The Sarawak Multimedia Authority (SMA) was established in November 2017 to facilitate the digital economy transformation. A Sarawak Digital Economy Strategy 2018 to 2022 was also drafted, detailing 47 strategies and strategic actions with seven anchor sectors - Agriculture, Manufacturing-Industry 4.0, Tourism, Smart City, Digital Health, e-Commerce, and Digital Government.

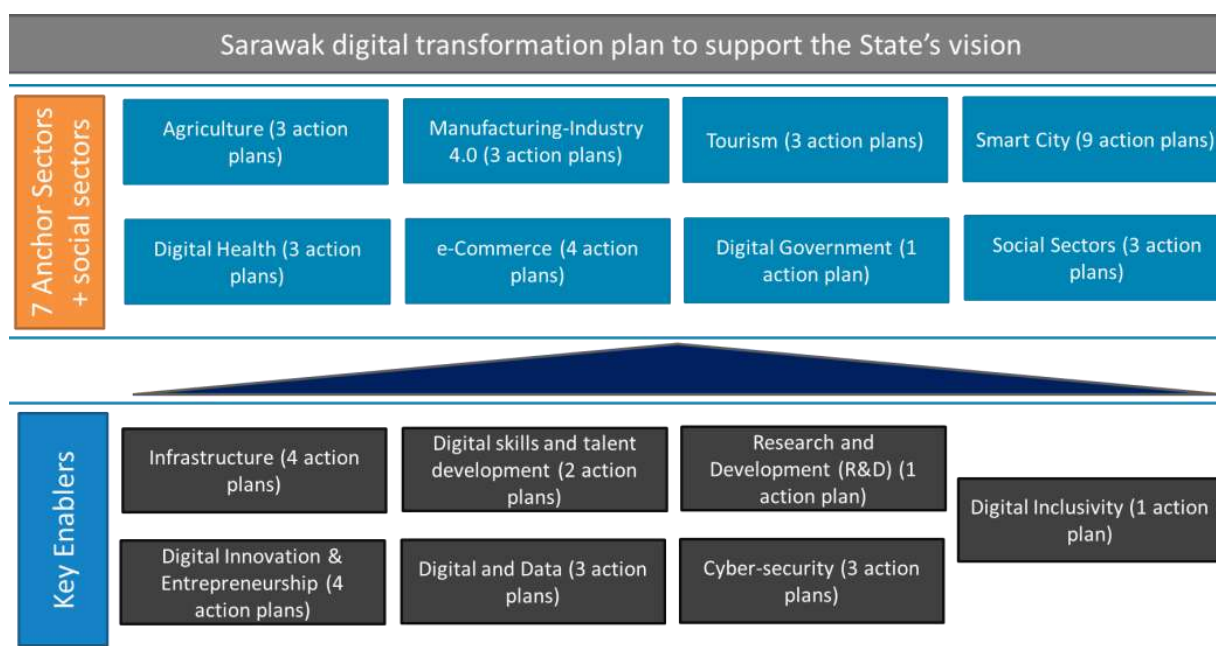


Figure 1-9: Sarawak Digital Economy Strategy

Source: Frost & Sullivan Analysis, Adapted from Sarawak Digital Economy Strategy (2018-2022)

1.4.3.4 12th Malaysia Plan on Sarawak (2021-2025)

Under the RMK-12 the main thrust of development for Sarawak focuses on improving the quality and availability of infrastructure, enhancing socio-economic potential, enhance access to social service, encourage inclusive development with cooperation between the federal and state government. The crux of the plan aims to reduce the disparities in living standards of Sarawak as compared to the rest of Malaysia.

The plan focuses on seven strategic areas that include:

Socioeconomic development – The development plan focuses on attracting investments through the RECODA initiative in particular in the manufacturing, heavy industries, and palm oil sectors. The plan also focuses on the development of the Tourism industry which has been severely impacted by the COVID-19 pandemic. Other economic development priorities under the RMK-12 include the development of small to medium enterprises and harnessing the economic potential of natural resources.

Enhancing connectivity through infrastructure – The plan focuses on the overall improvement of infrastructure which has been identified as a key factor that limits the growth of the Sarawak economy. Key developments include the continued development of the Pan Borneo highway, regional air services, improvements to short take-off and landing (STOL) airports and improving the interconnectivity with the internal regions of Sarawak.

Improving access infrastructure and basic services – The development programs proposed focuses on improving access to basic infrastructure such as water supply and electricity. In addition to basic infrastructure, the program under this bucket focuses on improving the access to more advanced infrastructure such broadband that would form the impetus for economic growth. Other aspects that fall under this bucket include access to key services such as education and banking.

Access to education and job opportunities – The development plan focuses on improving the access and quality of education particularly in the rural areas of Sarawak. A special channel will be setup to enhance access to public higher education for students with special needs, B40, indigenous population, and athletes. Other areas of focus include improving local participation in technical and vocational training

Native NCR land – The development plan aims to establish proper mapping of the NCR land to avoid disputes. In addition, the development plan aims to focus on economic development activities that would increase the economic activities based on NCR lands including attracting foreign investments that would drive large scale farming activities.

1.4.3.5 National Ecotourism Plan (2016-2025)

Summary: The National Ecotourism Plan is developed with the aim to serve as one of the instruments for overall sustainable development of Malaysia and also as a tool for conserving ecotourism sites. The plan focuses on 5 focus areas which are further broken by 19 strategies and 86 granular action items.



Figure 1-10: Overview of National Ecotourism Plan

Source: UNIMAS Holdings, Frost & Sullivan, National Ecotourism Plan (2016-2025)

As part of the Ecotourism Cluster focus area, the plan has identified 60 such clusters of which nine are in Sarawak including Sri Aman (Simanggang) - Batang Ai - Ulu Sungai Menyeng – Maludam. Developing

and promoting the nine ecotourisms clusters is the focus for the Sarawak Ministry of Tourism, Creative Industry and Performing Arts (Ministry of Tourism, 2016).

Developing Sri Aman (Simanggang) - Batang Ai - Ulu Sungai Menyang – Maludam cluster brings about immense potential in terms of revenue generation, employment opportunities as well as overall infrastructure development for the Sri Aman Division.



PART 2 **OVERVIEW OF SRI AMAN**

SECTION 2.1 REGIONAL CONTEXT

2.1.1 Location

The Sri Aman Division covers an area of approximately 5,629 square kilometres with an estimated population of 111,400 people (DOSM, 2020). It has a population density of 19.8 peoples per square kilometres. Sri Aman is one of the twelve (12) administrative divisions of Sarawak. The Sri Aman Division comprises of four (4) districts, Sri Aman, Lubok Antu, Lingga and Pantu, and one sub-district, namely Engkilili (under Lubok Antu District).

The Divisional capital of Sri Aman is Simanggang and is located at the southern bank of Batang Lupa. It is about 193km from Kuching and can be accessed via the Pan Borneo Highway. The Second Trunk Road is also being implemented which will connect to Simanggang from Sebuyau.

The Second Trunk Road will also include the construction of a bridge over Btng Lupa in Simanggang. This will be an important initiative in Sri Aman, facilitating access to the north side of the River, and providing a direct link from Simanggang to Betong.

Sri Aman is bounded by Samarahan and Serian to the west and Betong, Sarikei and Kapit Division to the east, northeast. The southern side of Sri Aman is defined by the Kelingkang range - part of the long international border shared between Sarawak and Western Kalimantan.



Figure 2-1: Sri Aman Division and Districts

Source: Land and Survey Dept, Sri Aman Division and Unit Pentadbiran Jabatan Premier Sarawak, 2022

Sri Aman is characterised by its current key economic activities. The Division is known for a number of tourism products and attractions associated with nature, adventure and the local culture. The Tidal Bore Festival is known throughout Sri Aman, celebrating the tidal bore phenomenon within Batang Lupar which occurs throughout the year. The Batang Ai Hydroelectric Dam is located within the study area. It features the Batang Ai Lake, and the catchment includes the Batang Ai National Park. The Batang Ai National Park shares its border with the largest trans-national protected area for tropical rainforest conservation in this region. Known as the Lanjak-Entimau Wildlife Sanctuary in Sarawak and the Bentuang-Karimun National Park in Kalimantan, this area is part of the HOB initiative.

Sri Aman has been reported to have a total of 665 settlements (based on data provided by the Sri Aman Resident Office). The Sri Aman District has a total of 387 settlements whereas Lubok Antu District has 278 settlements (Table 2-1).

Traditionally, settlements have been mostly located along the major riverine system, as rivers provided the main mode of transportation prior to the availability of the trunk and feeder roads. Settlements then started to develop in a linear pattern along major road.

Table 2-1: Number of Settlements

Districts	No. of Settlements ¹	No. of Household ^{*e}	Population Size ²
Sri Aman	387	17,950	78,300
Lubok Antu	278	8,631	33,100
Sri Aman Division	665	26,581	111,400

Note: ^{*e} = estimated

Source: ¹Sri Aman Resident Office, ²My Local Stats, 2019

The inland towns are predominantly made up of the local Chinese population. Malay-dominated villages on the other hand are located on the urban fringes of the region and on kampong lands towards the coast or along major rivers. The Iban community, which forms the majority group within the district, live in longhouses that are scattered throughout the Study Area. Padi farms and small agricultural plots are also often located within the vicinity of the longhouses.

2.1.2 Population and Settlements

Population denotes the people living within a designated area. Research and analysis of population data, which involves analysing the size, composition and distribution of people, is used to understand the changes in growth, age composition and distribution of a population. These population variables are crucial in ascertaining people's views on important issues, the development planning, the conduct of industry and commerce, the provision of social services, the collection of taxes, the election of legislators or representatives, etc. They have a substantial impact on income and investment, as well as the demands for employment, housing, education, health, welfare, and other services.

2.1.2.1 Demographic Analysis for Sri Aman Division

Longitudinal and retrospective research was carried out using appropriate demographic techniques to analyze and tabulate demographic data from 1980 to 2020 of Sri Aman's population in order to provide baseline information for the planning and implementation of the Sri Aman Master Plan, 2020-2030. The identification of the pattern and trends amongst Sri Aman's population will help inform the social and economic progress of its population as social and economic conditions are variables which influence the population.

The analysis data was drawn from the government census reports from over the last 50 years (1980, 1991, 2000, 2010, 2020), annual and monthly statistical reports as well as births and deaths registration statistics, and the New Administrative Boundaries of Sarawak (Serian, Samarahan and Sri Aman Divisions) prepared by the Unit Pentadbiran, Jabatan Ketua Menteri Seksyen Pentadbiran Bahagian (2021). They are valuable and reliable sources for measuring demographic differentials, dynamics of growth and change within the population.

This analysis focuses on the size, composition and distribution of people in the Sri Aman Division and its districts and sub-districts. The number of people, children and adults, the age-sex composition, urban and rural living, mobility and rate of migration are factors that were considered as part of the analysis. The recognition of the patterns and trends of growth and change of the population will be crucial in assisting with constructing social and economic development plans, as well as projections for the future growth of the population. Using the analysed population data, the Sri Aman masterplan was able to develop projections of the population size, age structure and migration trends within the region for over the next decade.

A cross demographic, socio-economic survey of the Sri Aman Division and its two districts and sub-districts was conducted and its findings were used to complement and assist in explaining the relevant variables for the desk research.

The results of the analysis have assisted in informing the development of various strategies to bring about population changes while acknowledging the effects of migration in line with the megatrends of economic, social and political systems. The implementation of these strategies aims to ensure optimum

use of Sri Aman Division's resources, human as well as physical, to raise the standard of living of its people, thus meeting the goal of ensuring improved welfare for the region's population as a whole.

2.1.2.2 *Demographic Perspectives and Constraints in Sri Aman Division*

According to government statistics, findings from the cross-sector field survey, assertions made by the community leaders during discussions, and participation observations by the project consultants, it can be clearly observed that Sri Aman's population of 111,400 in 2020 is notably small and the forecasted increase of its population to 132,000 in 2030 is still relatively small. The small and sparsely distributed population of Sri Aman has impeded the progress of commercialization, industrialization and mechanization of agriculture in Sri Aman Division as there lacks a substantial domestic market as well as the lack of a strong labor force and sufficient infrastructure. As predicted by the analysis, the expected growth of Sri Aman's population lies just slightly above 20,000 for over the next ten (10) years, from 2020 to 2030, which is arguably insufficient enough to handle the numerous projects prepared by the SAMP. The lack of manpower is further hampered by the heavy out-migration of young people from the villages to work in cities, which leaves behind many empty doors and swelling cohorts of old people in the longhouses, kampungs and villages. It is therefore crucial to formulate an expansive population policy by calling for return-migrants or resettle new migrants to meet the manpower needs for future development.

2.1.2.2.1 *The Pattern of Migration in Sri Aman Division*

Changes within a population are primarily determined by the birth, death and migration rates. The forecast for the migrant population amongst the total population of Sri Aman Division is 5,950 in 2020, and projected to be around 19,978 by 2030. Evidence from the findings of the cross-sector field survey and the assertion of the community leaders had revealed that the population movement in Sri Aman Division was frequent and intensive, constituting 23% of the sample population.

The primary reason given by the local population as to why they would migrate out of Sri Aman was for better employment opportunities, followed by the reason of family influence and furthering education. Migrants who leave would usually return within a duration of 10 years or sooner. This is symptomatic of what is referred to as short-term circulation movement, reflecting their desire to hold on to their local heritage while also attempting to benefit from the superior economy outside by engaging in temporary employment outside the village. Thus, the movement of people, ultimately, has no substantial change in terms of the population's permanent place of residence. This is typical for the longhouse dwellers, as they practice "bilek-family system" and they own the bilek unit in perpetuity. They will eventually return to their longhouse for retirement. However, permanent migration seems most likely to happen amongst the Chinese and, to some extent, the Malay population. The young Chinese and Malays, who wish to be employed in the city, are especially more likely to settle down there.

The local Community Leaders highlighted that migration was frequent in their villages. Around 79% of villagers had migrated out for employment. Kuching, Miri, Singapore and West Malaysia were the most favoured places for them to go. By comparing the migration pattern more closely by districts and sub-districts, it was found that Lingga had the highest rate of out-migration at Kampung Skait and Rumah Jiram, almost all the households there had members who had migrated. In Kampung Hilir Stumbin, Rumah Phyllis and Kampung Hulu Pankat, 50% of their residents had migrated. Kampung Masjid had 40% of its residents had migrated. In Engkilili, 80% of the Chinese in Jelukong, 50% of the Chinese in Merio/Selindung had migrated to Kuching, Miri, Singapore and West Malaysia for employment. At

Rumah Kandis in Engkilili, about 40% of its residents had migrated to work in Kuching, Bintulu and other places in Sarawak. In Lubok Antu, Rumah Sebinkai, 40% of its residents migrated to West Malaysia and Singapore for employment.

At the same time, it is wise to work out strategies to create employment for the people in order to curb out-migration from Sri Aman, and to enable sustainable growth of manpower for socio-economic development.

Strategies to curb out-migration from Sri Aman:

- a) To introduce Simanggang, the capital of the Sri Aman Division, to new urban developments within Sarawak's urban structure. A divisional program, with decentralizing development planning, as well as administrative and investment decision, should be formulated.
- b) To develop Sri Aman and Lubok Antu districts and their sub-districts into mechanizing agricultural and food-basket producing centres, and eco-tourism attractions.
- c) To develop Simanggang and introduce industrial and service centres, so that people of the rural areas in Sri Aman and Lubok Antu districts and sub-districts can come and work.
- d) To improve the village infrastructure, especially road links to Simanggang or Lubok Antu townland so as to enable changes of the villagers' labor and mobility patterns.
- e) To apply community-based agriculture schemes for selected cash crop plantations by a cluster of longhouses.
- f) To use available untitled idle longhouse NCR lands for community-based mechanized agriculture scheme.
- g) To inculcate change of circulation to commuting as an alternate form of movement for people in Sri Aman and Lubok Antu districts.
- h) To recognise the influence of Iban's traditional cultural values and attitudes toward migration (berjalai).
- i) To set up mechanized agriculture, light-industry, food processing or food packaging, tourist guard, home science training and learning institutions for high school leavers in Simanggang. The current educational curricula do not teach rural youths the practical skills on farm work. If anything, education now makes people less suited to rural life.

2.1.2.2.2 Summary Findings of the Cross Demographic, Socio-Economic Survey

The Sri Aman Master Plan 2020-2030 cross-sectional survey, which was accompanied by the community leaders' discussion on certain demographic variables, was conducted in Sri Aman and Lubok Antu districts and Engkilili, Pantu and Lingga sub-districts on 14-18 September 2020. The salient points in the report are highlighted as follows:

- a) This study covers five (5) sub-districts of Sri Aman
- b) Lubok Antu is an official border crossing point between Sarawak and Indonesian Kalimantan, while Engkilili, Batu Lintang and Lachau have accessible paths for border crossing.
- c) A total of nine hundred and ninety-nine (999) respondents were systematically and randomly selected in this study. The respondents consisted of 875 household heads and 124 others (wife or children).
- d) Around 23% of the people (household heads) surveyed have migrated in the past; and the remaining 77% have never migrated (refer Table 2-2: Item No.1). Statistics in figure below reveal the different pattern of migration among the people in the Sri Aman district and sub-districts of Sri Aman Division. There are 31% of the population who have been involved in migration in Sri Aman district, 30% in Engkilili sub-district, 25% in Pantu sub-district, 16% in Lubok Antu district and 15% in Lingga sub-district.
- e) Among those who have migrated, 42% involved in internal migration, while 58% involved in external migration (Table 2-2: Item No.2).

- f) The pattern of migration indicates that 48% involve in internal and 52% external migration in Sri Aman district, 59% and 41% respectively in Pantu, 26% and 73% respectively in Lingga, 21% and 70% respectively in Lubok Antu, and 59% and 41% in Engkilili (Table 2-2: Item No.2).
- g) The most popular receiving districts for Sri Aman Division out-migrants within Sarawak are Kuching, Sri Aman, Miri and Sib. Kuching accounts for 21%, Sri Aman for 20%, Miri for 13% and Sib. accounts for 9% of all Sri Aman Division's out-migrants (Table 2-2: Item No.3).
- h) Most of Sri Aman Division's out-migrants have stayed away for 5 years or less, 30%, and some stayed away for 6 to 10 years, 24%. However, there are people who stayed away for even more than 30 years, 7% and 26 to 30 years, 9% before they returned to Sri Aman Division (Table 2-2: Item No.4).
- i) Two of the main reasons for out-migration in Sri Aman Division are employment, 51%, and following family, 23%. 90% of Sri Aman Division's out migrants in Sarawak do not intend to return to Sri Aman before, and the reasons for them to return to Sri Aman before were to follow family members, having own house, to take care of family member and place of birth (Table 2-2: Item No.5).
- j) For those out-migrants involved in external migration, the places where most of them go are West Malaysia (Johor Baru), 65%, overseas (Brunei and Singapore), 24% and East Malaysia (Sabah), 11% (Table 2-2: Item No.6). The duration for the migrants to be away was 6 to 10 years, 30%, followed by 5 or fewer years, 29%. There were 18% of the migrants who stayed away for over 16 to 20 years (Table 2-2: Item No.7).
- k) The Statistics show that 85% of external migration was for employment, and 9% was following family members (Table 2-2: Item No.8).

Table 2-2: Summary Findings of the Cross Demographic, Socio-Economic Survey

No.	Questionnaire Items	Answers	Sri Aman		Lubok Antu		TOTAL	
			Simanggang	Pantu	Lingga	Lubok Antu	Engkelili	
			No. %	No. %	No. %	No. %	No. %	No. %
1	No. of Respondent Reside In Other Location Other Than Current Settlement	Yes	76 31.0%	25 24.5%	31 15.2%	39 16.0%	56 29.6%	227 23.1%
		No	169 69.0%	77 75.5%	173 84.8%	204 84.0%	133 70.4%	756 76.9%
		Total	245 100.0%	102 100.0%	204 100.0%	243 100.0%	189 100.0%	983 100.0%
2	No Of Respondent Resides Within Or Outside Sarawak Other Than Current Settlement	Within Sarawak	63 48.5%	22 59.5%	27 26.2%	21 29.6%	33 58.9%	54 42.5%
		Outside Sarawak	67 51.5%	15 40.5%	76 73.8%	50 70.4%	23 41.1%	73 57.5%
		Total	130 100.0%	37 100.0%	103 100.0%	71 100.0%	56 100.0%	127 100.0%
3	District Within Sarawak That Respondent Has Been Resided Other Than The Current Settlement	Limbang	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
		Kuching	17 28.8%	1 5.30%	8 30.77%	2 6.90%	3 18.75%	31 20.80%
		Sibu	2 3.4%	1 5.30%	5 19.23%	5 17.20%	1 6.25%	14 9.40%
		Bintulu	0 0.0%	3 15.80%	1 3.85%	1 3.40%	0 0.00%	5 3.40%
		Sri Aman	15 25.4%	6 31.60%	4 15.38%	2 6.90%	3 18.75%	30 20.10%
		Miri	3 5.1%	1 5.30%	3 11.54%	8 27.60%	4 25.00%	19 12.80%
		Belong	2 3.4%	0 0.00%	2 7.69%	1 3.40%	0 0.00%	5 3.40%
		Serian	2 3.4%	2 10.50%	0 0.00%	2 6.90%	0 0.00%	6 4.00%
		Pantu	0 0.0%	1 5.30%	0 0.00%	0 0.00%	0 0.00%	1 0.70%
		Lubok Antu	0 0.0%	0 0.00%	0 0.00%	4 13.80%	0 0.00%	4 2.70%
		Engkelili	2 3.4%	0 0.00%	0 0.00%	0 0.00%	2 12.50%	4 2.70%
		Others	16 27.1%	4 21.10%	3 11.54%	4 13.80%	3 18.75%	30 20.10%
		Total	59 100.0%	19 100%	26 100%	29 100%	16 100%	149 100%
4	Duration (in years) For Respondent To Reside Within Sarawak Other Than The Current Settlement	5 or less	16 27.6%	3 13.64%	12 44.44%	11 42.31%	7 21.21%	49 29.52%
		6 to 10	21 36.2%	4 18.18%	3 11.11%	4 15.38%	8 24.24%	40 24.10%
		11 to 15	7 12.1%	3 13.64%	2 7.41%	4 15.38%	1 3.03%	17 10.24%
		16-20	4 6.9%	3 13.64%	3 11.11%	1 3.85%	6 18.18%	17 10.24%
		21-25	6 10.3%	2 9.09%	3 11.11%	1 3.85%	4 12.12%	16 9.64%
		26-30	4 6.9%	4 18.18%	3 11.11%	2 7.69%	2 6.06%	15 9.04%
		More than 30	0 0.0%	3 13.64%	1 3.70%	3 11.50%	5 15.15%	12 7.23%
		Total	58 100.0%	22 100%	27 100%	26 100%	33 100%	166 100%
5	Reasons For Respondent To Reside Within Sarawak Other Than The Current Settlement	Working	36 63.2%	9 40.91%	8 29.63%	1 20.00%	19 59.38%	73 51.05%
		Following Family Member	6 10.5%	3 13.64%	15 55.56%	2 40.00%	7 21.88%	33 23.08%
		Studying	1 1.8%	1 4.55%	0 0.00%	0 0.00%	0 0.00%	2 1.40%
		Temporary Place to Stay	1 1.8%	0 0.00%	1 3.70%	0 0.00%	0 0.00%	2 1.40%
		Place of Origin	0 0.0%	9 40.91%	3 11.11%	1 20.00%	6 18.75%	19 13.29%
		Others	13 22.8%	0 0.00%	0 0.00%	1 20.00%	0 0.00%	14 9.79%
		Total	57 100.0%	22 100%	27 100%	5 100%	32 100%	143 100%
6	District Outside Sarawak That Respondent Has Been Resided Other than The Current Settlement	West Malaysia	15 68.0%	5 100%	4 100%	6 46%	5 50%	35 65%
		East Malaysia	2 9.0%	0 0%	0 0%	3 23%	1 10%	6 11%
		Overseas	5 23.0%	0 0%	0 0%	4 31%	4 40%	13 24%
		Total	22 100.0%	5 100%	4 100%	13 100%	10 100%	54 100%
7	Duration (in years) For Respondent To Reside Outside Sarawak Other Than The Current Settlement	5 or less	5 21.7%	2 40.00%	1 25.00%	4 28.57%	4 40.00%	16 28.57%
		6 to 10	7 30.4%	3 60.00%	0 0.00%	5 35.71%	2 20.00%	17 30.36%
		11 to 15	4 17.4%	0 0.00%	0 0.00%	1 7.14%	1 10.00%	6 10.71%
		16-20	3 13.0%	0 0.00%	1 25.00%	3 21.43%	3 30.00%	10 17.86%
		21-25	3 13.0%	0 0.00%	2 50.00%	1 7.14%	0 0.00%	6 10.71%
		26-30	1 4.4%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	1 1.79%
		More than 30	0 0.0%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
		Total	23 100.0%	5 100%	4 100%	14 100%	10 100%	56 100%
8	Reasons For Respondent To Reside Outside Sarawak Other Than The Current Settlement	Working	12 85.7%	3 60.00%	4 100.00%	20 90.91%	7 77.78%	46 85.19%
		Following Family Member	1 7.1%	2 40.00%	0 0.00%	1 4.55%	1 11.11%	5 9.26%
		Others	1 7.1%	0 0.00%	0 0.00%	1 4.55%	1 11.11%	3 5.56%
		Total	14 100.0%	5 100%	4 100%	22 100%	9 100%	54 100%

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.1.2.3 Summary Findings of the Community Leaders Discussion

The discussions were conducted between the survey consultants and 71 community leaders from the survey areas. The feedbacks from the community leaders indicate that 68% of them agreed that the population in the areas under study has increased over the last 10 or 20 years, while 21% has decreased, and 11% has not changed. Pantu and Batu Lintang are the two areas which have experienced population decrease at 60% and 44% respectively. 73% of the community leaders feel that there are fewer youths in the areas now and there are 66% of the families which are small-sized families, with 1 to 3 children, while 34% are medium-sized, with 4 to 6 children; there was no large-sized family in the area (Table 2-3).

Table 2-3: Summary Findings of the Community Leaders Discussion

No.	Questionnaire Items	Response	Simanggang	Pantu	Lingga	Batu Lintang	Lubok Antu	Engkelili	TOTAL
			No. %	No. %	No. %	No. %	No. %	No. %	No. %
1	Number of Population	Increase	13 72.2%	2 40.0%	10 76.9%	5 55.6%	10 71.4%	8 66.7%	48 67.6%
		Decrease	4 22.2%	3 60.0%	0 0.0%	4 44.4%	3 21.4%	1 8.3%	15 21.1%
		No Change	1 5.6%	0 0.0%	3 23.1%	0 0.0%	1 7.1%	3 25.0%	8 11.3%
		Total	18 100.0%	5 100.0%	13 100.0%	9 100.0%	14 100.0%	12 100.0%	71 100.0%
2	Number of Youth	Many	7 38.9%	1 20.0%	0 0.0%	3 33.3%	5 35.7%	3 25.0%	19 26.8%
		Few	11 61.1%	4 80.0%	13 100.0%	6 66.7%	9 64.3%	9 75.0%	52 73.2%
		Total	18 100.0%	5 100.0%	13 100.0%	9 100.0%	14 100.0%	12 100.0%	71 100.0%
3	Family Size	Small	7 38.89%	3 60%	7 53.85%	8 88.89%	14 100%	8 66.67%	47 66.20%
		Medium	11 61.11%	2 40%	6 46.15%	1 11.11%	0 0.00%	4 33.33%	24 33.80%
		Large	0 0.00%	0 0%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%
		Total	18 100%	5 100%	13 100%	9 100%	14 100%	12 100%	71 100%
4	Attending Secondary School	Many	11 61.11%	1 20%	4 30.77%	3 33.33%	1 7.14%	5 41.67%	25 35.21%
		Few	7 38.89%	4 80%	8 61.54%	6 66.67%	13 92.86%	7 58.33%	45 63.38%
		Total	18 100%	5 100%	13 100%	9 100%	14 100%	12 100%	71 100%
5	Youth Literacy	Literate	18 100%	5 100%	12 92.31%	9 100%	14 100%	12 100%	70 98.59%
		Illiterate	0 0.00%	0 0%	1 7.69%	0 0.00%	0 0.00%	0 0.00%	1 1.41%
		Total	18 100%	5 100%	13 100%	9 100%	14 100%	12 100%	71 100%
6	People Stay Away	Many	12 66.67%	3 60%	13 100%	9 100%	9 64.29%	10 83.33%	56 78.87%
		Few	5 27.78%	1 20%	0 0.00%	0 0.00%	3 21.43%	2 16.67%	11 15.49%
		None	1 5.56%	1 20%	0 0.00%	0 0.00%	2 14.29%	0 0.00%	4 5.63%
		Total	18 100%	5 100%	13 100%	9 100%	14 100%	12 100%	71 100%
7	People Go To Kalimantan	Sometime	0 0.00%	0 0.00%	0 0.00%	2 22.22%	5 35.71%	4 33.33%	11 15.49%
		Seldom	1 5.56%	0 0.00%	0 0.00%	0 0.00%	6 42.86%	0 0.00%	7 9.86%
		No	18 138%	5 100%	13 100%	6 66.67%	3 21.43%	8 66.67%	53 74.65%
		Total	18 100%	5 100%	13 100%	9 100%	14 100%	12 100%	71 100%
8	Relatives At Kalimantan	Many	0 0.00%	0 0.00%	0 0.00%	2 22.22%	3 21.43%	3 25.00%	8 11.27%
		A Few	5 27.78%	0 0.00%	0 0.00%	1 11.11%	7 50.00%	4 33.33%	17 23.94%
		None	13 72.22%	5 100%	13 100%	6 66.67%	4 28.57%	5 41.67%	46 64.79%
		Total	18 100%	5 100%	13 100%	9 100%	14 100%	12 100%	71 100%

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The community leaders informed that there are fewer youths attending secondary schools now and that all the youths aged 15 and over in the area are literate. However, many local residents, 79% of them have migrated out for employment. Kuching, Miri, Singapore and Peninsular Malaysia are the most favored place for them to go.

There are 16% of the residents in Sri Aman who sometime have gone across the border, 10% seldom go, and 75% have never gone to Kalimantan, Indonesia. There are 11% of the local residents who have many relatives living across the border in Indonesia, while 24% have only a few relatives living there, and 65% do not have relatives living there.

By comparing the migration pattern more closely by districts and sub-districts, it was found that Lingga has the highest rate of out-migration. At Kampung Skait and Rumah Jiram, almost all the household there have members who have migrated. In Kampung Hilir Stumbin, Rumah Phyllis and Kampung Hulu Pankat, all are having 50% of their residents who have migrated. Kampung Masjid has 40% of its residents who have migrated. The purpose of migration is for jobs. In Engkilili, 80% of the Chinese in Jelukong, 50% of the Chinese in Merio/Selindung have migrated to Kuching, Miri, Singapore and West Malaysia for employment. At Rumah Kandis in Engkilili, about 40% of its residents have migrated to work in Kuching, Bintulu and other places in Sarawak. In Lubok Antu, Rumah Sebinkai, 40% of its residents migrated to West Malaysia and Singapore for employment.

On relatives across the border, the residents in Rumah Tinting in Lubok Antu are all having relatives in Indonesia, while in Engkilili at Rumah Kumpang Paoh A, almost all households there have relatives across the border. At Rumah Muris, Soh, there are three quarters of its resident having relatives across the border.

On places of visit in Kalimantan, local residents in Batu Lintang visit Sungai Antu, Langgau, Jaong, Semuntik Lanjak and Sibau occasionally. Engkilili residents visit Marakai. This is because of close proximity of the areas to one another. The purposes of visit are visiting relatives, sight-seeing, on vacation and taking part in festival ceremony.

2.1.2.4 Overview of Population in Sri Aman Division

2.1.2.4.1 Regional Context: Population of Borneo/Kalimantan

Sarawak and Sabah, located within the island of Borneo, became two regions of the federation of Malaysia on 16 September 1963; Brunei Darussalam gained independence from the British government on 1 January 1984. It is a Malay Islamic monarchy country. The Kalimantan of Indonesia obtained independence from the Dutch government in 1949.

Sarawak is the largest in terms of land area in the Federation of Malaysia. It straddles across the north-west of the island of Borneo. It comprises twelve administrative divisions, and these divisions are further sub-divided into forty (45) administrative districts in 2021, but some of them have yet to be gazetted (Department of Statistics Sarawak, 5.4.2022).

Sarawak had a total population of 2,471,140 in 2010; and was estimated at 2,907,500 in 2020. Sarawak is a multi-ethnic society in which the six major communities, according to priority order in number in 2010, are Iban, 28.9 per cent; Malay, 23.4 per cent; Chinese, 23 per cent; Bidayuh, 8 per cent; Orang Ulu 6.3 per cent; and Melanau, 5 per cent. These ethnic communities have had distinctive cultural, social and economic conditions.

Sabah, the second largest in terms of land area, in the northern part of Borneo had a total population of 3.1 million in 2010; and it increased to 3.7 million in 2015. Sabah, like Sarawak, is a multi-ethnic society, and its main ethnic groups are Kadazan and Dusun, 17.8 per cent; Bajau, 14 per cent; Chinese, 9.1 per cent; Malay, 5.7 per cent; Murut, 3.2 per cent, and non-Malaysian citizen, 27.8 per cent.

Brunei is a sovereign state located on the north coast of Borneo. The ethnic groups of Brunei comprise Malays, 66.3 percent, Chinese, 11.2 percent, Indigenous Borneo, 2.3 percent, Indian, 2.3 percent and others, 16.8 percent. Though Brunei is a small country, both in land size and population, it has a wealthy economy. Its wealth derives mainly from oil and gas production, and these two products accounts for 90 percent of its GDP. Brunei produces about 167,000 barrels (26,600 m³) of oil every day, making Brunei the fourth largest production of oil in Southeast Asia. It produces approximately 25.3 million cubic meters of liquefied natural gas every day, making Brunei the ninth largest exporter of gas in the world. Meanwhile, Brunei carries investments in other countries to supplement its income revenue. Most of the food and consumer items of Brunei are imported from outside the country; it has little manufacturing and industry.

Indonesian Borneo/Kalimantan is divided into five provinces, namely: West Kalimantan, with an area of 147,307.00 square kilometers, a total population of 4,393,239 in 2010, and its capital is Pontianak; Central Kalimantan, having an area of 153,564.50 sq.km, a total population of 2,202,599, and its capital is Palangkaraya; South Kalimantan, having an area of 38,744.23 sq.km, a total population of 3,626,119, and its capital is Banjarmasin; East Kalimantan, occupying an area of 133,357/62 sq.km, a total population of 3,550,586, and its capital is Banjarmasin; North Kalimantan, occupying an area of 71,176.72 sq.km, a total population of 524,526, and its capital is Tanjung Selor. The population of Indonesian Borneo/Kalimantan is largely ethnic Malay and Muslim, who live mostly in coastal areas. However, there are also a significant number of non-Muslim Dayaks.

Table 2-4: Features of Borneo/Kalimantan

Basic Information	Malaysia (Sarawak)		Malaysia (Sabah)		Indonesia (Kalimantan)		Brunei	Total
Area (km ²)	124,450	16.9%	73,631	10.0%	544,150	74.1%	5,772	734,540
Population (million) (%)	2.7	13.1%	3.2	15.5%	14.3	69.4%	0.4	20.6
Date Gained Independence	16.9.1963				17.8.1945		1.1.1991	

Sources: <http://en.wikipedia.org/wiki/Kalimantan>. Retrieved 10 October, 2015; Kalimantan-Wikipedia, the free encyclopedia.

2.1.2.4.2 Population of Sarawak

Sarawak land area is 124,449.5 square kilometres, comprising of 12 administrative divisions and 45 administrative districts. It has an estimated population of 2,907,500 in 2020. The annual growth rate of Sarawak population was 2.60% between 1980 and 1991. The most recent annual growth rate between 2010 and 2020 was 1.63%, which had declined 0.97% for the last 50 years (Table 2-5).

Table 2-5: Sarawak Population, 1980, 1991, 2000, 2010 and 2020

	1980	1991	2000	2010	2020
Sarawak Population	1,235,553	1,642,771	2,071,506	2,471,140	2,907,500
Average Annual Growth Rate (%)	-	2.60	2.60	1.80	1.63

Sources: Population Census Malaysia 1980: Population and Housing Census of Malaysia, General Report of the Population Census, Vol. 1, Department of Statistics Malaysia, Kuala Lumpur; Population Census Malaysia 1991, 2000, 2010 State Population Report, Sarawak, Department of Statistics Malaysia, Kuala Lumpur; and 2020 Population by Age Group, Sex and Ethnic Group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak, 2020.

*Average Annual Growth Rates are calculated by exponential growth rate based on total Sarawak population.

2.1.2.4.3 Population of Sri Aman's Neighbouring Districts--Betong, Sarikei and Sibü

The size and population of Betong, Sarikei and Sibü districts, the districts neighbouring Sri Aman and Lubok Antu districts shows that Betong district had a population of 73,600 in 2020, while Sarikei had 67,400 and Sibü, 288,000. The growth of population reflects that Betong population increased by 99.9%, Sarikei increased by 63.7% and Sibü increased by 129.9% over the last 50 years (Table 2-6).

The average annual population growth rate of Betong, Sarikei and Sibü districts shows that Sibü attained the highest annual growth rate of 2.79% and 2.27% in 1980 to 1991 and 1991 to 2000 respectively, while Betong had the highest annual growth rate of 1.89% and 1.69% in 2000 to 2010, and 2010 to 2020 respectively. However, Sarikei's annual population growth rate was high at 1.70% and 1.54% in the early years of 1980 to 1991, and 1991 to 2000, it falls to 0.18% in 2000 to 2010, and rose to 1.50% in 2010 to 2020. In general, Betong district had always maintained a stable pattern of annual population growth rate comparing to the other districts, and its annual population growth rate was the highest among all the districts in recent years.

Table 2-6: Sri Aman Neighboring District Population, 1980, 1991, 2000, 2010 and 2020

	District	1980	1991	2000	2010	2020	Different between 1980 and 2020
Neighbouring District Population	Betong	36,821	43,993	51,428	62,131	73,600	36,779
	Sarikei	41,158	49,631	56,992	58,021	67,400	26,242
	Sibü	125,254	170,399	209,012	247,995	288,000	162,746
Average Annual Growth (%)	Betong	-	1.62	1.73	1.89	1.69	-
	Sarikei	-	1.70	1.54	0.18	1.50	-
	Sibü	-	2.79	2.27	1.71	1.50	-

Sources: 1980 Population and Housing Census of Malaysia, Vol.2, June 1983, pp.22-23., 1991: Monthly Statistical Bulletin Sarawak, Mac 2004, p.9., 2000: Ethnic Breakdown: Monthly Statistical Bulletin Sarawak, Mac 2004, pp.18-19. 2010: Monthly Statistical Bulletin Sarawak, June 2012, pp.19-20. 2020: Population by age group, sex and ethnic group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak.

2.1.3 Population Projection for Sri Aman Division and Districts, 2020 to 2030.

The projection of the future population of the Sri Aman Division, as well as the specific populations of the Sri Aman and Lubok Antu districts, were made based on the annual growth pattern and trends of the Sri Aman Division and districts' population for over the past 50 years (1980-2020). The annual growth rate of a population which has taken into account all of the demographic variables over a period of time is valid as a base for forecasting future population numbers. A separate projection was also made for the newly upgraded Lingga and Pantu districts.

This forecast will first compute the average annual growth rate from the total population of the Sri Aman Division, Sri Aman and Lubok Antu districts using the four government census reports of 1980, 1991, 2000, 2010 and the population estimation report of 2020. As there was no population data base for the newly upgraded Lingga and Pantu districts, until 1st December 2021 when the population of these two districts were officially released by the Unit Pentadbiran, Jabatan Ketua Menteri Seksyen Pentadbiran Bahagian (JKM), the pattern and trends of population of these two former sub-districts for the past 5 decades had to be analysed and presented under Sri Aman district in this report. However, a separate population projection and a separate estimation of out-migration population and population increase for these two new districts, together with Sri Aman district, using the new 2021 JKM population data

will be performed from 2021 till 2030 as a supplement to this report. The exponential growth formula is being applied (as shown in Table 2-40). The resulted pattern and trends of the population will be compared and explained.

The three (3) projections on population growth and population increases are made for Sri Aman Division, Sri Aman district and Lubok Antu district at a level decided for the 10 years period, 2020-2030. And a separate population projection is made for the newly upgraded Lingga and Pantu, together with Sri Aman districts, from 2021 to 2030.

The first one is based on the stable population growth rate of 2010-2020 of the three areas; the second one demonstrates the difference in growth rate in 2010-2020 between Lubok Antu and Sri Aman districts to their respective 2010-2020 growth rates for the 2020-2030 projection; and the third one shows the difference of Lubok Antu district's 2010-2020 and the 2000-2010 annual growth rate to each area's 2010-2020 annual growth rate for projection. From Table 2 7, the average annual growth rate of the Sri Aman district and Sri Aman Division fluctuated greatly between 1991-2000 and 2000-2010. In contrast, the Lubok Antu population growth rates for the last 30 years were quite consistent. The pattern and trends of Sri Aman population for the last 50 years was as a result of the extremely low average annual growth rate before 2010, especially for the Sri Aman district. However, since 2010 the average annual growth rate has gained more momentum.

Table 2-7: Sri Aman Population Projection, 2020 - 2030

Year	Area (Rate)	Sri Aman Division			Sri Aman District		Lubok Antu District		
	1.62%	1.73%	1.75%	1.59%	1.68%	1.72%	1.68%	1.77%	1.81%
2020	111,400	111,400	111,400	78,300	78,300	78,300	33,100	33,100	33,100
2021	113,205	113,327	113,350	79,545	79,615	79,647	33,656	33,685	33,699
2022	115,039	115,288	115,333	80,810	80,953	81,017	34,222	34,282	34,309
2023	116,902	117,282	117,351	82,095	82,313	82,410	34,796	34,889	34,930
2024	118,796	119,311	119,405	83,400	83,696	83,828	35,380	35,504	35,562
2025	120,721	121,375	121,495	84,726	85,102	85,269	35,975	36,135	36,206
2026	122,676	123,475	123,621	86,073	86,532	86,736	36,580	36,774	36,861
2027	124,664	125,612	125,784	87,442	87,985	88,228	37,194	37,425	37,528
2028	126,683	127,784	127,985	88,832	89,464	89,745	37,819	38,088	38,208
2029	128,735	127,784	130,225	90,245	90,967	91,289	38,455	38,762	38,899
2030	130,821	132,244	132,504	91,679	92,495	92,859	39,101	39,448	39,603

Sources: 2020 population derived from the Population by Age Group, Sex and Ethnic group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak, and the average annual growth rate 2020 refer to Table 2-46. 2030 population are tabulated by the average annual growth rate worked out by exponential growth formula from the preceding census population. The forecasted medium rank annual growth rate was applied, e.g. 1.73% for Sri Aman Division; 1.68% for Sri Aman District; and 1.77% for Lubok Antu district.

The population projection based on the three assumptions of growth rates as stipulated above has yielded the following results. The population of Sri Aman Division will have 130,821 or 132,244 or 132 504 people respectively in 2030; while Sri Aman district will reach the number 91,679 or 92495 or 93859 respectively; and Lubok Antu district will achieve the number of 39,101 or 39448 or 39,603 respectively in 2030 (Table 2-7).

The three projections can be reasonably considered to be accurate if the following conditions are fulfilled. When the Sri Aman Division and its districts start their well-planned social and economic development under the Sri Aman Master Plan, 2020-2030, the population growth rate and the population number in Sri Aman will increase moderately for the first 5 years, this fits into the prospect

of Projection Two, and when the development programs are vigorously pursued, the growth and the increase of population will be actual in the Projection Three. But if there is no further development in Sri Aman, there will be a low growth rate and small increases of population which is a reflection in Projection One. With the expectation that there are development projects to be implemented in Sri Aman in the coming decade, the population growth rate and the population increase as shown in the Forecast 2 and 3 are more plausible.

In view of the extensive expansion of land area as delineated from Sebuyau sub-district and Sri Aman district; the absorption of a large number of population from the delineated areas into the newly upgraded Lingga and Pantu districts; and many development projects initiated by the SAMP, 2020-2030, it is expected that the population growth will be faster in Lingga and Pantu districts. The population growth index, based on SAMP Sri Aman district's 1.68% average annual growth rates is set for the projection.

The computation of the population projection in 2030 yields 14,247 for Lingga district, which increased 1,984 people or 16.2%; and 13,005 for Pantu district, which increased 1,811 people or 16.2% (Table 2-8, bottom line).

Table 2-8: Lingga and Pantu Districts Population Projection, 2021-2030*

(1) Year	(2) Lingga district Population	(3) Pantu District Population
2021	12,263*	11,194*
2022	12,469	11,382
2023	12,679	11,573
2024	12,892	11,768
2025	13,108	11,965
2026	13,328	12,166
2027	13,552	12,371
2028	13,780	12,579
2029	14,011	12,790
2030	14,247	13,005
Population increases: 2021-2030(%)	14,247-12,263=1,984(16.2%)	13,005-11,194=1,811(16.2%)

Note: * 2021 Population derived from Unit Pentadbiran, Jabatan Ketua Menteri Seksyen Pentadbiran Bahagian 2021. The forecast index was based on 1.68% average annual growth rate (Table 2-7(2)), SAMP Final Report.

2.1.3.1 Impacts of Migration to Population Change in Sri Aman Division, Sri Aman and Lubok Antu Districts

The changes within a population are primarily influenced by the rate of birth, death and migration. In view of information on migration, in or out is practically non-existent in the Sri Aman Division and its districts. Therefore, the net effect of migration on population size can only be reasonably approximated from vital statistics and census data. The official vital statistics of crude birth, death and natural increase rates are available in Sri Aman and Lubok Antu districts for 2010 to 2018, but they are not available as from 2019 to 2030. The natural increase rate (NIR) of Betong district on three year moving average of 2000 to 2018 and their extended times series forecast was adapted for the population forecast of Sri Aman. The reasons being that Betong's NIR at 8.2 per thousand population in 2018 was on par with the Sarawak's overall NIR; Sri Aman's NIR in 2010 to 2018 was extremely low, notably from 2015 to 2018, its NIR at 3.5 per thousand in 2018 was 2.3 times below that of the Sarawak and Betong, which was

defective and unreliable; and Betong had started its socio-economic development 10 or more years earlier than the current development of Sri Aman which started in 2020, and its NIR was stable. By comparing the census counts with the forecast vital statistics natural population, on balancing equation principle over these years in Sri Aman, the net migration population was approximated.

The purpose of the application of 3 years moving average in this analysis is to calculate the natural increase rate (NIR) of the population, from birth and death statistics of Sri Aman division, Sri Aman district and Lubok Antu district. It is used to work out the natural increase population for comparison with the census population data for the Sri Aman division, Sri Aman district and Lubok Antu district in 2020 and 2030, and confirm the net migration population in the three areas.

The 3 years moving average value of NIR is expressed as: $MA(3) = \frac{y_1+y_2+y_3}{3}; \frac{y_2+y_3+y_4}{3}; \frac{y_3+y_4+y_5}{3} \dots$ where y_1 is the previous average value of NIR; y_2 is the fixed average value of NIR, and y_3 is the next successive average value of NIR; then the next 3 years moving average value is $y_2+y_3+y_4/3$ and continue on to y_n , the end of the time period at 2030.

The NIRs thus computed are shown in Table 2-8. The population derived from the NIRs show that Sri Aman division's population was 105,450 in 2020, and will reach 112,266 in 2030; while Sri Aman district's population was 76,910 in 2020, and 81,881 in 2030; and Lubok Antu district was 28,571 in 2020, and 30,417 in 2030.

2.1.3.1.1 The Out-Migration Population of Sri Aman Division, Sri Aman and Lubok Antu Districts

The out-migration population of Sri Aman Division was estimated at 5950 in 2020, and 19,978 in 2030 (Table 2-9). The out-migration population constituted 5.3% in 2020 and expected to be 15.1% of the total population of Sri Aman Division in 2030. At the district level, the Sri Aman District had 1,390 out migrants in 2020, and in 2030 this expected to be 10,614. Hence, the out-migration population constituted 1.8% of the total population in 2020 and is expected to be 11.5% of the total population of Sri Aman District in 2030. For Lubok Antu District, the out-migration population was 4,529 in 2020 and expected to be 9,031 in 2030. The out-migration population constituted 13.7% of total population of Lubok Antu in 2020 and expected to be 22.9% in 2030.

Table 2-9: Out-Migration Population of Sri Aman Division. 2020 - 2030

Area	Year	Population by Census	Population by NIR	Out-migration pop (Census-NIR)	Out-Migration (%)
		(1)	(2)	(3)	(3) / (1)
Sri Aman Division	2020	111,400	105,450	-5,950	-5.34%
	2030	132,244	112,266	-19,978	-15.11%
Sri Aman District	2020	78,300	76,910	-1,390	-1.78%
	2030	92,495	81,881	-10,614	-11.48%
Lubok Antu District	2020	33,100	28,571	-4,529	-13.68%
	2030	39,448	30,417	-9,031	-22.89%

Note: Col(1) in above Table, 2020 and 2030 population by census derived from Table 2-47.

Col(2) Computed by using Betong district's NIR on three year moving average of 2000 to 2018 and their extended times series forecast.

By applying the new 2021 JKM population data and NIR data, using the equation balancing formula, Lingga district had 1,307 out migrants in 2030; Pantu district, 1,193 and Sri Aman district, 5,986 in 2030. Hence, the out-migration population of the three districts constituted 9.2% of its population in 2030 (Table 2-10).

Table 2-10: Projected Out-Migration Population of Lingga, Pantu & Sri Aman Districts. 2021 - 2030

Area (Rate) Year	Lingga District			Pantu District			Sri Aman District		
	Population by Jabatan Ketua Menteri (1)	Population by NIR (2)	Out- migration population (%) (3)=(1)-(2)	Population by Jabatan Ketua Menteri (4)	Population by NIR (5)	Out- migration population (%) (6)=(4)-(5)	Population by Jabatan Ketua Menteri (7)	Population by NIR (8)	Out- migration population (%) (9)=(7)-(8)
2020									
2021	12,263			11,194			56,158		
2022	12,469	12,364		11,382	11,287		57,102	56,622	
2023	12,679	12,459		11,573	11,373		58,061	57,057	
2024	12,892	12,548		11,768	11,454		59,036	57,464	
2025	13,108	12,630		11,965	11,529		60,029	57,841	
2026	13,328	12,706		12,166	11,598		61,038	58,187	
2027	13,552	12,715		12,371	11,661		62,062	58,503	
2028	13,780	12,837		12,579	11,718		63,105	58,786	
2029	14,011	12,892		12,790	11,768		64,166	59,038	
2030	14,247	12,940	-1,307 (9.2%)	13,005	11,812	-1,193 (9.2%)	65,243	59,257	-5,986 (9.2%)

Note: Col(1)in above Table, 2021 population by Unit Pentadbiran, Jabatan Ketua Menteri Seksyen Pentadbiran Bahagian 2021; 2030 population by above Table 2-7a. Sri Aman district population is by proportional adjustment from Table 2-7.

Col(2) Computed by using Betong district's NIR on three year moving average of 2021 to 2029 and their extended times series forecast.

The out-migration pattern as analyzed by census and NIR of birth and death statistics for Sri Aman division, Sri Aman district and Lubok Antu district; and by JKM and NIR for the newly upgraded Lingga and Pantu districts shown in above Table 2-9 and Table 2-10, and have reinforced the findings of a social and economic survey in Sri Aman Division conducted by SAMP, 2020-2030 consultants in November 2020 in which it pointed out that out migration of people in Sri Aman was frequent and intensive, at an overall average of 23.0% in 2020.

2.1.3.1.2 The New In-Migrant Population to the Increase of Sri Aman Population, 2030

The various development projects initiated by the SAMP, 2020-2030, will create 19,961 new jobs (Chia, SAMP, 2022), and generate up to 41,230 in the new populations for Sri Aman Division in 2030 (Chia, SAMP, 2022). As a result, the new in-migrants population will pump up another 37% towards Sri Aman's population growth rate of 18.7%, from the total population of 111,400 in 2020 to 173,474 in 2030. The total population of Sri Aman Division will increase 55.7% for the next 10 years up to 2030 (Table 2-11, col.6 line 2).

Table 2-11: The New In-Migrant Population to the Increase of Sri Aman Population, 2030

(1)	(2) 2020 Population	(3) 2030 Population	(4) 2030 New In- migrants pop	(5) 2030 Total Pop (3)+(4)	(6) Diff. btw. 2020 & 2030 (5)-(2)/(2) (%)
Sri Aman Division	111,400*	132,244*	41,230**	173,474	62,074 (55.7%)

Note: * 2020 & 2030 are forecast population derived from Table 2-7.

** Compiled from Chia, "Population Projection 2020 to 2030 by Projects, SAMP, Table 8-3, 2022.

This section applies the scale of land use in hectare for agriculture projects under SAMP 2020-2030 in Sri Aman Division as the variable to approximate the distribution of 41,230 new in-migrant populations

to Sri Aman, Lingga, Pantu and Lubok Antu districts. SAMP 2020-2030 focuses on agriculture, aquaculture, and other land resource related projects strongly and predominantly, it is therefore expected that more agriculture projects in an area will require bigger land areas; it will create more employments, and more in-migrants will come to work and settle, thus increasing population accordingly.

Table 2-12 shows the computation results of the distribution of the new in-migrant population to the four districts, plus Engkilili sub-district. Sri Aman district has taken 2,061 new in-migrants; Lingga district, 1,443; Pantu, 8,741; and Lubok Antu district, 28,985 (incl. Engkilili, 26,552) from the total number of 41,230 new in-migrants (Table 2-9, col.(6)).

Table 2-12: The Distribution of New In-Migrant Population by Districts, 2030

(1) Div/District	(2) Total Land Use (ha)*	(3) District Land use*	(4) % of Land Use (3)/(2)x100	(5) Total Nos. of New In- Migrant Pop**	(6) Nos. of New In- Migrant Pop (4)x(5)
Sri Aman Division	114,337.55 ha		100.0	41,230	
Sri Aman district		5,746.27 ha	5.0		2,061
Lingga district		4,010.19 ha	3.5		1,443
Pantu district		24,183.0 ha	21.2		8,741
Lubok Antu district		80,398.09 ha	70.3		28,985

Sources: * Compiled from Agriculture Projects by District Land Use, SAMP, 2022

** Chia, "Population Projection 2020 to 2030 by Projects, SAMP, Table 8-3, 2022.

The distribution analysis of the new in-migrant population to the increase of Sri Aman, Lingga, Pantu and Lubok Antu districts show that the new in-migrant population will pump up another 3.7% towards the total 19.8% increase of Sri Aman district's population; 11.8% towards the total 27.9% increase of Lingga's; 78.1% towards the total 94.3% increase of Pantu district's population; and 86% towards the total 103.2% increase of Lubok Antu district's population in 2030 (Table 2-13).

Table 2-13: The New In-Migrant Population to the Increase of Sri Aman Lingga, Pantu & Lubok Antu Districts Population, 2030

(1) District	(2) 2021 Population*	(3) 2030 Population*	(4) 2030 New In- migrants pop***	(5) 2030 Total Pop (3)+(4)	(6) Diff. btw. 2020 & 2030 (5)-(2)/(2) (%)
Sri Aman District	56,158	65,243	2,061	67,304	11,146 (19.8)
Lingga District	12,263	14,247	1,443	15,690	3,427 (27.9)
Pantu District	11,194	13,005	8,741	21,746	10,552 (94.3)
Lubok Antu	33,685	39,448	28,985	68,433	34,748 (103.2)

Note: * 2021 population derived from Table 2-44, column (8), lines 2,3&4.

** 2030 Lingga & Pantu population are forecast population derived from Table 2-8 above the bottom line; 2030 Sri Aman district population are forecast population from Table 2-7, bottom line: 92,495-14,247-13,005=65,243

*** From Table 2-12, col. (6). Compiled from Chia, "Population Projection 2020 to 2030 by Projects, SAMP, Table 8-3, 2022

2.1.3.2 On Net Migration Rate

Net-migration rate is the difference between immigration into and emigration from a given area during the given years. The increase of new population into Sri Aman division as a result of the SAMP projects has resulted in the positive net-migration rate (**net in-migration**) of 13.7% to the change of Sri Aman's population in 2030.

Table 2-14: Net- Migration Rate of Sri Aman

(1)	(2)2030 Total Population (3)+(4)	(3)2030 Forecast Population	(4)2030 In-Migration Population	(5)2030 Out- Migration Population	(6)2030 Net- Migration (4)-(5)	(7) Net- Migration rate (%) (6)/(2)X100
Sri Aman Division	173,474	132,244	41,230*	17,517**	23,713	+13.7%

Note: * Compiled from Chia, "Population Projection 2020 to 2030 by Projects, SAMP, Table 8-3, 2022
 ** Derived from Table 2-9 & 2-10 (5)17,517=5986(Sri Aman district)+1307(Linga)+1193(Pantu), 9031(Lubok Antu).

A separate analysis of net-migration rate for Sri Aman, Lingga, Pantu and Lubok Antu districts in terms of the increase of new population as a result of the SAMP development projects show a net out-migration rate of 5.7% to the change of Sri Aman district's population, a net in-migration rate of 0.8% to the change of Lingga population, 39.8% to Pantu district and 29.1% to Lubok Antu district.in 2030 respectively (Table 2-15, col.(7), lines 2,3,4 &5).

Table 2-15: Net- Migration Rate of Lingga, Pantu & Sri Aman Districts, 2030

(1)	(2)2030 Total Population (3)+(4)	(3)2030 Forecast Population	(4)2030 In- Migration Population*	(5)2030 Out- Migration Population*	(6)2030 Net- Migration (4)-(5)	(7) Net- Migration rate (%) (6)/(2)X100
Sri Aman District	68,913	65,243	2,061	5,986	-3,925	-5.7
Lingga District	16,803	14,247	1,443	1,307	+136	+0.8
Pantu District	18,983	13,005	8,741	1,193	+7,548	+39.8
Lubok Antu District	68,474	39,448	28,985	9,031	+19,954	+29.1

Note: * Compiled from Table 2-12
 ** Derived from Table 2-10, Col.(5),(8) & (11) bottom line

2.1.4 Existing Land Use

The existing land use and economic activity information was obtained from various sources including:

- Base maps from the Economic Planning Unit (EPU) indicating settlements and roads;
- Existing agriculture areas from the regional perspective maps provided by Economic Planning Unit (EPU) which are updated where latest data are available;
- Information on Permanent Forest Estate (PFEs), Totally Protected Area (TPAs) and License for Planted Forest (LPFs) from the Forestry Department or Sarawak Forest Corporation;
- Built-up major urban centres from various Land and Survey Department maps, plans and satellite imageries; and
- Water catchment areas from Drainage and Irrigation Department (DID).

The existing land use for this master plan study is summarised in Table 2-16. The study area covers an area of approximately, 5,629 sq. km. Out of this 5,629 sq. km., 68.97% is made up of forest area that includes PFes, LPFs and TPAs.

Table 2-16: Existing Land Use of Sri Aman Division 2020

Area	Area (sq. km)	Area (ha.)	%
Urban Area and Settlement	17.6	1,760	0.31%
Cleared Land	661.4	66,140	11.75%
Oil Palm Plantation	829.8	82,980	14.74%
Other Agriculture	129.2	12,920	2.30%
Forests	3882.5	388,250	68.97%
Water Bodies	107.8	10,780	1.92%
Road	0.7	70	0.01%
Total Area	5629	562,900	100.00%

Source: Land & Survey Dept. Sarawak, Forest Dept. Sarawak, DOA Sarawak, SEDC, SALCRA, JKR Sarawak, Sri Aman District Council, Sewerage Services Department Sarawak, SFC, DID

Approximately 129.2 sq. km. (2.30%) of the Sri Aman Division land area is used for agriculture. The main crops are rubber, traditional paddy, pepper, rambutan and oil palm. Oil palm plantations covered an area of 829.8 sq. km. or (14.74%) of the study area. Oil Palm with 829.8 sq. km. is the second largest land use after forest land.

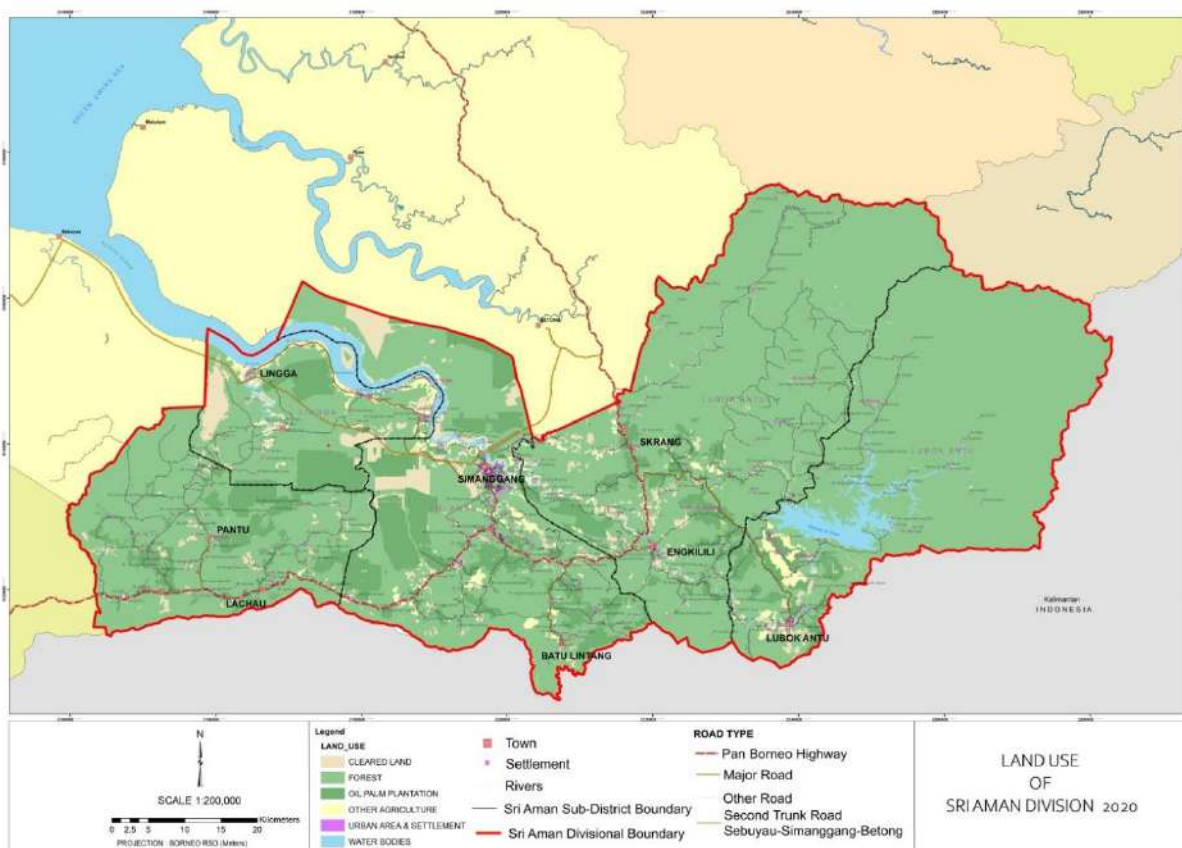


Figure 2-2: Land Use of Sri Aman Division 2020

Source: Land & Survey Dept. Sarawak, Forest Dept. Sarawak, DOA Sarawak, SEDC, SALCRA, JKR Sarawak, Sri Aman District Council, Sewerage Services Department Sarawak, SFC, DID

2.1.4.1 Land Availability and Land Suitability

The evaluation of land availability and land suitability are integral parts of the land use planning as availability does not necessarily guarantee that these pieces of land are suitable for development. Sri Aman can be said to have an abundant supply of land area for future development but at the same time not all these lands are suitable for the intended use. A vast area of low-lying peat may be great in numbers but do these land areas suitable for agriculture? Similarly, a vast area of alluvial soils on both banks of Batang Lupar may not be suitable for development as they are probably located in flood prone zones.

Preliminary analysis of existing land availability indicated that Sri Aman has approximately 50% of its land area available for future development. However, on agriculture for instance, a further analysis has indicated that significant portions of these land areas possess certain limitation to be used for agriculture use.

In the planning of the future land use of Sri Aman, the competing demand of various development and economic sectors will be look into. Broad land use plan with key land use functions and activities will be drawn up and tabulated. These broad land uses shall incorporate the requirements of all economic and development planning sectors.

The Sri Aman Division is generally considered a “green” division where approximately 75% of its land area is still covered by its forests. With 17% of the total land area, agriculture use comes second largest land use. Based on the review of National and State policy and strategies, future development of the land use in Sri Aman in 2030 will cover five (5) dimensions- urban development, agriculture, conservation areas, tourism and connectivity.

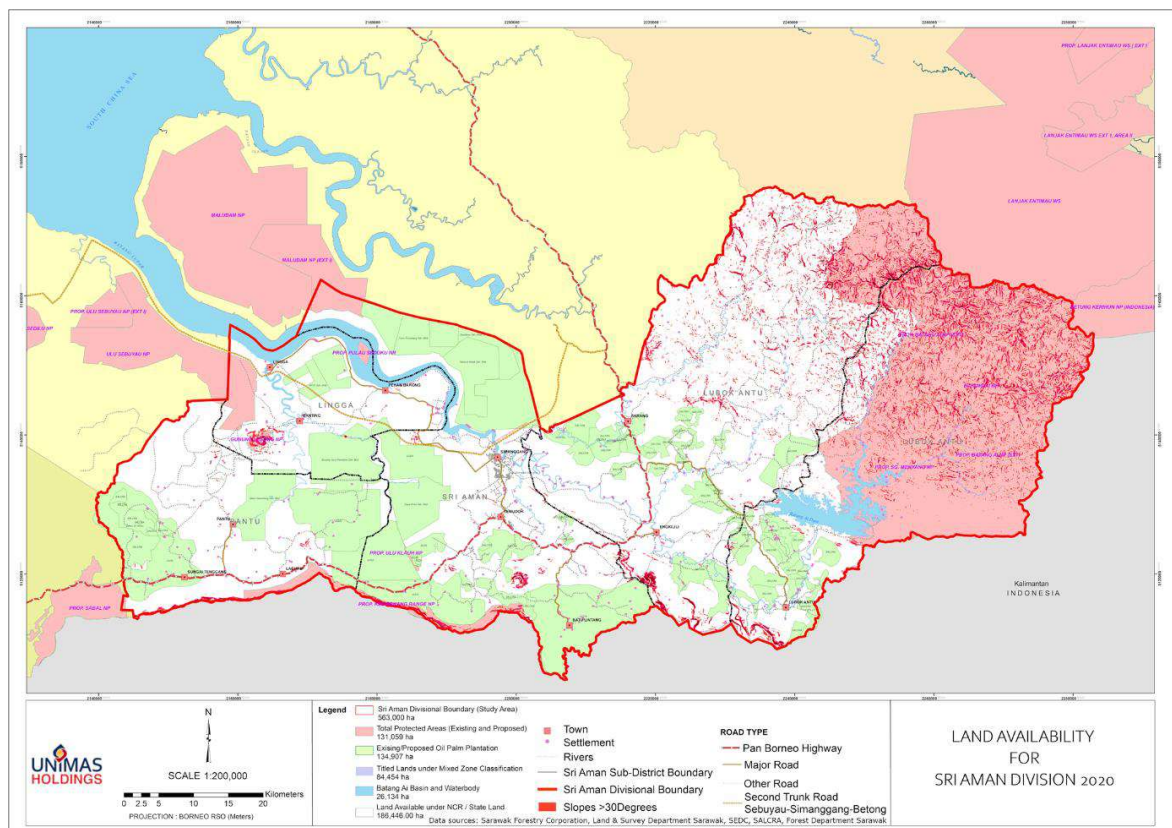


Figure 2-3: Land Availability of Sri Aman Division 2020

Source: Sarawak Forest Corporation, Land & Survey Dept. Sarawak, SEDC, SALCRA, Forest Department Sarawak

The proposed land use plan of Sri Aman was defined by a higher order strategy delineated by the State of Sarawak SAEC, policies and agenda delineated at the Federal Government level. At the town planning level, the master plan strategies call for the establishment of a new concentrated urban centre, with suitable commercial and service functions. At the same time, it needs to create green and conservation corridors and areas, not only for recreation, but also for adaptive strategies for climate resilient development.

The overall land use philosophy for Sri Aman is to:

- Protection of Unique and Sensitive environmental areas and resources;
- Promotion efficiency in land and resource utilization;
- Promotion of mixed and multi-functional development;
- Prevention of urban sprawl and ribbon development along the main traffic corridors radiating from the main traffic corridors i.e. the Pan Borneo and the Second Trunk road (Coastal Highways);
- Allow formation of green and preservation areas taking advantage of existing water bodies (rivers, lakes and streams) in the planning area;
- Encourage Transit Oriented development (TOD) to complement the proposed public transport station and/or intermodal interchange linking Simanggang and its peripheries.

2.1.4.2 *Future Growth Scenario of Sri Aman Division*

2.1.4.2.1 *Urban Development*

Simanggang Town is expected to continue acting as the main administrative and service hub of the Division. The town will likely expand along the south bank of Batang Lupar and along the Sri Aman arterial road. When the proposed road link to Betong via a bridge over Batang Lupar is implemented, the town will likely also be expanded to the north bank of the River.

It was identified in the SADA workshop that, beyond 2020, Sri Aman would need to establish a large technical or post-secondary learning institution as well as an industrial estate to meet the regional demand.

Lubok Antu, Pantu and Lingga are the district centres in the division. The status of Lubok Antu as a border town with Kalimantan, and the expected growth in trading, tourism and other cross-border activities will result in the expansion of its urban area.

Other service centres such as Lachau and Engkilili will continue to cater for the rural communities. Recent planning schemes drafted by the State government through Lands & Surveys Department in these centres have been identified and reviewed.

2.1.4.2.2 *Agriculture*

The hinterland areas will continue to be developed for agriculture purposes, and a granary area has also been designated around Bijat and Lingga. Oil palm plantations, as with other parts of Sarawak, have been a major land use activity. The Sarawak Land use Master Plan Study has called for a review of the current oil palm plantation development in deep peat areas. Other key agricultural projects such as the granary would also need to be further analysed and refined due to the initial assessment of its land suitability.

2.1.4.2.3 Conservation Areas

The TPAs in the division are the Batang Ai National Park and Lanjak Entimau Wildlife Sanctuary. There are also large areas under PFEs and LPFs and all these will be conserved. While no new PFEs and LPFs will be gazetted, there is a likelihood that TPAs could be extended with the creation of new areas or extension of existing ones.

2.1.4.2.4 Tourism

The tourism industry is currently facing an especially challenging period. Tourism will nevertheless continue to be the bread and butter of Sri Aman. It will continue to be focused on cultural, heritage and eco-tourism products. While Simanggang will be the hub for other tourism destinations in the division, it also has its own tourism attractions such as the observation of tidal bore (benak). Simanggang is also blessed with rich history. This historical aspect of Simanggang and Sri Aman have potential to be further explored and exploited for tourism development purposes. In the post Covid-19 era, Simanggang will see an increase in hotels and other tourism related services towards 2030.

2.1.4.2.5 Roads and Linkages

Over the next five decades up to 2050, various proposals have been recommended for the establishment of new regional road links in the division to facilitate socio-economic development. Such include the Sri Aman-Betong link road.

2.1.4.3 Land Tenure

In Sarawak, the earliest written law controlling the administration and disposition of land was enacted by the Rajah in 1863. From 1863 to 1957 numerous regulations were made by the Government pertaining to land administration, and these culminated in the consolidation and enactment into one single act - the Land Code (Cap, 81), which came into operation on 1st January 1958. Since then, numerous amendments had been made to further facilitate land administration and land alienation.

The Land Code is an omnibus piece of legislation, which provides for the alienation, administration and dealing in land, etc. and the most important provision affecting land development is the Land Classification. Part II of the Land Code was introduced to facilitate land classification in defining the rights of native and non-natives.

2.1.4.3.1 Land Classification

Land in Sarawak is classified into five categories, namely:

Mixed Zone Land

Mixed Zone Land may be alienated to, and occupied by, any race of Sarawak origin without restriction. Registered titles within Mixed Zone Land may be freely dealt with among members of any race, who are Malaysian citizens of Sarawak origin or permanent residents in Sarawak.

Within this category of land, the natives of Sarawak may still occupy land, where it is not surveyed, under customary land tenure, and such cannot be alienated to others until the native customary rights have been distinguished by, or surrendered to, the State.

Native Area Land

Under this category, only the natives of Sarawak may occupy and hold title. Non-natives are prohibited from acquiring any rights or privileges over this type of land (Section 8). Registered titles in respect of Native Area Land may be dealt with among the natives of Sarawak only. However, non-native (including company, stationary body) may, if they are identified with and subject to any native system of personal law, be deemed to be a native under Section 9(1)(b) and 9(1)(d) of the Land Code may acquire Native Area Land.

In fact, much of the area is not surveyed and may therefore held under native customary tenure, and it is legally Native Customary Land.

Native Customary Land

All land held by the natives of Sarawak under customary tenure falls within this classification. That is, Native Customary Land may be found within the classification of Mixed Zone Land, Native Area Land and Interior Area Land. The Government has always recognised the customs of the natives and their traditional rights to land established by them under the Native Customary Law related to land. Such law, however, has not been codified although the method by which such rights may be created by a native relating to land has now been written into Section 5 (2) of the Sarawak Land Code (Cap 81).

The methods by which NCR may be created are:

1. The felling of virgin jungle and the occupation of the land thereby cleared;
2. The planting of land with fruits trees;
3. The occupation or cultivation of land;
4. The use of land for burial ground or shrine;
5. The use of land of any class for rights of ways; or
6. Any other lawful method

The most of common method of creating customary rights is through the felling of virgin jungle for farming purposes. However, with the introduction of the Land (Classification) (Amendment) Ordinances, (Ordinance No 3) of 1954 and Ordinance No 1 of 1955), the creation of NCR over land has since ceased in respect of land in:

Interior Area Land on 16.4.1955 except for a permit under Section 10 issued by a District Officer in whose district the land is situated to a native to clear virgin jungle. The power to issue permit has now been vested in the Superintendent of Lands and Surveys with effect from this year, 1998 in the Division where the land is situated.

The Sarawak Land Code (Cap. 81) entails that until a title has been issued in respect of the land, such land shall continue to be State land and any native lawfully in occupation of the land is deemed to hold the land by license from the State until a title has been issued and shall not be required to pay rent for the use and occupation of the Land (Section 5(20) (ii)).

In the Land Code (Amendment) Ordinance 2000 (Cap A78), provisions to introduce a system of registration and for a Register of Native Rights were introduced but never come into effect. The provisions have since been repealed by the Land Code (Amendment) Ordinance 2018. The Sarawak Land Code has been amended with effect from 1st August 2019, to include "Native territorial domain" which right cannot be assigned or transferred to any person who is not a member of the native community named therein. Native Territorial Domain shall not be more than 500 hectares, unless MMKN approved the Minister of Urban Development and Natural Resources to claim of up to 1,000 hectares.

Reserve Land

This category of land, including unencumbered State Land, is used by and reserved for Government for various purposes. Reserved Lands (RL) include:

- Forest Reserves
- Protected Forest
- National Parks
- Government Reserves

Only in this category of land there is no native customary right claim. Unauthorised occupation of such land is considered as squatting.

Interior Area Land

Land that does not fall into any of the above four categories is classified as Interior Area Land. It comprises mainly of primary forest or unsurveyed State Land, which may be subject to native customary right claims. The Government may alienate unencumbered Interior Area Land and it has to be classified into Mixed Zone Land or Native Area Land.

2.1.4.4 Native Customary Rights (NCR) Issues

Generally, most of the suitable and yet undeveloped lands are under the customary land tenure, being “owned” by the natives. Such lands are wealth to the “owners” and yet they are mainly left idle because:

- Adjudication of NCR and survey of the land involved are cumbersome and time consuming;
- Uncertainty over the boundary between NCL and State Land;
- Some native abandoned their Temuda (NCL), which were later occupied by different groups, resulting in disputes between different communities and different individuals; and
- Absentee owners

The private sector involvement in plantation agriculture has largely been on unencumbered State Land that is excised and alienated to the investor by the issuance of 60-year leases. Where minor encroachments, by the native farmers have occurred, the farmers are usually compensated in one way or another for giving up their farmland.

Since most of the lands suitable for large-scale commercial agriculture would probably falls under the NCL land tenure, the need to identify and formulate the best way of developing this land ha need to be undertaken. The current NCR development models would need to be reviewed to identify strengths and weaknesses and hopefully the most appropriate way of developing these lands through a better “business” model could be identified.

2.1.5 Access, Transport and Linkages

Federal Route 1 (FT1) serves as the backbone of Sarawak’s highway network. This 1000-km regional trunk road stretches between the Kuching Division to the west and the Miri Division to the northeast before passing through neighbouring Brunei Darussalam to reach Limbang Division. Currently being upgraded as part of Pan Borneo Highway this route is also known as Asian Highway 150 (AH150), which ultimately connects Sarawak and Sabah with Brunei and Kalimantan of Indonesia. The remaining road networks of Sarawak are formed by municipal roads and state highways that consists of village as well as agricultural roads. In general, road networks are mainly concentrated at the coastal and lowland

corridors. With low road connectivity, river transport and aviation network become important especially for the isolated areas of the hinterland.

Regionally, Sri Aman is strategically located halfway between Kuching, capital City of Sarawak and Sibu Town. Directly linked by regional trunk road of FT1, it is approximately 190 km east of Kuching and about 230 km southwest of Sibu. In addition, Federal Route 3 (FT3) that is also referred to as Batang Ai Road runs from north of Engkilili to Lubok Antu and subsequently to its regional hinterland of Indonesia.

The road network of the Sri Aman Division covers approximately 863 km of sealed road. The Sri Aman - Betong road, which is also referred to as Federal Route 1 Sections 22 to 30 inclusive, forms part of the overall Pan-Borneo Highway.

Compared to both existing coastal Road Network and Pan Borneo Highway, the proposed 225-km Kuching-Sibu Second Trunk Road (STR) will shorten existing travelling distance between the two areas by two and a half hours. Within the study area, STR is divided into two sections with total length of about 142 km - the northern section directly connects Sebuyau with Roban while the southern section passes through Lingga, Simanggang and Betong before connected back to Pan Borneo Highway. Designed with JKR R5 standard and speed of 90 km/h, STR will complement Pan Borneo Highway and the existing coastal road. Together, these road networks will enhance the connectivity of both intra-division as well as inter-division movements. In addition, it will provide economic injection to the coastal areas.

2.1.6 Border Security

The international border along the Sri Aman division covers a total distance of 226 kilometres. This is approximately 14% of the total Malaysia / Indonesia land border of 1,648 kilometres. In the Sri Aman division the Border security issues are heightened by the fact that a significant portion of the Pan Borneo highway runs parallel to the border and only a few kilometres distance from it. This means that access to the border is relatively easy.

2.1.6.1 Border towns

There are 3 locations considered to be Border towns in Sri Aman division:

2.1.6.1.1 Lubok Antu

There is a major Immigration, Customs and Quarantine (ICQ) checkpoint and Border Crossing point located approximately six kilometres from Lubok Antu. This consists of guardhouses and inspection facilities set up separately by the Malaysian Immigration authorities and their counterparts on the Indonesian side. Anyone crossing the border here must negotiate both inspection / checking facilities.

The crossing operates during daytime hours only.

Figure 2-4: ICQ Border checkpoint at Lubok Antu (Malaysia, left; Indonesia, right)



2.1.6.1.2 Batu Lintang

There is a border post crossing point at Batu Lintang. Police, Immigration and Custom personnel are tasked to operate the post. It is accessible by unsealed roads on the Malaysia side and sealed roads on the Indonesian side.

2.1.6.1.3 Lachau

Lachau township is on the Pan Borneo highway at a location within two kilometres of the international border. There is no formal crossing point here but it is known that informal cross-border traffic is very common. The township itself is reliant upon the trade resulting from the cross-border traffic, with a thriving market selling goods from Indonesia, and supplying basic foodstuffs and necessities to the transient Indonesian border transgressors.

Access to the border from Lachau is generally via jungle foot tracks colloquially known as *Jalan Tikus*.

2.1.6.2 Border Issues

There are a number of issues that need to be considered in assessing the border security arrangements for this Master Plan:

2.1.6.2.1 Porous border

The length of the border in Sri Aman division is very long (226 km) and, geographically, is along the ridge of a rugged, forested mountain range with difficult access. While there are few good access roads multiple jungle tracks are also available, affording access to illegal entry for those who use them. Further there are a number of plantations and forestry concessions that extend to the border, with the unsealed roads enabling access for 4WD vehicles in some cases.

On the Indonesian side there is a good quality road that runs parallel with the border. While this facilitates border monitoring by regular patrols, it also provides easy access in the case where the patrols can be avoided.

Current arrangement of Joint Military patrols twice a year to cover vast areas seem to be ineffective.

2.1.6.2.2 Illegal workers

There is a demand for workers in Sarawak for the plantation and construction industries. Illegal migrants (those who cross the border at informal locations without obtaining immigration papers) have

traditionally filled a large part of this demand. As they are undocumented, employers can get away with paying them lower wages than the minimum wage prescribed for Malaysian workers. They have no rights and their conditions and treatment is also unregulated.

Despite problems for illegal worker noted above, the supply of illegal workers remains high, reflecting the fact that the opportunities afforded by working illegally in Malaysia still outweigh the risks and disadvantages that are apparent. This reflects the lack of employment opportunities on the Indonesian side of the border and the low remuneration for those positions that can be obtained.

At this stage the impediments to these workers migrating legally as sponsored workers still needs to be investigated, but there will be financial and administrative implications for the employing companies.

2.1.6.2.3 Border location

The exact border location is yet to be clearly defined and agreed by Indonesia and Malaysia. This can make enforcement difficult where the exact boundary is not clearly marked on the ground.

2.1.6.2.4 Trading activities at Border Towns

There is consistent traffic across the border in the areas near the Border Towns (Lubok Antu, Batu Lintang, and Lachau) for the purpose of small-scale trade. This involves individuals or groups using informal jungle tracks to cross from Indonesia into Sarawak, carrying agricultural products or handicrafts for sale to the traders in the border towns.

They use the proceeds of these sales to procure staple foods (sugar, salt, rice, etc) and other basic necessities which they carry back over the border on their return trip. Staple foods and basic necessities are easier to obtain, and significantly cheaper to purchase, in Sarawak, than on the Indonesian side of the border.

On the face of it this activity appears to have little negative impact and is actually beneficial to traders on both sides. However, it is noted that government subsidies and taxes are not applied as intended and there will be a net loss from the Government perspective.

2.1.6.2.5 Family events and visits

The international border has artificially separated many tribal groups who were geographically located along the area covered by the border. This means that, for a number of tribal groups, kinship ties across the border are very strong. Accordingly, in the event of social functions such as weddings, funerals, or some special occasions people cross the border to attend these functions with relations on the other side. On completion of the event, they return to their village.

2.1.6.3 Smuggling activities

Smuggling activities occur in both directions across the border (Table 2-17). In Malaysia many basic products are heavily subsidised by the (Federal) Government, such as sugar, rice, petrol, cooking gas. Carrying these across the border is prohibited. Nevertheless, there is considerable traffic of these items mainly through informal crossing points. There are also Items smuggled from Indonesia into Sarawak include cigarettes, weapons, drugs, rattan.

There is also a trade in illegal timber, whereby Malaysian contractors extend their activities into the Indonesian forest area. Because Malaysia has a security and tracking system for timber logs from the local forests, the timber felled in Indonesia is brought into Sarawak as sawn timber.

Table 2-17: Main types of products subject to smuggling activities

IMPORT TO MALAYSIA	EXPORT FROM MALAYSIA
RATTAN	SUGAR
SAWN TIMBERS	RICES
CIGARETTES	COOKING GAS
AIR GUN	COOKING OIL
HANDICRAFT ITEMS	FUEL/ POL
AGRICULTURAL PRODUCT	STOLEN CAR

Source: Daya Rancang

SECTION 2.2 ENVIRONMENTAL CONDITION

This section describes the existing environmental condition within the Study Area in order to identify the issues, challenges and opportunities as well as initial recommendations and strategies. The Study Area covers the entire Sri Aman Division comprising four (4) districts namely Sri Aman, Lubok Antu, Pantu and Lingga districts and one (1) sub-district namely Engkilili, and hereinafter will be referred to as the “Study Area” or “Sri Aman Division” throughout this section.

2.2.1 The Wider Picture – Environmental Sector in Sarawak

The environmental protection expenditure in Malaysia has demonstrated an annual growth rate of 4.0% with a total of RM 2,695.7 million recorded in 2018 as compared to RM 2,592.6 million recorded in 2017 (Department of Statistics Malaysia, 2019). In the year 2018, the environmental protection expenditure recorded in Sarawak itself amounted to a total of RM 210.6 million (Department of Statistics Malaysia, 2019). This amount accounts to 7.8% of the total (RM 2,695.7 million) that was recorded for Malaysia in the year 2018 (Department of Statistics Malaysia, 2019). Based on the Department of Statistics (2019), the environmental protection expenditure is further categorised into pollution management, protection and conservation of wildlife and habitat, environmental assessment and charges, waste management, and other environmental protection expenditure. Pollution management is in fact the largest contributor followed by waste management (refer to Table 2-18).

Table 2-18: Type of Environmental Protection Expenditure Recorded in Sarawak in 2018

Type of Expenditure	Cost (RM'000)	Percent (%)
Pollution management	131,664	62.50
Protection and conservation of wildlife and habitat	734	0.35
Environmental assessment and charges	3,764	1.79
Waste management	71,906	34.14
Other environmental protection expenditure	2,572	1.22
Total	210,640	100

Source: Department of Statistics (2019),

2.2.2 Sri Aman's Place Within Sarawak's Environmental Sector

2.2.2.1 Industrial Pollution Management

Based on the Malaysian Palm Oil Board (MPOB), there are four palm oil mills located within the Sri Aman Division with a total processing capacity of 1,220,000 ton/year. A typical palm oil mill process involves the reception of fresh fruit bunches from plantations, sterilization, threshing of the bunches to free the palm fruit, mashing and pressing to extract crude palm oil. In the process, oil palm residues (empty fruit bunches, palm kernel shells, palm kernel cake) and palm oil mill effluent (POME) are generated.

The palm oil mill effluent (POME) is known to contain high concentrations of organic nitrogen, phosphorus, biochemical oxygen demand (BOD) and chemical oxygen demand (COD), hence, the untreated discharge of POME into receiving waterways will create adverse impacts to the environment.

The discharge of untreated POME into receiving waterways is strictly prohibited in Malaysia, hence, palm oil mills are typically equipped with wastewater treatment system to treat their POME.

Furthermore, a license from the Department of Environment (DOE) is required to occupy and operate a prescribed premise such as palm oil mills under the Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977. The Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977 also set a limit for effluent quality prior to discharge.

In terms of industrial effluent, there are no known heavy industries in Sri Aman presently. Small and medium industries are scattered across Simanggang Town. However, the Ministry of International Trade, Industry and Investment (MINTRED) Sarawak intends to establish a 5.5-hectare Sri Aman Industrial Area approximately 2 km from Simanggang Town. The Sri Aman Industrial Area is expected to cater for the light and medium industries.

2.2.3 Protection and Conservation of Wildlife and Habitat

In terms of protection and conservation of wildlife and habitat, there are six gazetted Totally Protected Areas (TPAs) in the Sri Aman Division, namely four national parks, a wildlife sanctuary, and a nature reserve. The Totally Protected Areas (TPAs) refers to forest lands designated and established under the provision of the National Parks and Nature Reserves Ordinance, 1998 and Wild Life Protection Ordinance, 1998. The earliest TPA gazetted in Sri Aman was the Lanjak-Entimau Wildlife Sanctuary which was gazetted in 1983. The Lanjak-Entimau Wildlife Sanctuary is part of the Heart of Borneo (HOB) Initiative, a trilateral international agreement between Brunei Darussalam, Indonesia and Malaysia to manage the forest and its resources in the region in a sustainable manner. The most recent TPA was gazetted in 2015; the Pulau Seduku Nature Reserve. The TPAs in Sri Aman are discussed in Section 2.2.9.

2.2.3.1 Environmental Assessment

Based on the Environmental Quality Report 2015, the Natural Resources and Environment Board (NREB) received and processed a total of 128 Environmental Impact Assessment (EIA) reports for the whole Sarawak (NREB, 2015). With respect to the Sri Aman Division, a total of six EIA reports which can be further categorised into forestry, realty and infrastructure projects, were submitted to the NREB (NREB, 2015). This translates to only 4.7% of the total EIA reports submitted for the whole of Sarawak.

2.2.3.2 Waste Management

Presently, solid wastes collected in Sri Aman are sent to Entulang Dumpsite and Pantu Dumpsite. Lubok Antu and Engkilili are equipped with level 1 landfills. Level 1 landfill is similar to a dumpsite except that the solid waste is dumped in a controlled manner (controlled tipping).

2.2.4 Covid-19 and Its Impacts on the Environment

2.2.4.1 *Degraded Ecosystems (Biodiversity Loss and Habitat Degradation) Linked to Disease Outbreak*

Evidence suggested that the virus that caused Covid-19 was allegedly traced back to bats and pangolins via transmission from animals to humans (Schmeller et. al., 2020). Besides the Covid-19 outbreak, past disease outbreaks include SARS, Ebola, avian influenza and swine influenza were also linked with the transmission from animals to humans (Schmeller et. al., 2020).

Rapid urbanisation and population growth increases the rate of wildlife/animal and human contacts and interactions. As we continue to explore new landscapes for development, the increase in wildlife/animal and human contacts and interactions exacerbate the probability of pathogen transfer from wildlife/animals to humans, contributing to the periodic emergence of new viral pathogen over the last decades (Woolhouse et al., 2012).

The present Covid-19 crisis, as well as past and future epidemics, underlines the importance of animal and human health, emphasising the need for a holistic management and relationship between man and nature. Environmental conservation and protection are imperative in controlling future disease outbreaks.

2.2.4.2 *Improvement in Air Quality*

Improvement in air quality can be observed due to the reduction of traffic and industrial activities during the movement control order. Literature documented that in Malaysia, PM₁₀, PM_{2.5}, NO₂, SO₂ and CO concentrations have decreased by 26-31%, 23-32%, 63-64%, 9-20% and 25-31% respectively in the urban areas during the movement control order, compared to the same periods in 2018 and 2019 (Kanniah et al., 2020). Furthermore, the Department of Environment (DOE), Malaysia monitored and analysed the air pollutant index (API) from 1 March 2020 to 28 April 2020 throughout the movement control order and recorded an increase of 26% of good API status (DOE, 2020). The decline of air pollution is likely due to reduced outdoor activities or reduced sources of air emissions such as vehicle exhaust emissions, industrial emissions and open burning activities (DOE, 2020).

Beyond Malaysia, the concentration of NO₂ in China reduced by 12.9 µg/m³ and in Wuhan the concentration of NO₂ reduced by 22.8 µg/m³ during the quarantine period (Zambrano-Monserrate, Ruana, and Sanchez-Alcalde, 2020). The concentration of PM_{2.5} fell by 1.4 µg/m³ in Wuhan and decreased by 18.9 µg/m³ in 367 cities in China during the quarantine period as well (Zambrano-Monserrate, Ruana, and Sanchez-Alcalde, 2020).

Although emissions are reduced as a result of restricted movement control policies due to the pandemic introduced in respective countries, these reductions could have little impact on the total concentrations of greenhouse gasses (GHG) that have accumulated in the atmosphere for decades. The decrease in GHG emissions in these countries may be temporary as GHG emissions are expected to increase as these countries revive their economy. For a sustainable and significant decline in GHG emissions, long-term structural changes in the countries' economies and environmental commitments should be considered.

2.2.4.3 Increase on Clinical Waste and Solid Waste

Malaysia generated approximately 1,665,300 tonnes of scheduled waste in 2014. (Department of Statistics, 2015). The clinical waste generated is estimated at 22,000 tonnes; approximately 1.3% of the total volume of scheduled waste generated in 2014 (Department of Statistics, 2015). Presently, the DOE reported increase in clinical waste of about 17% during the Covid-19 pandemic starting early February 2020. Among the clinical waste generated are medical gowns, medical masks, and gloves. The DOE also assured that these clinical wastes are properly disposed off at twelve licensed incinerators throughout Malaysia as per the Environment Quality (Scheduled Wastes) Regulations 2005.

Based on the findings from the Survey on Solid Waste Composition, Characteristics & Existing Practice of Solid Waste Recycling in Malaysia (Jabatan Pengurusan Sisa Pepejal Negara, 2012), a total of 33,000 tonnes of solid waste is generated per day, averaging to 1.17 kg of solid waste generated per capita. According to the Waste Management Association of Malaysia (WMAM), waste generation in residential areas has increased from 20% to 30% since the implementation of the MCO in March 18 (Bernama, 2020). The increase in household waste can be attributed to the plastic packaging of take-home meals and groceries deliveries during the MCO. Furthermore, the current Covid-19 pandemic has also introduced a new class of wastes; personal protective equipment such as used face masks. Used face mask will be a source of concern as improper disposal may become a source of disease and deterioration of landscape aesthetic. Hence, proper waste management, conducive living environment, and public awareness are essential to ensure public safety and health.

2.2.4.4 Improvement in Water Quality

Positive changes in the river water quality were reported as a result of the implementation of the MCO in Malaysia which restricted business activities, human movement and other anthropogenic activities. Based on the DOE analysis and comparison of river water quality from a total of 29 water quality monitoring stations throughout Malaysia during the MCO (18 March 2020 to 14 April 2020) and before the MCO period (18 August 2019 to 17 March 2020), eight of the 29 water quality monitoring stations recorded improvement in river water quality in terms of the Water Quality Index (WQI), another eight stations did not show any apparent changes and the remaining 13 stations displayed a slight decline in WQI (DOE, 2020). On average, there was a decline in biochemical oxygen demand, chemical oxygen demand and total suspended solids during the MCO, 5%, 6% and 1% respectively, contributing to the improvement of the WQI (DOE, 2020). During the MCO in 2020, there was also a decrease of around 50% in rubbish collected from Sungai Klang boom in comparison to 2017 and 2018 (refer to Table 2-19).

Table 2-19: Volume of Rubbish Collected from Sg Klang Boom

Months	Volume (m ³)
February to March 2020	9
February to March 2018	21
February to March 2017	18

Source: DOE, 2020

2.2.4.5 *Reduction of Noise Pollution*

The implementation of the MCO in Malaysia which restricted business activities, human movement and other anthropogenic activities brought about new norms within Malaysia society. The Star (2020) reported the improvement of noise quality as the sound of birds are more apparent in urban settings. With the public complying with the 'stay at home' directive, restricted economic activities, and restricted cross-border and international travel, environmental noise was reduced, particularly in the urban settings. However, this observation has yet to be substantiated with quantitative data.

2.2.4.6 *Increase Use of Chemical Disinfectants and Cleaning Agents*

Enhanced routine cleaning and disinfection of surfaces and objects that are frequently in contact/used using alcohol and antimicrobial based chemical disinfectants and cleaning agents has been practiced since the emergence of the Covid-19 pandemic. There have been constant reminders to maintain the most stringent level of personal hygiene and cleanliness be it at the workplaces, respective homes, or public places, leading to an increased use of chemical disinfectants and cleaning agents. Presently, there is little data to link the impacts of the increased use of disinfectants and cleaning agents on the environment (Mahmood, et. al., 2020). In the event of spills, aquatic organisms will be directly impacted by the chemical disinfectants and cleaning agents in the waterbody. Furthermore, accidental spills of chemical disinfectants and cleaning agents may cause terrestrial flora and fauna toxicity and these chemicals may infiltrate and contaminate groundwater and even existing drinking water sources.

However, there has been growing health concerns in regards to toxicity and chemical poisoning due to exposure to disinfectants and cleaning agents (Chang, et. al., 2020). This is often due to increased use of disinfectants and cleaning agents, improper use such as using more than directed on the label, mixing multiple products together, not wearing protective gear during application or applying in poor ventilated areas (Chang, et. al., 2020). In the absence of medication or vaccines that can cope with the Covid-19 infection, preventive measures, which include frequent cleaning and disinfection, are a primary tool to fight the Covid-19 pandemic. However, it is important to use approved chemical disinfectants and cleaning agents and ensure that these chemicals are used in a correct manner.

2.2.4.7 *Fear of Bushmeat Consumption*

As the origin of Covid-19 can be traced back to wildlife such as bats and pangolins, the fear of bushmeat consumption among the society is expected to rise. This will lead to a decrease in the demand for wild meat. The decrease in consumers' demand for wildlife is an opportunity to protect and conserve the wildlife population. In response to the Covid-19 pandemic, there has been a growing number of calls to ban the trade and consumption of wildlife globally. Recently, a strict ban policy on the consumption and farming of wild animals has been introduced in China, reflecting an important step to protect and conserve wildlife population (Li, 2020).

However, outlawing bushmeat may push wild meat trades to unregulated, underground markets. For example, during the West Africa Ebola outbreak from 2013 to 2016, underground wildlife trade markets began to appear when the ban for bushmeat was introduced (Bonwitt et al., 2018). Following the ban in China, it was reported that sellers have started dealing online instead and, in the month of February alone, 140,000 webpages and 17,000 online trader accounts relating to the sale of bushmeat or wild animal parts for medicinal use were removed, deleted or blocked by the China State Council (Bowmer, 2020). Furthermore, unregulated markets may worsen food hygiene conditions and is a driver to

potentially spread disease, defeating the purpose of banning wildlife trade and consumption in the first place.

2.2.4.8 Increase Need for Proper Waste and Sanitation Management

The Covid-19 pandemic has resulted in an increase in clinical waste. Although there is little evidence to suggest waste is a medium to transmit the Covid-19 coronavirus, it is imperative to ensure the health and safety for workers in the waste management industries. An article in Bernama newspaper also reported on the strengthening of the existing standard operating procedure (SOP) related to the handling of clinical waste by waste concessionaries appointed by the Ministry of Health (MOH) to manage clinical waste from public medical facilities in Malaysia (Wei, 2020). For example, the personnel are equipped with full body personal equipment such as face masks, face shields, aprons and gloves when handling Covid-19 wastes according to the guidelines and SOPs set by the MOH (Wei, 2020).

The increase in clinical waste is expected to create additional stress to the waste management and sanitation sector. This has been reflected in China where the industry struggled to cope with the medical waste generated during the Covid-19 outbreak. The Hubei province in China had to double its capacity to dispose medical waste from 180 tonnes/day to 372 tonnes/day in less than three weeks and within two months, the capacity doubled to 670 tonnes/day (China Integrated Waste Management, 2020). The capacity to treat medical waste in China also grew from 4.9 tonnes/day to 6.0 tonnes/day (China Integrated Waste Management, 2020).

During the peak of the Covid-19 outbreak, approximately 1.8 million employees in the sanitation sector worked round the clock to ensure proper waste management, city cleaning and disinfection in China (China Integrated Waste Management, 2020). According to the Ministry of Housing and Urban-Rural Development (MoHURD), the workload for sanitation workers doubled during the peak of the coronavirus epidemic (China Integrated Waste Management, 2020).

The Covid-19 pandemic has challenged the existing waste management practices particularly in the aspect of clinical waste management, its disposal and treatment capacities, and the workers in the industry.

2.2.4.9 Impact of Adapting to New 'Norm' and Culture

The Covid-19 pandemic has introduced new norms and cultures in our daily lives. The formulation of Covid-19 SOPs has been set as a pre-requisite for workplaces and businesses to resume their operation.

Furthermore, digital platforms such as video calls and video conferencing has become the preferred medium over face-to-face meetings to avoid direct contact with people or being confined in an air-conditioned room with other people for a long period of time.

Within the environmental assessment industry, delays in processing time and challenges in logistics arrangements has been encountered. This includes travel bans during the MCO and reduced number of flights as well as frequent flight cancellations or postponements.

2.2.5 Environmental Resource Inventory

2.2.5.1 Physico-chemical Environment

2.2.5.1.1 Topography

The Sri Aman Division encompasses relatively flat floodplains along the downstream and estuarine reach of the Batang Lupar and its tributaries. This transitions to a series of hills and ranges with elevations ranging from less than 20 m (+msl) to more than 1,000 m (+msl). Banjaran Kelingkang is found along the southern boundary of the Sri Aman District, which also forms the international border between Sarawak, Malaysia and Kalimantan, Indonesia. Major hills found in the Sri Aman District include Gunung Silantek (736 m (+msl)), Bukit Begunan (344 m (+msl)), and Bukit Balau (263 m (+msl)). Hilly and mountainous terrain are also found in the interior area of Lubok Antu District. The major hills in the area are Bukit Lanjak (1,285 m (+msl)), Bukit Sadok (829 m (+msl)), and Bukit Kranggas (853 m (+msl)).

2.2.5.1.2 Geology

The geology of the Study Area is predominantly underlain by Layar Member of Belaga Formation, Lubok Antu Melange Formation and Silantek Formation.

- Layar Member of Belaga Formation of Late Cretaceous age consists of rhythmically interbedded shale, mudstone, slate, and phyllite.
- Lubok Antu Melange Formation is composed of a chaotic assemblage of sandstone, mudstone, siltstone, chert, basalt and gabbro, and limestone blocks. The rock matrix in the Melanga has been dated as Paleocene to Eocene age.
- The Silantek Formation of the Eocene-Oligocene age is composed of silty and carbonaceous mudstone and shale with sandstone.

2.2.5.1.3 Soils

Approximately 25% of the Sri Aman Division is covered with red-yellow podzolic soils and 35% are skeletal soils which are found on steep and hilly terrain. The major soil series in skeletal soils include Kapit series whereas Bekenu series and Merit series are the major series classified in the red-yellow podzolic soils.

The remaining area in the Division is predominantly found on flat to undulating floodplains or valleys, which are covered with organic soils, gley soils, and grey white podzolic. The organic soils consist of deep peat soils of Anderson 2 and Anderson 3 soil.

2.2.5.2 Meteorology & Climate

Sarawak's climate is typically tropical with uniform yearly temperature, high humidity and abundant rainfall. Located just north of the equator, Sarawak receives an average of five hours of sunshine a day. Winds are generally light, with occasional squalls associated with rainstorm events.

Generally, the climate at the Study Area is typical of Sarawak; equatorial climate characterised by warm and humid weather all year round. It is affected by the seasonal movement of the Inter-Tropical Convergence Zone (ITCZ) and the associated movements of the warm air with the monsoons. The ITCZ has two distinct monsoon regimes, the Northeast Monsoon which moves southwards across Borneo

from November to March and the Southwest Monsoon which moves northwards across Borneo from May to September. The periods between the two monsoons are known as the inter-monsoon months.

The meteorological data such as rainfall, temperature, relative humidity and winds are obtained from the Sri Aman Meteorology Station situated at 1° 13'N 111° 27'E (with elevation at 9.6 mm above mean sea level).

2.2.5.2.1 Temperature and Relative Humidity

The temperature recorded in Sri Aman was fairly consistent as the 24 hours mean temperature ranged from 26.0°C recorded in the month of January to 27.1°C recorded in the month of May (Figure 2-5). On average, the coolest month in the region was January whereas the warmest months were May and June. The highest maximum temperature and the lowest minimum temperature were recorded over a period of 37 years, from 1983 to 2019 (Figure 2-6). The highest maximum temperature of 37.5°C was recorded in the month of July 2015 whereas the lowest minimum temperature of 18.5°C was recorded in the month of February 2014.

Throughout the year, the mean monthly humidity remained high fluctuating from 83.4% to 87.6% (Figure 2-7). The lowest relative humidity occurred in August while the highest relative humidity occurred during the month of January.

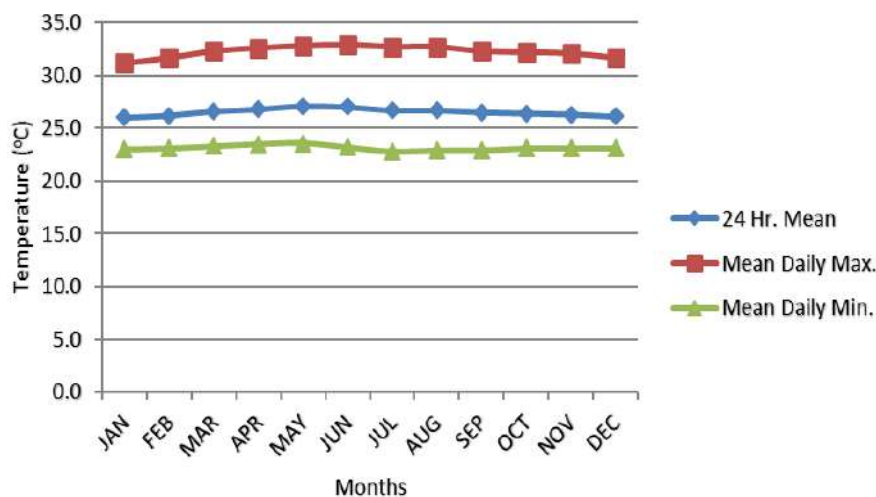


Figure 2-5: The Monthly 24-Hours Mean, Mean Daily Maximum and Mean Daily Minimum Temperature Recorded at Sri Aman Meteorology Station from 1983 to 2019

Source: Sri Aman Meteorology Station

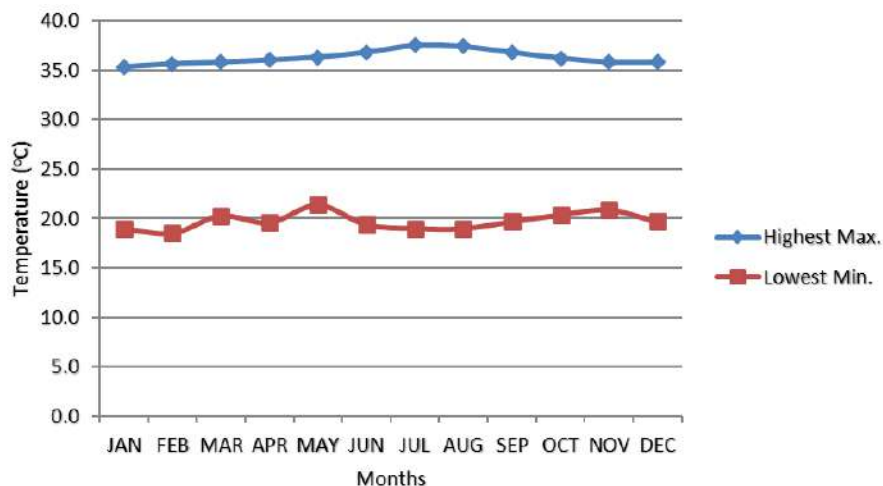


Figure 2-6: The Highest and Lowest Temperature Recorded at Sri Aman Meteorology Station from 1983 to 2019

Source: Sri Aman Meteorology Station

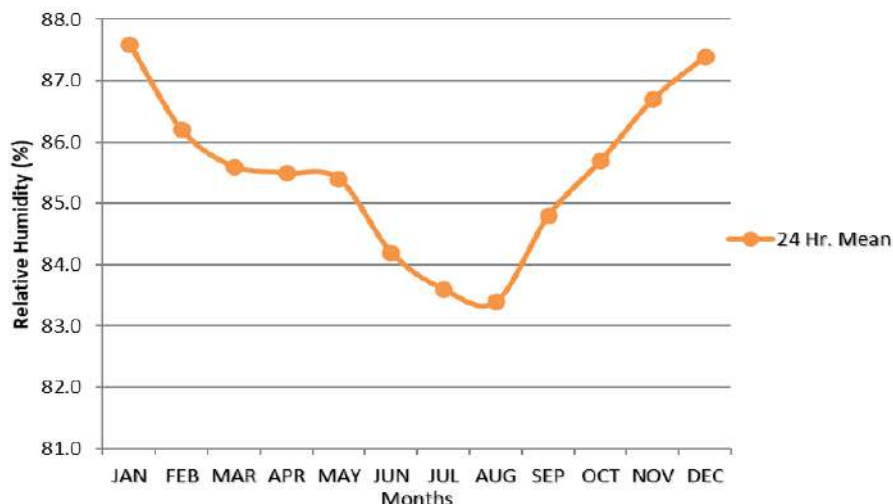


Figure 2-7: The 24-Hours Mean Relative Humidity at Sri Aman Meteorology Station from 1983 to 2019

Source: Sri Aman Meteorology Station

2.2.5.2.2 Rainfall

The mean annual rainfall recorded at Sri Aman Meteorology Station was 3374.7 mm and the mean number of rain days recorded is 226 days. The highest rainfall occurred in the month of December whereas the minimum rainfall occurred in February (Figure 2-8). The mean occupies a narrow range between 200 mm to 400 mm per month.

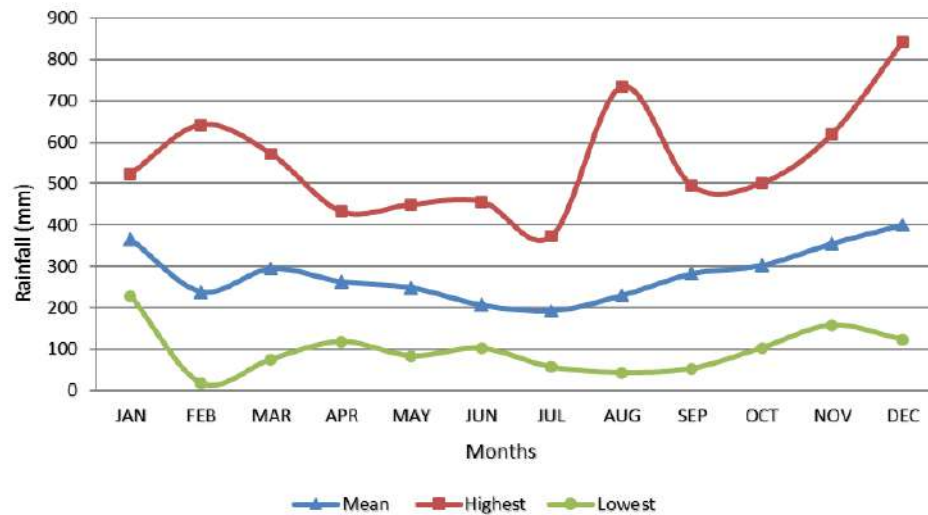


Figure 2-8: The Mean, Highest and Lowest Rainfall Recorded at Sri Aman Meteorology Station from 1983 to 2019

Source: Sri Aman Meteorology Station

2.2.5.2.3 Surface Winds

Wind direction and velocity plays an important role in the assessment of air quality as wind is a medium to transport and disperse air pollutants. Thus, it is important to consider the general wind flow patterns when providing an assessment of air quality and the potential impacts of development. The annual wind rose measurement and the four different monsoon periods at Sri Aman recorded from 1983 to 2019 are shown in Figure 2-9 and Figure 2-10.

On average, the predominant wind directions come from the east, south, and south-east. Based on the annual wind rose summary illustrated in (Figure 2-9), wind condition is generally calm 21.2% of the time.

During the north-east monsoon season from (November to March), the prevailing wind direction is from the east, north, north-west, west, south and south-east direction with speeds between 0.3 m/s to 7.9 m/s. During the south-west monsoon season from May to September, the prevailing wind direction is from the east, south and south-east direction. During the inter-monsoon months, the wind blew from the south-east direction at reduced wind speed and frequency.

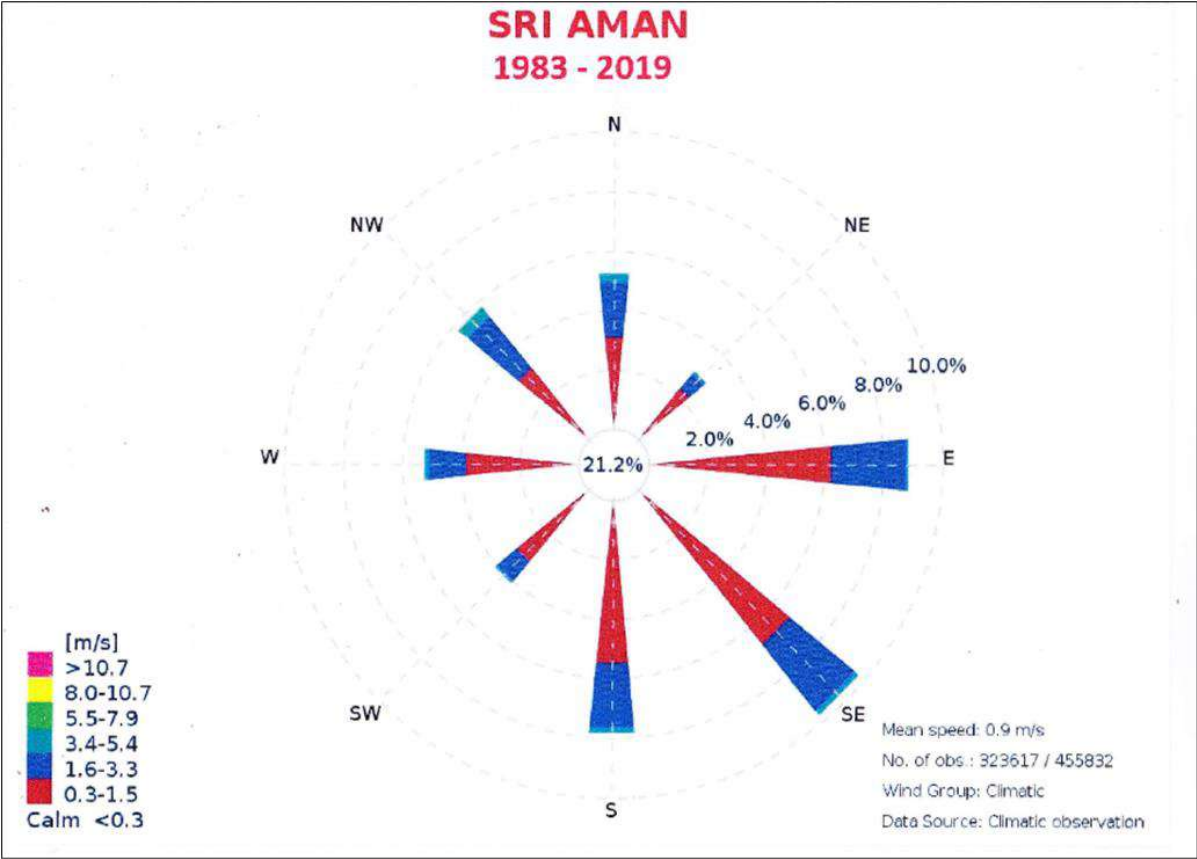
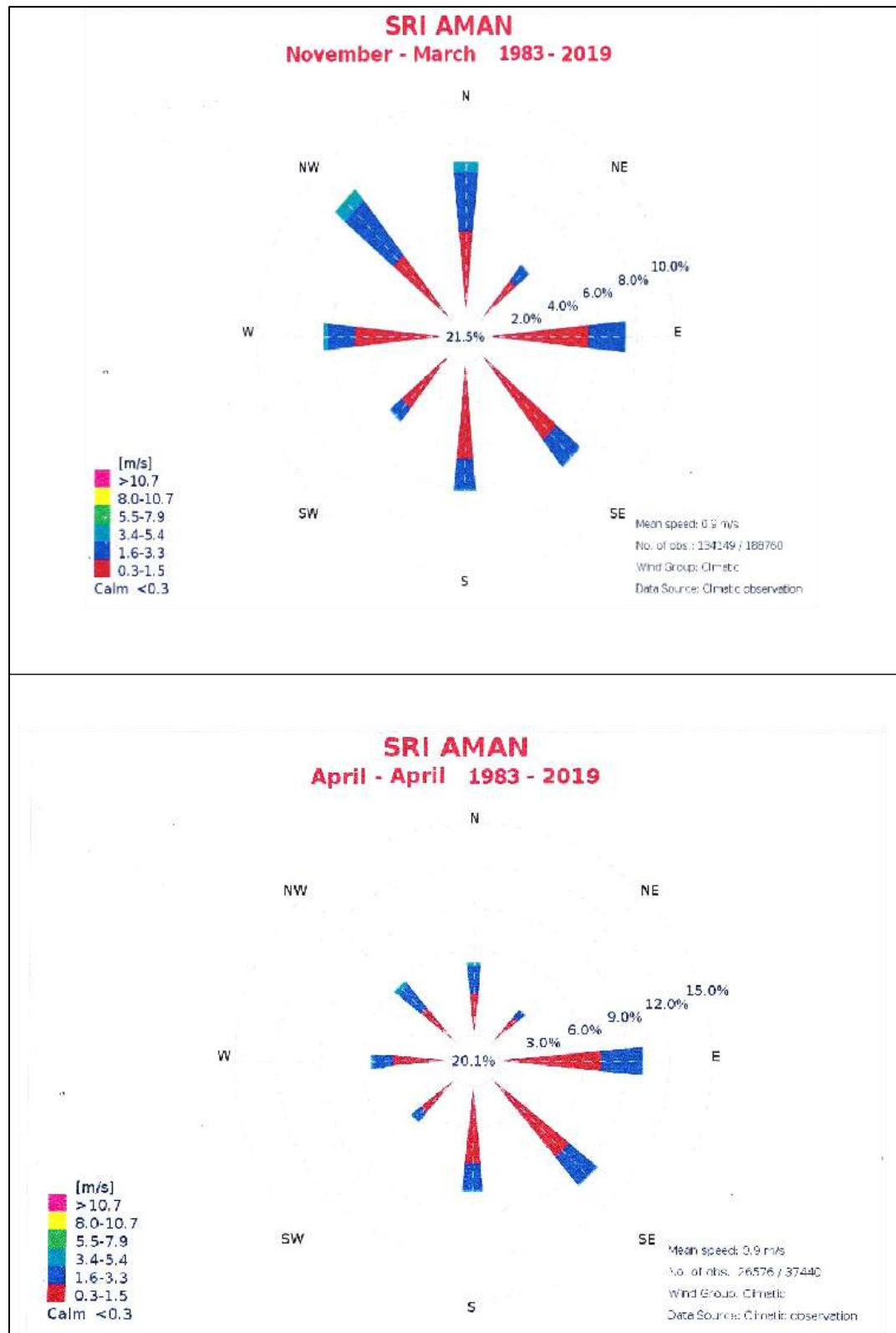


Figure 2-9: Annual Wind Rose Summary Recorded at Sri Aman Meteorology Station

Source: Sri Aman Meteorology Station



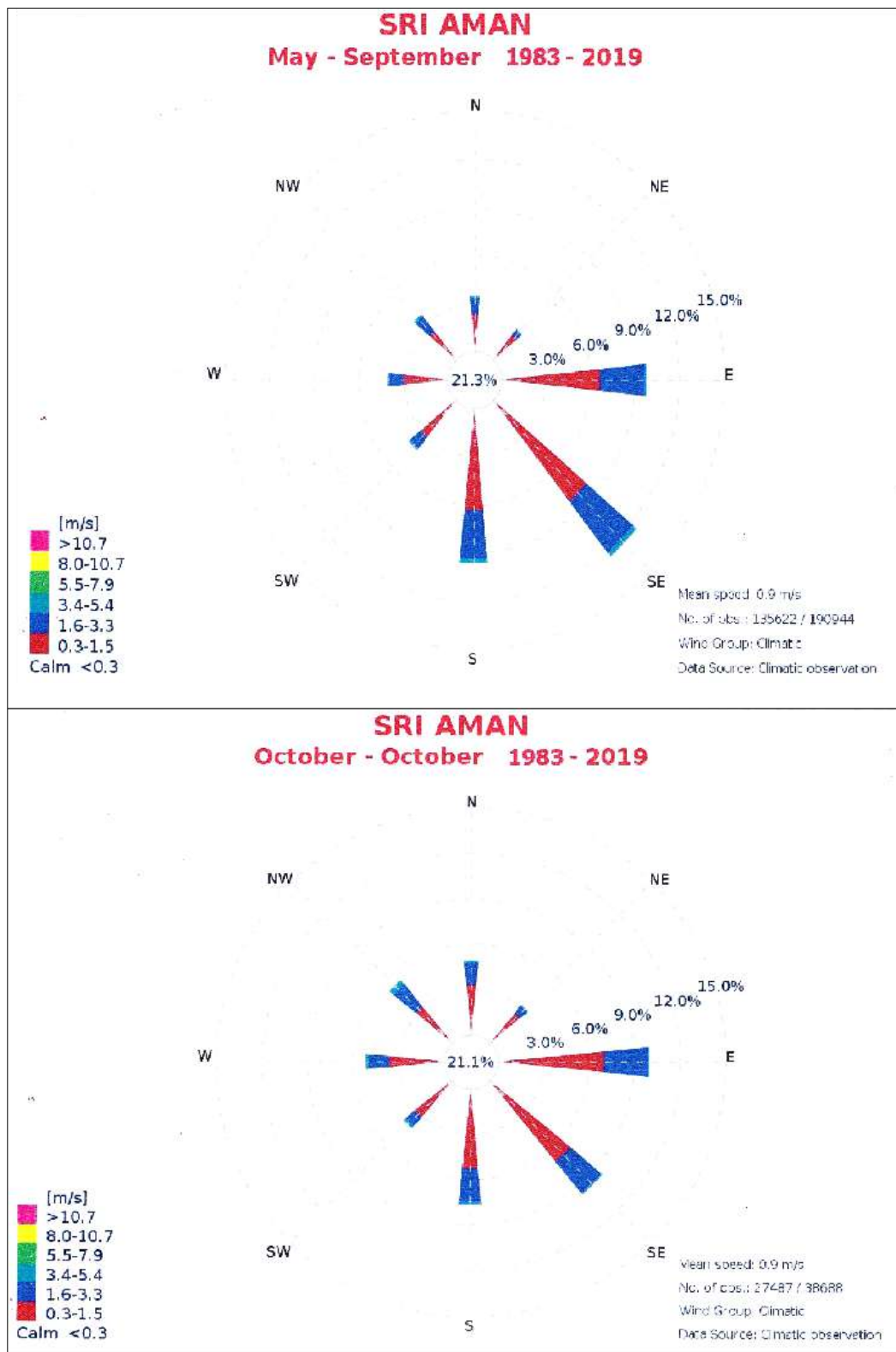


Figure 2-10: Seasonal Wind Rose Summary Recorded at Sri Aman Meteorology Station

Source: Sri Aman Meteorology Station

2.2.5.3 Hydrology and Drainage

The Sri Aman Division is drained by the Batang Lupar. The main tributaries of the Batang Lupar are the Batang Ai, Batang Undup, Batang Lemanak, Batang Skrang, Batang Lingga, Batang Seterap, and Batang Klauh. The Batang Lupar Basin originates from a series of hills and ranges located some 100 to 125 km from the coast. The Batang Lupar Catchment covers an area of about 6,500 km²; an area of over 5,400 km² of the Batang Lupar Catchment is within the Sri Aman Division. The rest of the Batang Lupar Catchment falls into the neighbouring Betong Division.

The Batang Ai Hydroelectric Dam, located within the Batang Ai Catchment (i.e. the sub-catchment of the Batang Lupar), has a reservoir area of about 85 km²; and the Batang Ai Catchment itself covers an area of approximately 1,200 km². Other sub-catchments of the Batang Lupar include the Batang Lemanak Catchment (approximately 600 km²), the Batang Skrang Catchment (approximately 900 km²), Batang Undup Catchment (approximately 225 km²) and the Batang Lingga-Batang Seterap-Batang Klauh Catchment (approximately 1,000 km²). These sub-catchments cover about 70% of the Sri Aman Division.

2.2.5.4 Water Quality

The assessment of water quality is based on three years (2017 to 2019) secondary water quality (rivers and dam) data from the monitoring programme by the Natural Resources and Environment Board (NREB). The existing NREB water monitoring stations within the Study Area are described in Table 2-20 and Table 2-21.

Table 2-20: Description of NREB River Water Monitoring Stations

Code	Description of Sampling Points	Rivers	Coordinates (WGS84)	Monitoring Frequency
SL1	Lingga Wharf	Batang Lupar	1° 21' 19.61" N 111° 10' 8.64" E	Quarterly
SL2	Bakong R.C. Jetty		1° 19' 52.03" N 111° 18' 15.18" E	
SL3	Kubu Alice Jetty		1° 14' 13.49" N 111° 27' 46.24" E	
SL4	Kpg Melayu Hulu		1° 14' 13.49" N 111° 38' 58.66" E	
SL5	Batang Lupar Bridge		1° 9' 6.52" N 111° 38' 58.66" E	
SL6	Pasar Engkilili		1° 21' 19.61" N 111° 10' 8.64" E	
SU1	Pasar Batu Lintang	Batang Undup	1° 01' 13.2" N 111° 32' 57.5" E	
SU2	Sungai Tandok		1° 01' 12.8" N 111° 32' 58.0" E	
SU3	Jambatan Batang Undup		1° 07' 14.7" N 111° 32' 13.6" E	
SU4	Bayai JKR Raw Water Intake		1° 08' 13.2" N 111° 30' 59.2" E	

Source: NREB

Table 2-21: Description of NREB Dam Reservoir Water Quality Monitoring Stations

Code	Description of Sampling Points	Dam	Coordinates (WGS84)	Monitoring Frequency
*DA1	MDLA Shophouse Batang Ai Jetty	Batang Ai Hydroelectric Dam, Sri Aman	1° 09' 05.6" N 111° 51' 26.7" E	Half-yearly
*DA2	Hilton Batang Ai Resort Jetty		1° 08' 58.9" N 111° 52' 33.6" E	
**DA3	Jambatan Batang Ai		1° 08' 31.5" N 111° 52' 14.4" E	
**DA4	Lubok Antu Town Jetty		1° 02' 39.1" N 111° 49' 45.1" E	

Note: * stations are located in the reservoir; ** stations are located downstream of the dam

The parameters analysed were pH, turbidity, dissolved oxygen (DO), 5-day biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), total suspended solids (TSS), ammoniacal nitrogen (AN), phosphorus (P), total coliform count (TCC) and faecal coliform count (FCC).

The NREB monitors the water quality of the Batang Lupar and the Batang Undup on a quarterly basis and the water quality of the Batang Ai Hydroelectric Dam reservoir on a half-yearly basis. The average values of the parameters obtained from the NREB analyses are compared against the National Water Quality Standards for Malaysia (NWQSM) and the respective Water Quality Index (WQI) are derived.

The Water Quality Index (WQI) is a 100-point scale that summarises the results from a total of six (6) water quality parameters: DO, COD, BOD₅, AN, TSS and pH. According to the formula for the WQI, sub-index for each parameter is computed for its best fit equation. Each sub-index is given a weighting factor which sets the relative importance of the parameter to the overall water quality. The total value for the six sub-indexes multiplied with its respective factor will add up to the WQI. This WQI acts as a guide only so that a general classification of the water can be derived. Each classification also corresponds with respective river usage where the Class IIB standard has been set as water quality target for all rivers in Sarawak (Table 2-22).

Furthermore, the higher the WQI is, the better the water quality will be, and vice versa (Table 2-23). The average readings of the key parameters obtained from the NREB analyses and WQI are categorised into the respective water classification according to the NWQSM (Table 2-24). The summary of the water analysis and WQI are tabulated in Table 2-25 and Table 2-26.

Table 2-22: Water Class and Uses

Water Classification		Uses
Class I		- Conservation of natural environment - Water supply I – Practically no treatment necessary - Fishery I – Very sensitive aquatic species
Class II	Class IIA	- Water supply II – Conventional treatment required - Fishery I – Sensitive aquatic species
	Class IIB	Recreational use with body contact
Class III		- Water supply III – Extensive treatment required - Fishery II – Common, of economic value and tolerant species; livestock drinking
Class IV		Irrigation
Class V		None of the above

Source: NREB

Table 2-23: Water Quality Index Rating Scale

Water Quality Index Range	Status
81 - 100	Clean
60 - 80	Slightly polluted
0 - 59	Polluted

Source: NREB

Table 2-24: NWQSM Classification with Respect to Parameter Readings

Class	DO (mg/L)	BOD ₅ (mg/L)	AN (mg/L)	COD (mg/L)	FCC (MPN/100mL)	TSS (mg/L)
I	>7	<1	<0.1	<10	10	<25
IIA	5 - 7	1 - 3	0.1 - 0.3	10 - 25	100	25 - 50
IIB	5 - 7	1 - 3	0.1 - 0.3	10 - 25	400	25 - 50
III	3 - 5	3 - 6	0.3 - 0.9	25 - 50	<20,000	50 - 150
IV	1 - 3	6 - 12	0.9 - 2.7	50 - 100	<20,000	150 - 300
V	< 1	>12	>2.7	>100	-	>300

Source: NREB

Table 2-25: Summary of NWQSM Classification and WQI of the NREB River Water Monitoring

Year	Monitoring Points	Organic Matter			COD	Bacteria	Suspended Solids	WQI	Class	Status
		DO	BOD ₅	AN						
2017	SL1 Lingga Wharf	III	I	II	IV	III	IV	57.1	III	Polluted
2018		II	II	III	III	III	IV	62.6	III	Slightly Polluted
2019		II	II	II	V	IIB	IV	60.2	III	Slightly Polluted
2017	SL2 Bakong R.C. Jetty	III	II	III	III	IIB	IV	64.7	III	Slightly Polluted
2018		II	I	II	III	IIB	IV	61.9	III	Slightly Polluted
2019		II	II	II	IV	IIB	IV	56.1	III	Polluted
2017	SL3 Kubu Alice Jetty	III	II	II	II	III	IV	75.1	III	Slightly Polluted
2018		III	II	IV	II	III	IV	59.5	III	Polluted
2019		II	II	II	III	III	IV	71.1	III	Slightly Polluted
2017	SL4 Kpg Melayu Hulu	III	II	II	II	III	IV	69.9	III	Slightly Polluted
2018		III	II	III	II	III	IV	66.6	III	Slightly Polluted
2019		II	II	III	III	III	IV	68.3	III	Slightly Polluted
2017	SL5 Batang Lupar Bridge	III	II	II	I	III	III	78.9	II	Slightly Polluted
2018		III	II	II	I	III	III	77.2	II	Slightly Polluted
2019		II	II	III	III	III	III	77.9	II	Slightly Polluted
2017	SL6 Pasar Engkilili	II	II	II	I	III	I	83.8	II	Clean
2018		III	II	II	I	III	II	82.1	II	Clean
2019		II	II	III	I	III	I	84.1	II	Clean
2017	SU1 Pasar Batu Lintang	II	II	III	I	III	I	89.3	II	Clean
2018		II	II	II	I	III	III	84.5	II	Clean
2019		II	II	II	II	III	I	90.5	II	Clean
2017	SU2 Sungai Tandok	II	II	III	I	III	I	87.5	II	Clean
2018		II	II	III	I	III	III	82.7	II	Clean
2019		II	II	II	II	III	I	85.1	II	Clean
2017	SU3	II	II	II	I	III	I	86.9	II	Clean

Year	Monitoring Points	Organic Matter			COD	Bacteria	Suspended Solids	WQI	Class	Status
		DO	BOD ₅	AN						
2018	Jambatan Batang Undup	II	II	II	II	III	III	79.7	II	Slightly Polluted
2019		II	II	II	II	III	I	84.6	II	Clean
2017	SU4	II	II	II	II	III	I	86.9	II	Clean
2018	Bayai JKR Raw Water Intake	II	II	II	I	III	III	80.2	II	Slightly Polluted
2019		II	II	II	II	III	II	86.2	II	Clean

Note: - exceeded Class IIB limit of the NWQSM

Source: NREB

Table 2-26: Summary of the NWQSM Classification and WQI of the NREB Dam Reservoir Water Monitoring

Year	Monitoring Points	Organic Matter			COD	Bacteria	Suspended Solids	WQI	Class	Status
		DO	BOD ₅	AN						
2017	DA1	II	II	III	II	IIB	I	86.3	II	Clean
2018	MDLA	II	II	II	I	IIA	I	92.9	I	Clean
2019	Shophouse Batang Ai Jetty	I	II	I	I	IIA	III	89.9	II	Clean
2017	DA2	II	II	III	II	IIB	I	86.3	II	Clean
2018	Hilton	II	II	I	I	I	I	93.9	I	Clean
2019	Batang Ai Resort Jetty	I	II	I	I	IIA	I	95.7	I	Clean
2017	DA3	III	II	III	II	IIB	I	77.6	II	Slightly Polluted
2018	Jambatan Batang Ai	III	II	I	II	I	I	77.9	II	Slightly Polluted
2019		III	II	I	I	IIA	I	88.5	II	Clean
2017	DA4	III	II	II	II	III	I	83.3	II	Clean
2018	Lubok Antu	II	II	II	II	III	I	86.7	II	Clean
2019	Town Jetty	II	II	I	I	IIB	I	93.6	I	Clean

Note: - exceeded Class IIB limit of the NWQSM

Source: NREB

With respect to the Class IIB standard which has been set as water quality goals for all rivers in Sarawak, all the NREB river water monitoring points recorded moderate levels of FCC which exceeded the Class IIB standard except for SL2 monitoring station established at Bakong RC Jetty throughout the three years and SL1 monitoring station established at Lingga Wharf in the year 2019. Downstream of the Batang Lupar particularly from Batang Lupar Bridge (SL4) to Lingga Wharf (SL1) recorded moderate to moderately high levels of TSS, corresponding to the moderate to moderately high turbidity levels. The existence of tidal bore at these stretches of Batang Lupar will naturally lead to erosion of alluvial sediments at the peak water flow (between high and low tide) and deposition when the flow velocity is low or when the tidal range is low. Hence, alluvial silts are expected to be very mobile, moving upstream and downstream of these stretches of the Batang Lupar. The moderately high TSS and turbidity readings observed can also exacerbated by soil erosion due to clearing at the riverbanks where sediment and organics are being washed into the rivers. Moderate FCC were also recorded at most of the monitoring points established at Batang Lupar. Moderately low to moderately high AN were detected throughout the monitoring period. Most of the AN concentration recorded were well within the Class IIB stipulated limit of 0.3 mg/L.

Similarly, the Batang Undup also recorded moderate levels of FCC with moderately low to moderate AN levels throughout the monitoring period from 2017 to 2019. Low to moderate levels of TSS and turbidity were also recorded.

Based on the NREB data, the downstream stretches of Batang Lupar can be generally classified as Class III river with WQI ranging from 57.1 to 75.1 whereas the upstream stretches from Batang Lupar Bridge to Pasar Engkilili can be classified as Class II river with WQI ranging from 77.2 to 84.1. Batang Undup can be classified as Class II river with WQI ranging from 79.7 to 90.5. Based on the NWQSM, Class III water will require extensive water treatment if it is to be used for potable purposes. However, it is considered as suitable for livestock drinking needs. In terms of fishery, Class III water is suitable for the protection of common and moderately tolerant aquatic species of economic value.

In terms of the dam water quality monitoring, the NREB establishes four monitoring points at the Batang Ai Hydroelectric Dam reservoir. Generally, the dam water quality can be classified into Class I to Class II with majority in the clean status except for DA3 (Jambatan Batang Ai) station which recorded slightly polluted status with WQI at 77.6 in the year 2017 and 77.9 in the year 2018. (Note that this monitoring point measures water quality at the outlet from the power station). Generally, Improvement of water quality is observed as the WQI ranging from 77.6 in the year 2017 to 95.7.

Low TSS were generally recorded at all the dam monitoring points except for DA1 (MLDA Shophouse Batang Ai Jetty) monitoring point in 2017. Microbiology analysis recorded low to moderately low levels of FCC expect for DA4 monitoring station at Lubok Antu Town Jetty in the year 2017 and 2018. Furthermore, low to moderate AN were also detected.

In conclusion, the downstream river stretches within the Batang Lupar River Basin can generally be classified as Class III whereas the upper portion of the catchment can be classified into Class I to Class II river, meeting the Class IIB standard which has been set as water quality goals for all rivers in Sarawak.

2.2.5.5 Air Quality

The assessment of air quality is based on the monthly air pollutant index (API) recorded at the Department of Environment (DOE) Continuous Air Quality Monitoring Station (CAQM) established at Sri Aman for a period of three years, from 2017 to 2019 (Table 2-27).

Table 2-27: Description of DOE Continuous Air Quality Monitoring (CAQM) Station

Station ID	Location
CA0036	Sri Aman, Sarawak

Source: DOE

The Air Pollutant Index (API) is derived from sulphur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), particulate matter with size of 10 micron or less (PM₁₀), ground level ozone (O₃), and particulate matter with the size of 2.5 micron or less (PM_{2.5}) (Figure 2-11). The API acts as a guide to report the ambient air quality or the intensity of air pollution.

Generally, the lower the API the better the air quality. In order to relate the status of air quality with its effects on human health, the range of index is characterised as: good, moderate, unhealthy, very unhealthy and hazardous. This is tabulated in Table 2-27. The monthly air pollutant index (API) recorded at the Department of Environment (DOE) Continuous Air Quality Monitoring Station (CAQM) established at Sri Aman for a period of three years, from 2017 to 2019, is tabulated in Table 2-29.

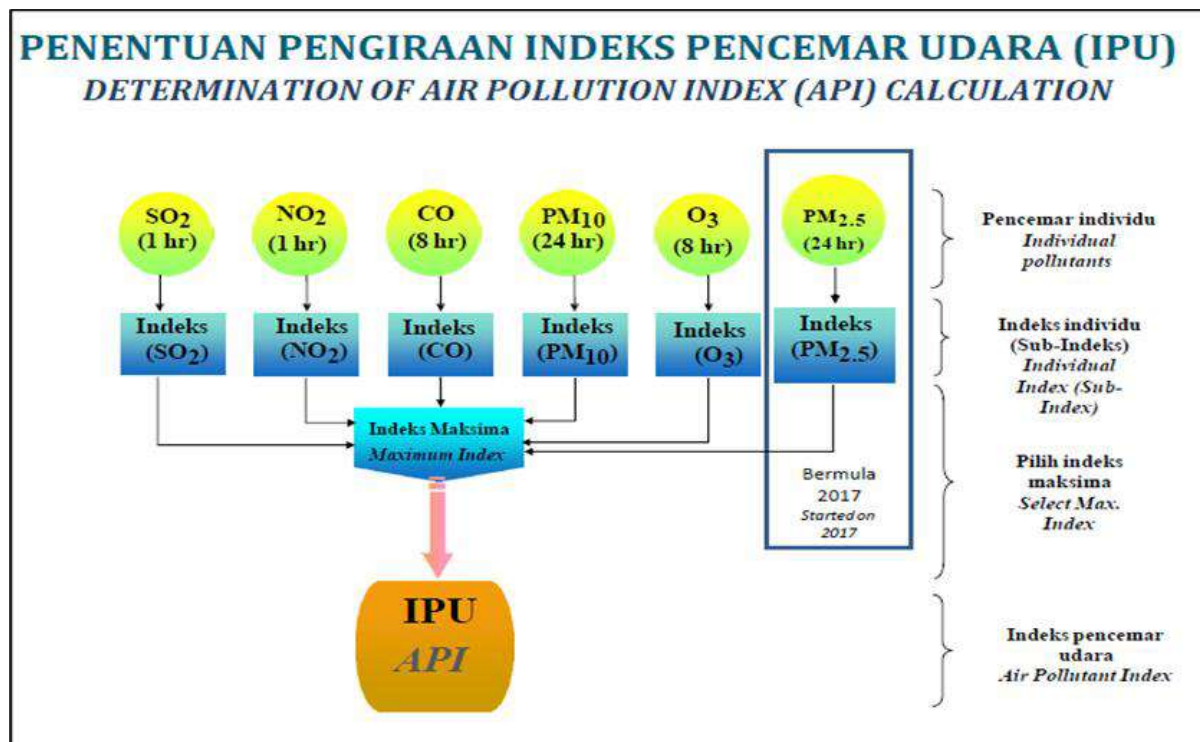


Figure 2-11: Air Pollutant Index (API) Calculation

Source: DOE

Table 2-28: The Malaysian Air Pollutant Index Rating Scale

API Range	Quality
0 – 50	Good
51 – 100	Moderate
101 - 200	Unhealthy
201 - 300	Very unhealthy
>300	Hazardous

Source: DOE

The overall air quality in Sri Aman in terms of monthly API readings ranged from good to moderate from 2017 to 2019 except for August and September 2019 which recorded very unhealthy and hazardous API reading of 294 and 467 respectively (Table 2-29). Haze was recorded at Sri Aman as the API sky-rocketed in those months. The high API reading recorded in the month of August and September 2019 can be attributed to the forest clearing, dry season, peat fire and haze from Kalimantan, Indonesia.

Table 2-29: Air Pollutant Index (API) Recorded at Sri Aman Station from 2017 to 2019

Month	Year 2017		Year 2018		Year 2019	
January	32	Good	40	Good	59	Moderate
February	32	Good	55	Moderate	53	Moderate
March	37	Good	55	Moderate	60	Moderate
April	29	Good	59	Moderate	56	Moderate
May			53	Moderate	55	Moderate
June			66	Moderate	56	Moderate
July	64	Moderate	69	Moderate	75	Moderate
August	63	Moderate	92	Moderate	294	Very Unhealthy
September	88	Moderate	76	Moderate	467	Hazardous
October	56	Moderate	55	Moderate	53	Moderate
November	56	Moderate	52	Moderate	64	Moderate
December	52	Moderate	46	Good	51	Moderate

Note:  - Not valid data due to change of equipment  - very unhealthy  - hazardous

Source: DOE

2.2.6 Biological Environment

2.2.6.1 Flora

Based on the Forest Cover map, approximately 38% of the Study Area is made up of mixed dipterocarp forest (MDF), followed by secondary forest (24%), plantation (19%) and patches of peat swamp forest (6%).

2.2.6.1.1 Mixed Dipterocarp Forest (MDF)

Mixed dipterocarp forest is predominantly found in the hinterlands within the Batang Ai National Park, the Lanjak-Entimau Wildlife Sanctuary, the northern portion of the Ulu Sungai Menyang landscape and the Sungai Lemanak catchment area. Besides dipterocarp trees, the flora community consists of non-dipterocarp trees, herbs, ferns, palms, and climbers.

Dipterocarp tree species belonging to the genus *Shorea*, *Hopea*, *Dipterocarpus*, *Vatica*, and *Anisoptera* is the predominant tree flora community. Commonly found dipterocarps recorded in the Batang Ai National Park were *Shorea macroptera* (*meranti melantai/engkabang melantai*), *Shorea paryifolia* (*meranti sarang punai*) and *Shorea amplexicaulis* (*meranti langgai*). Other common families include *Anarcardiaceae*, *Annonaceae*, *Burseraceae*, *Cannabaceae*, *Euphorbiaceae*, *Rubiaceae*, *Palmae*, *Myrtaceae*, *Leguminosae*, *Tiliaceae*, and *Lauraceae*.

2.2.6.1.2 Peat Swamp Forest

Patches of peat swamp forest are commonly found at the western portion of the Study Area along the Batang Lupar and in the Maludam and Ulu Sebuyau National Park. Among the flora communities recorded were the tree species from the *Euphorbiaceae*, *Fagaceae*, *Ebenaceae*, *Sapindaceae*, *Sapotaceae*, *Thymelaeaceae*, *Crypteroniaceae*, and *Dipterocarpaceae* family (Van der Mer, et. al., 2013; Tawan, et. al., 2016). Non-tree species such ferns, palms, herbs, shrubs, and grasses, climbers were also recorded from the *Araceae*, *Cyperaceae*, *Pandanaceae*, *Rubiaceae*, *Arecaceae* and *Marantaceae* (Van der Mer, et. al., 2013; Mohd-Azlan & Das, 2016).

Table 2-30: Flora Community in Peat Swamp Forest

Family	Scientific name	Common name
Euphorbiaceae	Blumeodendron tokbrai	Bantas
	Neoscortechinia kingii	Bantas/Berias
	Baccaurea bracteata	Tampoi
Fagaceae	Lithocarpus dasystachyus	-
Ebenaceae	Diospyros evena	Merpinang Daun Kecil
Sapindaceae	Nephelium maingayi	Serai
Sapotaceae	Madhuca motleyana	Ketiau Paya
Thymelaeaceae	Gonystylus bancanus	Ramin
Crypteroniaceae	Dactylocladus stenostachys	Jongkong
Dipterocarpaceae	Vatica mangachapoi	Resak
	Shorea inaequilateralis	Semayur
	Shorea teysmanniana	Meranti Paya
	Shorea albida	Alan Bunga
	Dryobalanops rappa	Kapur Paya
Pandanaceae	Pandanus spp.	Pandan/Mengkuang
Arecaceae	Licuala sp.	Palas
	Eleiodoxa conferta	Maram/Asam Paya
Nephrolepidaceae	Nephrolepis biserata	Paku Kubok
Blenchnaceae	Stenochlaena palustris	Paku Midin
Marantaceae	Donax cannaefornis	Bembam
Araceae	Aglaonema nitidum	Keladi Hutan
	Alocasia longiloba	Mayak Rarong
	Amydrium medium	Sakat Gajah
	Cyrtosperma ferox	Birah Hutan
	Homalomena rostrata	Keladi Kemoyang
	Lasia spinosa	Keladi Keris
	Pothos scandens	Selasih Hutan

Source: Van der Mer, et. al., 2013 (Alterra, Wageningen UR, Forest Department Sarawak & Sarawak Forest Corporation); Tawan, et. al., 2016 (UNIMAS); Mohd-Azlan & Das, 2016 (UNIMAS)

The *Madhuca motleyana* is listed as protected plant species under the Wild Life Protection Ordinance 1998 and is listed as near threatened plant species in the International Union for Conservation of Nature (IUCN) Red List of threatened species 2018. The *Shorea teysmanniana* is listed as endangered in the International Union for Conservation of Nature (IUCN) Red List of threatened species 1998. The *Vatica mangachapoi* is listed as vulnerable in the International Union for Conservation of Nature (IUCN) Red List of threatened species 2017. The *Gonystylus bancanus* is listed as critically endangered threatened in the International Union for Conservation of Nature (IUCN) Red List of threatened species 2018 whereas the *Shorea inaequilateralis* and *Dryobalanops rappa* are listed as endangered and *Shorea albida* is listed as vulnerable in the International Union for Conservation of Nature (IUCN) Red List of threatened species 2019.

2.2.6.1.3 Secondary Forest

Secondary forests are scattered throughout the Study Area, predominantly found at the eastern portion of the Ulu Sungai Menyang landscape, near Lubok Antu, southern portion of Sri Aman and at the Kelingkang Range. Secondary forests consist of regrowth from abandoned shifting cultivation areas near settlement areas, old secondary forest (more than 40 years old, found at the Ulu Sungai Menyang landscape) and young secondary forest. The commonly found flora community in the secondary forest are tabulated in Table 2-31.

Table 2-31: Commonly Found Flora in Secondary Forest

Family	Scientific name	Common name
Dipterocarpaceae	<i>Shorea amplexicaulis</i>	Meranti langgai
	<i>Vatica vinosa</i>	Resak Tangkai Ungu
	<i>Hopea pachycarpa</i>	Merkoyong
Fabaceae	<i>Koompassia malaccensis</i>	Kempas
	<i>Archidendron clypearia</i>	Jering Monyet
Hypericaceae	<i>Cratoxylum arborescens</i>	Manat
Rosaceae	<i>Prunus arborea</i>	Pepijat
	<i>Prunus spicata</i>	Entili Nipis
Phyllanthaceae	<i>Baccaurea hookeri</i>	Jentik Bukit
	<i>Glochidion littorale</i>	Hujan Panas
Sapindaceae	<i>Nephelium cuspidatum</i>	Buah Kebuau/Sibau
Myrtaceae	<i>Syzygium kunstleri</i>	Ubah Merah
	<i>Syzygium corymbifera</i>	Ubah Lingkau
Moraceae	<i>Artocarpus odoratissimus</i>	Madang
Crypteroniaceae	<i>Crypteronia macrophylla</i>	Beludang Semut
Cannabaceae	<i>Gironniera parvifolia</i>	Belian Landak
Elaeocarpaceae	<i>Elaeocarpus canipes</i>	Emperdu
Rutaceae	<i>Euodia malayana</i>	Serang
Aquifoliaceae	<i>Ilex cissoidea</i>	Aras
Myristicaceae	<i>Knema curtisii</i>	Kumpang enseluai
Lauraceae	<i>Litsea ferruginea</i>	Medang
Euphorbiaceae	<i>Macaranga gigantea</i>	Banek
	<i>Macaranga trachyphylla</i>	Benuah Cincin Merah
Melastomataceae	<i>Melastoma polyanthum</i>	Sekenduduk
Rubiaceae	<i>Psychotria elmeri</i>	Engkerabi Selop Besai
Blechnaceae	<i>Blechnum orientale</i>	Paku Gajah
	<i>Stenochlaena palustris</i>	Paku Akar
Hypoxidaceae	<i>Curculigo latifolia</i>	Kelapa Puluh
Marantaceae	<i>Phrynium capitatum</i>	Lirek
Dennstaedtiaceae	<i>Pteridium aquilinum</i>	Bracken
Vitaceae	<i>Tetrastigma pedunculare</i>	-

Source: Envisar Sdn Bhd, 2019

The *Dipterocarpus oblongifolius*, *Shorea macrophylla*, *Ficus* spp., *Begonia* spp., *Coelogyne septemcristata*, and *Cyrtandra* spp are protected plants listed in the Wild Life Protection Ordinance 1998. The *Parashorea macrophylla* is listed as critically endangered plan and the *Dimocarpus longan* is listed as near threatened in the International Union for Conservation of Nature (IUCN) Red List of threatened species 1998.

2.2.6.2 Fauna

The habitat for wildlife in the Sri Aman Division is comprised of oil palm plantations, grasses and shrubs, MDF, primary forest, secondary forest, secondary forest and patches of logged forest.

The Totally Protected Areas in Sri Aman Division are home to the largest orangutan conservation area in Sarawak, and these habitats thrive with Bornean orangutan, Bornean gibbons, leaf-monkeys, white-fronted and red langurs, seven hornbill species, eagles, and hundreds of other species of avifauna, reptile, and mammal species. The fauna found in the Study Area and their protection status are tabulated in Table 2-32.

Table 2-32: Fauna Commonly Found in the Study Area

Order/Family	Species Name	Common Name	IUCN*	WLPO**	CITES***
Artiodactyla					
Cervidae	<i>Rusa unicolor</i>	Sambar deer	Vu	NL	NL
	<i>Muntiacus</i> sp.	Muntjac	LC	NL	NL
Suidae	<i>Sus barbatus</i>	Bearded pig	Vu	NL	NL
Tragulidae	<i>Tragulus</i> sp.	Mouse deer	LC	NL	NL
Carnivora					
Felidae	<i>Pardofelis badia</i>	Bornean bay cat	En	I	II
	<i>Pardofelis marmorata</i>	Marbled cat	Vu	I	I
	<i>Prionailurus bengalensis</i>	Leopard cat	LC	II	II
	<i>Neofelis diardi</i>	Clouded leopard	Vu	I	I
Herpestidae	<i>Herpestes</i> sp.	Mongoose	LC	II	NL
Mustelidae	<i>Martes flavigula</i>	Yellow-throated marten	LC	NL	NL
Ursidae	<i>Helarctos malayanus eurypilus</i>	Bornean sun bear	Vu	II	I
Viverridae	<i>Arctictis binturong</i>	Binturong	Vu	II	NL
	<i>Paguma larvata</i>	Masked palm civet	LC	II	NL
	<i>Prionodon linsang</i>	Banded linsang	LC	II	II
	<i>Viverra zangalla</i>	Malay civet	LC	II	NL
Primate					
Cercopithecidae	<i>Macaca fascicularis</i>	Long-tailed macaque	LC	II	NL
	<i>Macaca nemestrina</i>	Pig-tailed macaque	Vu	II	NL
	<i>Presbytis frontata</i>	White-fronted langur	Vu	I	NL
	<i>Presbytis rubicunda</i>	Red langur	Vu	I	NL
	<i>Presbytis chrysomelas</i>	Red Banded Langur	CR	I	NL
	<i>Nasalis larvatus</i>	Proboscis monkey	En	I	I
Hominidae	<i>Pongo pygmaeus</i>	Bornean orangutan	CR	I	I
Hylobatidae	<i>Hylobates muelleri</i>	Bornean gibbons	En	I	I
Tarsiidae	<i>Tarsius bancanus</i>	Nocturnal western tarsier	Vu	I	NL
Lorisidae	<i>Nycticebus borneanus</i>	Bornean slow loris	Vu	I	NL
Rodentia					
Hystricidae	<i>Hystrix brachyura</i>	Common porcupine	LC	II	NL
	<i>Thrichys fasciculata</i>	Long-tailed porcupine	NL	II	NL
	<i>Thecurus crassispinus</i>	Thick-spined porcupine	NL	II	NL
Muridae	<i>Maxomys whiteheadi</i>	Whitehead's Sundaic Maxomys	Vu	II	NL
Muridae	<i>Maxomys surifer</i>	Indomalayan Maxomys	LC	II	NL
Muridae	<i>Niviventer rapit</i>	Montane Bornean Niviventer	LC	II	NL
Muridae	<i>Sundamys muelleri</i>	Müller's Sundamys	LC	II	NL
Sciuridae	<i>Rheithrosciurus macrotis</i>	Tufted ground squirrel	Vu	II	NL
Sciuridae	<i>Lariscus insignis</i>	Three-striped ground squirrel	LC	NL	NL
Pholidota					
Manidae	<i>Manis javanica</i>	Pangolin	En	II	II
Reptilia					
Varinidae	<i>Varanus salvator</i>	Monitor lizard	LC	II	II
Crocodylidae	<i>Crocodylus porosus</i>	Estuarine crocodile	LC	II	II
	<i>Tomistoma schleglii</i>	False gharial	Vu	II	I
Amphibia					
Dicroglossidae	<i>Limnonectes para macrodon</i>	Malaya Wart Frog	LC	NL	NL
	<i>Kurixalus appendiculatus</i>	Friiled tree frog	LC	NL	NL
Aves					
Alcedinidae	<i>Actenoides concretus</i>	Rufous-collared Kingfisher	NT	II	NL
	<i>Alcedo atthis</i>	Common Kingfisher	LC	II	NL
	<i>Alcedo euryzona</i>	Javan blue-banded Kingfisher	CR	II	NL
	<i>Alcedo meninting</i>	Blue-eared Kingfisher	LC	II	NL
	<i>Ceyx erithacus</i>	Oriental dwarf-kingfisher	LC	II	NL
	<i>Ceyx rufidorsa</i>	Oriental dwarf-kingfisher	LC	II	NL
	<i>Lacedo pulchella</i>	Banded Kingfisher	LC	II	NL
Phasianidae	<i>Argusianus argus</i>	Great argus	NT	I	II

Order/Family	Species Name	Common Name	IUCN*	WLPO**	CITES***
	<i>Lophura ignita</i>	Crested fireback	NT	II	NL
	<i>Lophura erythrophthalma</i>	Crestless fireback	Vu	II	NL
Columbidae	<i>Chalcophaps indica</i>	Emerald dove	LC	NL	NL
Pittidae	<i>Pitta baudii</i>	Blue headed pitta	Vu	I	NL
Pycnonotidae	<i>Iole charlottae</i>	Buff-vented bulbul	NT	NL	NL
	<i>Pycnonotus simplex</i>	Cream-vented Bulbul	LC	NL	NL
	<i>Pycnonotus pseudosimplex</i>	Cream-eyed Bulbul	LC	NL	NL
Pycnonotidae	<i>Alophoixus phaeocephalus</i>	Yellow-bellied Bulbul	LC	NL	NL
Bucerotidae	<i>Anthracoceros malayanus</i>	Black hornbill	Vu	I	II
	<i>Anthracoceros albirostris</i>	Oriental pied hornbill	LC	I	II
	<i>Dicaeum dayakorum</i>	Spectacled flowerpecker*			
Nectariniidae	<i>Anthreptes malacensis</i>	Brown-throated sunbird	LC	NL	NL
	<i>Anthreptes simplex</i>	Plain sunbird	LC	NL	NL
	<i>Arachnothera longirostra</i>	Little spiderhunter	LC	NL	NL
	<i>Hypogramma hypogrammicum</i>	Purple-naped Spiderhunter	LC	NL	NL
Calyptomenidae	<i>Calyptomena viridis</i>	Green broadbill	NT	NL	NL
Muscicapidae	<i>Copsychus malabaricus</i>	White-rumped shama	LC	II	NL
	<i>Cyornis turcosus</i>	Malay blue flycatcher	NT	NL	NL
	<i>Ficedula dumetoria</i>	Rufous-chestnut Flycatcher	LC	NL	NL
	<i>Enicurus leschenaulti</i>	White-crowned Forktail	LC	NL	NL
	<i>Enicurus ruficapillus</i>	Chestnut-naped Forktail	NT	NL	NL
Trogonidae	<i>Harpactes diardii</i>	Diard's Trogon	NT	NL	NL
	<i>Harpactes kasumba</i>	Red-naped Trogon	NT	NL	NL
Timaliidae	<i>Macronous ptilosus</i>	Fluffy-backed Tit-babbler	NT	NL	NL
Pellorneidae	<i>Malacocincla abbotti</i>	Abbott's babbler	LC	NL	NL
	<i>Malacopteron affine</i>	Sooty-caped babbler	NT	NL	NL
Chiroptera					
Hipposideridae	<i>Hipposideros cineraceus</i>	Least leaf-nosed bat	LC	II	NL
Hipposideridae	<i>Hipposideros cervinus</i>	Fawn-colored leaf-nosed bat	LC	II	NL
Pteropodidae	<i>Penthetor lucasi</i>	Lucas's short-nosed fruit bat	LC	II	NL
Pteropodidae	<i>Macroglossus minimus</i>	Dagger-toothed long-nosed fruit bat	LC	II	NL
Pteropodidae	<i>Balionycteris maculata</i>	Spotted-winged fruit bat	LC	II	NL
Pteropodidae	<i>Cynopterus brachyotis</i>	Lesser Dog-faced fruit bat	LC	II	NL
Rhinolophidae	<i>Rhinolophus luctus</i>		LC	II	NL
Rhinolophidae	<i>Rhinolophus trifolius</i>	Trefoil Horseshoe bat	NT	II	NL
Vespertilionidae	<i>Arielulus cuprosus</i>	Coppery sprite	Vu	II	NL
Vespertilionidae	<i>Kerivoula hardwickii</i>	Common woolly bat	LC	II	NL
Vespertilionidae	<i>Kerivoula intermedia</i>	Small woolly bat	NT	II	NL
Vespertilionidae	<i>Myotis muricola</i>	Nepalese whiskered bat	LC	II	NL
Vespertilionidae	<i>Myotis ridleyi</i>	Ridley's myotis	NT	II	NL
Scandentia					
Ptilocercidae	<i>Ptilocercus lowii</i>	Pen-tailed Tree shrew	LC	II	NL
Tupaiaidae	<i>Tupaia minor</i>	Lesser tree shrew	LC	II	NL
Eulipotyphla					
Soricidae	<i>Suncus etruscus</i>	Pygmy White-toothed shrew	LC	NL	NL

Note: IUCN = The IUCN Red List of Threatened Species. Version 2020-2. Category; LC = Least concern, NT = Near threatened, Vu = Vulnerable, En = Endangered, CR = Critically Endangered. WLPO = Sarawak Wild Life Protection Ordinance 1998; I = Totally Protected Animals under Schedule I, II = Protected Animals under Schedule I. CITES = Convention on International Trade in Endangered Species of Wild Flora and Fauna; I = Appendix I – Species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances. II = Appendix II – Species is not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. NL = Not listed.

2.2.6.2.1 Mammals

The conservation areas in the Sri Aman Division such as the Lanjak-Entimau Wildlife Sanctuary, Batang Ai National Park, Ulu Sebuyau National Park, Maludam National Park, Gunung Lesung National Park and the Ulu Sungai Menyang landscape have been known to support a rich primate community. These areas have been recorded to support the population of Bornean orangutan, Bornean gibbon, red langur and white-fronted langur. Besides, long-tailed macaque and pig-tailed macaque are also can found in these areas. In addition, the areas are also home to primitive primates such as slow loris and the western tarsier.

Other large mammals such as sambar deer, mouse deer and wild boar are sighted by camera trapping (Silang, *et al*, 2016). Han and Lading (2000) also recorded small mammals such as bats, rats, squirrels, tree shrews, porcupines, civets, marten, flying lemur, barking deer and mouse deer.

2.2.6.2.2 Avifauna

Hundreds of bird species have been recorded in the lowland and hill dipterocarp forests especially at the conservation areas in the Study Area. This shows that these areas form an important refuge for the avifauna. The avifauna composition includes resident, migrant and endemic species. Avifauna recorded were hornbills, woodpeckers, bulbuls, babblers, flycatchers, sunbirds and spiderhunters, cuckoos and malkota, doves and pigeons, kites and eagles, great argus and Bulwer's pheasant.

2.2.6.2.3 Reptiles

In Sarawak, the *C. porosus* (estuarine crocodiles) population is abundant in the estuarine river systems, mangrove floodplains and inland freshwater swamps (Tisen & Ahmad, 2010). With respect to the Study Area, the population of estuarine crocodiles in the Batang Lupar river basin is tabulated in Table 2-33. It is noted that the density of estuarine crocodiles is higher in the Batang Lingga, Batang Seterap and Batang Undup; ranging from 3.2 – 5.3 individuals per km as compared to other tributaries of Batang Lupar.

Table 2-33: Population of Estuarine Crocodiles in the Study Area

No.	River	Crocodile Counting		Density (ind/km)
		Distance Discovered	WH	p WH
1	Batang Lupar	126.2	234	1.85
2	Batang Lingga	18.0	96	5.33
3	Batang Seterap	15.5	54	3.48
4	Batang Klauh	6.0	13	2.17
5	Batang Undup	2.8	9	3.21
6	Batang Skrang	35.5	15	0.42
7	Batang Lemanak	10.0	7	0.70
8	Batang Ai	20.0	8	0.40
Total		234	436	1.86

Note: WH denotes without hatchlings

Source: Sarawak Forestry Corporation, 2015

Furthermore, Pulau Seduku Nature Reserve, a riverine island in Batang Lupar, has been gazetted as a totally protected area in 2015 and is dedicated to the conservation of crocodiles (Tisen et al., 2013). In 2016, *C. porosus* in Malaysia was transferred from Appendix I to Appendix II and approved by the CITES (Sarawak Forestry Corporation, 2018). With that, the wild harvest is restricted to Sarawak and a zero quota for wild specimens for the other parts of Malaysia (Sabah and Peninsular Malaysia). Additionally, under the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of

Threaten Species, *C. porosus* had been categorized as lower risk/least concerned due to the recovery of this species in several countries.

Within the Study Area, false gharials (*T. schlegelii*) have been recorded in Sungai Tisak, Batang. Seterap, Sungai. Dor (Stuebing et al., 1998), and Batang. Klauh (Cox and Gombek, 1985). The geographical records for *T. schlegelii* are associated with low lying areas such as peat swamps, freshwater swamps and flood plains. Most museum or field records of *T. schlegelii* nests are from peat swamp or freshwater swamp forest, and the species has generally been regarded as a peat swamp specialist (Bezuijen *et al.*, 1998, 2001a; Ross *et al.*, 1998). False gharial or *T. schlegelii* is listed as vulnerable species in the International Union for Conservation of Nature (IUCN) Red List 2014 and is a protected species under the Wild Life Protection Ordinance 1998.

2.2.7 Environmentally Sensitive Receptors

2.2.7.1 Water Catchment Areas

Based on the Sarawak Integrated Water Resource Management Master Plan Study (2008), there are a total of six gazetted water catchment areas and four existing drinking water catchment areas (non-gazetted) within the Sri Aman Division (Table 2-34 and Table 2-35).

Table 2-34: List of Gazetted Water Catchments in Sri Aman Division

No.	Gazetted Water Catchment	Gross Area (ha)
1.	Sri Aman Catchment	23,794
2.	Stumbin Bijat Catchment	2,407
3.	Lubok Antu LDS Catchment	45,448
4.	Pantu Catchment	27,568
5.	Engkilili	2,519
6.	Lingga	483

Source: Sarawak Integrated Water Resource Management Master Plan Study (2008)

Table 2-35: List of Existing Drinking Water Catchments in Sri Aman Division (Non-gazetted)

No.	Existing Drinking Water Catchment	Gross Area (ha)
1.	Banting Catchment	223
2.	Skrang Catchment	73,655
3.	Lubok Antu Catchment	113,057
4.	Melugu Catchment	456

Source: Sarawak Integrated Water Resource Management Master Plan Study (2008)

In addition to the existing water catchments, the Jabatan Bekalan Air Luar Bandar (JBALB) is currently proposing for a new raw water intake point abstracting from the Batang Lupar to supplement the existing Bayai Water Treatment Plant in Sri Aman.

2.2.7.2 Fishery Sanctuary

Terubok fishing grounds are located along the stretch of the Batang Lupar, from the river mouth of Batang Lupar to Sungai Lingga. The Batang Lupar supports substantial fisheries, and it is also a spawning ground for Terubok at certain stretches of the river.

2.2.7.3 High Conservation Value Area

The Ulu Sungai Menyang area, adjacent to the Batang Ai National Park has been identified as a high conservation value forest (HCVF). This is following a survey in 2013 conducted by FDS, SFC, WCS and Borneo Adventure to determine the orangutan population in the area. The results showed that a total of 995 nests were found and another 199 nests were detected through aerial survey. This shows that the Ulu Sungai Menyang area is an important habitat for Borneo orangutan.

2.2.8 Forestry

2.2.8.1 Forest Cover

The forest cover of Sri Aman Division is deduced from the Land and Survey Department Sarawak, 1: 250,000 Scale Land Use Map (Sarawak Series No. 22, Sheet NA49-11, Edition 3) published in the year 1995. The Land Use Map indicated that the hinterland at the northeast of the Study Area is dominated by forest land, in particular, hill forest. On the other hand, the riparian area at the west and northwest of the Sri Aman Division is dominated by swamps, marshlands, and wetland forests such as mixed swamp forest and alan forest. The large area of landmass in the Sri Aman Division is dominated by shifting/ex-shifting agriculture land and logged-over forest which have formed tracts of cleared lands. Patches of cultivated and horticultural lands are scattered all over the Sri Aman Division.

A preliminary verification is also made against valid Google Earth satellite images taken in the year 2016. Satellite images have shown that much of the mixed swamp forest and alan forest have been converted into palm oil plantation estate. In regard to the cleared lands formed after shifting/ex-shifting agricultural and timber harvesting activities, there is minimal or no sign of restoration of the forest landscape. The signs of barren land area can be seen clearly from satellite images.

2.2.9 Totally Protected Area (TPA)

The totally protected area (TPA) refers to the land area gazetted under the National Parks and Nature Reserve Ordinance, 1998, as National Park or Nature Reserve, or under Wild Life Protection Ordinance, 1998, as Wildlife Sanctuary. These land areas are set aside to preserve and conserve the variety of landscapes, forest types, flora and fauna that make Sarawak unique. There are six gazetted TPAs in the Sri Aman Division: four national parks, a wildlife sanctuary and a nature reserve (Table 2-36).

Table 2-36: List of Totally Protected Areas in Sri Aman Division

Totally Protected Area	Total Hectareage (Ha)	Area in Sri Aman Division (Ha)	Year of Establishment
Lanjak-Entimau Wildlife Sanctuary	182,983	36,346	1983; *2013
Batang Ai National Park	24,040	24,040	1990
Maludam National Park	53,568	2,327	2000; *2013
Gunung Lesung National Park	595	595	2013
Ulu Sebuyau National Park	18,287	2,508	2010
Pulau Seduku Nature Reserve	360	360	2015
Total Area (Ha)	279,833	66,176	-

Note: * Year of gazettelement of extensions

Source: Sarawak Forest Dept.

In the case of the Lanjak-Entimau Wildlife Sanctuary and Batang Ai National Park, these locations are part of the Heart of Borneo (HOB) Initiative. The HOB Initiative is a trilateral international agreement between Brunei Darussalam, Indonesia and Malaysia to sustainably manage the forest and its resources in the region. In addition to existing TPAs, the proposed totally protected areas (TPAs) in Sri Aman are the Kelingkang range National Park and the proposed extensions of the Batang Ai National Park.

2.2.9.1 *Lanjak-Entimau Wildlife Sanctuary*

The Lanjak-Entimau Wildlife Sanctuary which covers an area of approximately 182,983 ha is located within the Sri Aman, Kapit, Sarikei and Sibuan Division. Located north of the Batang Ai National Park, approximately 20% (26,246 ha) of the park is within the Sri Aman Division. The Lanjak-Entimau Wildlife Sanctuary forms a part of a large transboundary protected area connected to Indonesia known as the Heart of Borneo (HOB). The Lanjak-Entimau Wildlife Sanctuary is gazetted for the protection of wildlife, particularly for Borneo orangutan and hornbills, as well as the biological and genetic resources that are found within the area. Furthermore, it is estimated there are 1,600 orangutans in Sarawak, with 90% of the population living in the Batang Ai-Lanjak Entimau landscape (WCS, 2020).

2.2.9.2 *Batang Ai National Park*

The Batang Ai National Park covers an area of approximately 24,040 ha and is located at the headwaters of the Batang Ai and Sungai Lubang Baya, about 15 km upstream of the Batang Ai Hydroelectric lake. The Batang Ai National Park is accessible via 2 hours boat ride from the Batang Ai jetty. The park is located adjacent to the Lanjak-Entimau Wildlife Sanctuary, forming a part of a large transboundary protected area connected to Indonesia.

The mixed dipterocarp forest and secondary forest in the Batang Ai National Park serves an important habitat for the Bornean orangutan and other primates such as Bornean gibbon, long-tailed macaque, pig-tailed macaque, white-fronted langur and red langur (Soepadmo & Chai, 2000; Mohd-Azlan & Engkamat 2013). Other mammals such as bearded pig, sambar deer and clouded leopard as well as birds such as hornbills, buff-vented bulbul, cream-vented bulbul and cream-eyed bulbul were also recorded in the Batang Ai National Park (Shakya et. al., 2019; Sheldon & Shakya, 2019). It is also noted that there is a proposal to extend the Batang Ai National Park

2.2.9.3 *Gunung Lesong National Park*

The Gunung Lesong National Park which covers an area of 595 ha of mixed dipterocarp forest, kerangas and patches of swamp forest is also commonly known as Bukit Lingga. In addition to flora and fauna protection and conservation, it is also culturally significant particularly to the Iban communities residing nearby (WWF, 2019). Utusan Borneo (2020) reported that primates such as red-langurs and Bornean orangutan can be sighted at the Gunung Lesong National Park.

2.2.9.4 *Pulau Seduku Nature Reserve*

The Pulau Seduku Nature Reserve is an island in the middle of the Batang Lupar, located approximately 30 km from Simanggang Town. The 360-ha island has been gazetted as a totally protected area for the conservation of crocodile population (Tisen et al., 2013).

2.2.9.5 *Maludam National Park*

The Maludam National Park which covers an area of approximately 53,568 ha is located at the Maludam peninsula. Essentially, a vast area of the Maludam National Park is located within the Betong Division with approximately 4% (2,327 ha) of the park located within the Sri Aman Division. Comprising low-lying peat swamp forest, the Maludam National Park serves as habitat for notable fauna such as the proboscis monkey, black hornbills, oriental pied hornbill, and red banded langur. It is noted that the red banded langur (*Presbytis chrysomelas*) is endemic to Sarawak (Sarawak Tourism, 2020).

2.2.9.6 *Ulu Sebuyau National Park*

The Ulu Sebuyau National Park is located at the lower Batang Lupar river catchment covering essentially the low-lying peat swamp forests in the Samarahan and Sri Aman Division. Approximately 25% (4,400 ha) of the park is located within the Sri Aman Division. The Ulu Sebuyau National Park serves as an important habitat for notable fauna such as proboscis monkey, Bornean orangutan, black hornbill, bushycrested hornbill, and false gharial (Silang et. al., 2016).

2.2.9.7 *Proposed Kelintangan Range National Park*

The Kelintangan Range runs along the Sarawak-Indonesia border in the east of the Serian Division and the west of the Sri Aman Division. The hilly terrain is an important watershed for the area.

2.2.10 **Permanent Forest Estate (PFE)**

In Sarawak, permanent forest estate (PFE) was established based on the Forest Ordinance, 2015. The PFE comprises three sub-categories which are: forest reserve, protected forest and communal forest. The existing permanent forest estate in Sri Aman is approximately 6,734 ha whereas the proposed permanent forest estate is approximately 29,497 ha. Therefore, permanent forest estate makes up approximately 6.6% of the entire Sri Aman.

The forest reserve is made up of a productive forest and is a principal as well as permanent source of timber supply for the timber industry. They also form the major component of the PFE. Approximately 15% (84,557.7 ha) of Sri Aman is made up of forest license area.

2.2.11 **Environmentally Sensitive Areas (ESAs)**

In 2005, the National Physical Plan defined and earmarked the environmentally sensitive areas in the Peninsular Malaysia into various ranks with respective management criteria. Based on the Sarawak Land Use Master Plan Study, the environmentally sensitive areas in Sarawak were categorised into inland ESA and coastal ESA before being ranked along with respective management criteria. Table 2-37 summarises the definition of ESA from the National Physical Plan and Sarawak Land Use Master Plan Study.

With respect to each rank/level attached to ESA, these areas are to remain untouched by development, conserved or sustainably managed depending on the type, characteristic and level of sensitivity/importance involved (Table 2-38).

Table 2-37: Comparison of the definition of ESA between the National Physical Plan and the Sarawak Land Use Master Plan Study

Rank/Level	National Physical Plan (2005)	Sarawak Land Use Master Plan	
		Inland	Coastal
Rank /Level 1	-All Protected Areas, potential Protected Areas, wetlands and turtle landing sites -Catchment of existing and proposed dams -All area above 100 m contour	-Inland area totally protected areas (TPA) and proposed protected areas (TPA)	-Coastal totally protected areas (TPA) and proposed totally protected areas (TPA) -Intact mangrove forest -Intact swamp forest
Rank/Level 2	-All other forest, corridors, corridors linking important Protected Areas, buffer zone around Rank 1 areas -All areas between 300 m – 1000 m contour	-Include areas within the Eco-Corridor, Heart of Borneo Zones with intact forest and priority conservation area	-Peat soils and mangrove swamps within 1 m sea level rise zone
Rank/Level 3	-All marine park inlands buffer zone around Rank 2 areas -Catchment for water intakes and groundwater extraction (wellfields)	-Areas within Eco-Corridor, priority conservation area, Heart of Borneo with degraded forest or alternate land cover	-Peat soil and mangrove swamps outside of the sea level rise inundation zone

Source: National Physical Plan and the Sarawak Land Use Master Plan Study

Table 2-38: Comparison of the Management Criteria of ESA between the National Physical Plan and Sarawak Land Use Master Plan Study

Rank/Level	National Physical Plan (2005)	Sarawak Land Use Master Plan	
		Inland	Coastal
Rank /Level 1	No development, agriculture or logging shall be permitted except for low impact nature tourism, research, and education	Totally protected-no resource extraction	To be preserved intact and protected from resource extraction and exploitation
Rank/Level 2	No development or agriculture. Sustainable logging and low impact tourism may be permitted subjected to local constraint.	Heightened conservation restrictions but still allow for resource management that are more restrictive of Level 3	Areas for restoration focus and limited long-term resource use. Agricultural practices within the area should shift towards native/high water table tolerant crop alternatives that require little to no drainage.
Rank/Level 3	Controlled development where the type and intensity of the development shall be strictly controlled-depending on the nature of constraint.	Less restrictive in terms of resource management practices as the land has already been disturbed and targeted regrowth initiatives in critical areas	Ecologically sensitive, but its location may be suitable for long-term to carefully managed drainage schemes and cultivation of alternate crops.

Source: National Physical Plan and the Sarawak Land Use Master Plan Study

This section discusses the environmentally sensitive areas that have been identified in this Study to protect ecological significant habitats and resources in Sri Aman through the interpretation of ESAs by both the National Physical Plan, 2005 and the Sarawak Land Use Master Plan Study, 2020. These identified environmentally sensitive areas shall be integrated in the planning and management of land use and natural resources in Sri Aman (Table 2-39).

Table 2-39: Environmentally Sensitive Areas in Sri Aman

ESA Category	Definition
ESA Rank 1	Totally protected areas (TPA), proposed totally protected areas (TPA), important conservation areas
	Catchment of existing and proposed dams
	Steep areas above 1000 m contour
ESA Rank 2	Steep areas between 300 m – 1000 m contour
	Areas within the Heart of Borneo with intact forest
	Zone of 8 km of intake point within catchment areas
ESA Rank 3	Steep areas between 150 m – 300 m contour
	Areas within the Heart of Borneo with sparse forest
	Water catchment areas beyond the zone of 8 km of the intake point
	Deep peat areas
	Terubok Refugia

Source: National Physical Plan, The Sarawak Land Use Master Plan Study and UNIMAS analysis

2.2.12 Digital Environment Presence

2.2.12.1 Introduction

A digital environment refers to integrated communications system where digital devices communicate and manage the content and activities within it. The concept is based on digital electronics system which are integrated and implemented for a global community. Major components of a digital environment generally include websites, cloud servers, search engine, social media outlets, mobile applications, audio and video, and other web-based resources (Wikipedia, accessed on 22 September 2020).

Rapid digitalisation is changing the way we collect data/information. It is changing the way we observe, understand and interact with our ecosystems. It is also changing the ways we communicate with each other and the actions that we take on environmental issues.

2.2.12.2 Digital Environment – Global

Digital technology has been changing the state of nature conservation and protection in increasingly profound ways. The impact and its significance can be explained through five pivotal dimensions: data on nature, data on people, data integration and analysis, communication and experience, and participatory governance.

The digital revolution is directly relevant to the social practices and organizations concerned with the conservation and protection of nature. Digital applications have started to gain prominence in nature conservation and protection in both number and diversity and are progressively shaping conservation and protection discourses and practices. Mass produced, high-tech sensors and related technology make it possible for there to be more, better, faster and cheaper capture of data on nature (Van Tamelen, 2004; Koh and Wich, 2012; Will et al., 2014). These technologies are implemented in various ways, from multi-sensor equipped smart phones carried by humans and satellite tags carried by animals, to camera traps, drones, deep-sea submarines and space satellite. It has enabled more frequent monitoring of the natural environment, on a larger spatial scale, at a finer resolution in inaccessible or dangerous locations. Many tools also allow automated capture of data: once activated they require almost no or minimal further human involvement.

Globally, big data and AI algorithms can be used to monitor and preserve endangered species on land, as well as provide early warning against natural disasters such as earthquakes, wildfires, floods, and droughts. Data collection and satellite imagery tools can also help to ensure ocean sustainability by preventing overfishing and by monitoring the health and pollution levels of marine ecosystems and ocean habitats. However, that is not all there is to AI and data. Smart grids powered by AI can help monitor trends in energy consumption and ultimately reduce the emission of GHGs.

Blockchain is another digital technology that may revolutionise environmental efforts. According to the report entitled 'Building Block(chain)s for a Better Planet', blockchain technologies could have several uses in environmental sustainability. For instance, blockchain could allow for decentralised and sustainable resource management, including water and energy consumption. In addition, it could help conserve marine biodiversity by preventing practices such as overfishing through traceable and transparent supply chains.

The ASEAN Specialised Meteorological Centre (ASMC) is designated as the regional centre to monitor and assess land and forest fires and provide early warning on the occurrence of transboundary smoke haze affecting the entire ASEAN region. The website provides a wide range of operational and regularly updated information and products on the weather, climate and smoke haze situation in the ASEAN region that can be used by meteorological experts and end users from different sectors (such as the environment, forestry, agriculture, etc.). The major products include hotspots reports, NOAA-series satellites images, Terra and Aqua MODIS satellite images.

Internet supported social media have offered laymen and experts new means to self-organise and exchange ideas, experience, and footage. Platforms such as Open Air Laboratory (OPAL), eBird, the iNaturalist App, the Atlas of Living Australia and WikiAves do not only provide scientist with data, but also allow people to become part of a community through uploading observations of flora and fauna, inspecting sightings by others, and fostering discuss on and learning about the natural world.

The Global Environment Monitoring System for freshwater (GEMS/Water) provides the world community with sound data on freshwater quality to support scientific assessments and decision making on the subject. Surface and ground water quality monitoring from the GEMS/Water monitoring network is shared through the GEMStat information system. GEMS/Water supports the Sustainable Development Goal for Water (SDG 6) with methodology support, data management, quality assurance, indicator calculation and capacity development.

A topical dimension of participatory governance is e-governance, i.e. the use of ICT in the practices. Participatory governance may involve a wider digital public participation in natural resources management, decision making and policy making. This can be supported with computer models and GIS mapping exercises.

2.2.12.3 Digital Environment – Malaysia

As an emerging and developing country, Malaysia has been improving continually in coverage, quality, and affordability of digital technology. This section describes the existing technology practices to monitor the existing physico-environment in Malaysia.

2.2.13 Environmental Quality Monitoring Programme (EQMP) by Department of Environment (DOE), Malaysia

The Environmental Quality Monitoring Programme (EQMP) is a Government initiative to strengthen the monitoring of environmental quality. The programme includes data collection for air quality, river water quality and marine water quality throughout Malaysia for the purpose of reporting the actual level of environmental quality in the country in order to monitor, prevent and control pollution. Pakar Scieno TW Sdn Bhd (PSTW) has been appointed as the concessionaire to conduct the EQMP under the Ministry through the Department of Environment for a period of 15 years from year 2017 to January 2032.

The Environmental Data Centre (EDC) is the database management system of the EQMP. All data obtained from all the automated monitoring stations under the EQMP is transmitted, stored and displayed in the EDC. Data analysis, data presentation and visualisation of the data in relation to relevant spatial information represents elements of decision support capability. In addition, key operational parameters such a data transmission is also monitored at the EDC. Alert arising from potential pollution events are also sent from the EDC for follow-action by PSRW personnel and the DOE. The EDC comprise a server farm, command centre and disaster recovery site.

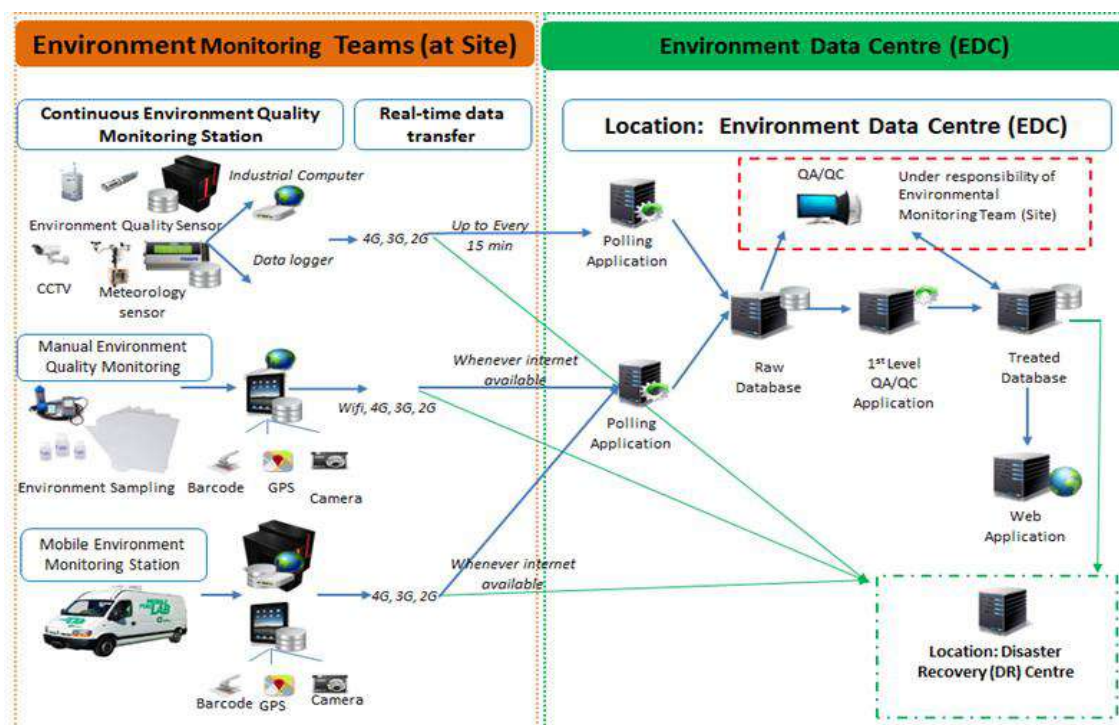


Figure 2-12: Environmental Monitoring Team and Environmental Data Centre System

Source: DOE and Pakar Scieno TW Sdn Bhd

2.2.13.1 Continuous Air Quality Monitoring (CAQM)

The Department of Environment (DOE) monitors country's ambient air quality through a network of 68 stations (DOE website at apims.doe.my/public_v2/api_table.html, assessed on 8 October 2020). Out of the 68 stations, 65 are continuous air quality monitoring (CAQM) stations and three are mobile continuous air quality monitoring (MCAQM) stations. There are 13 CAQM stations in Sarawak. Out of the 13 stations in Sarawak, one is stationed in Sri Aman town.

These monitoring stations are strategically located in urban, suburban, industrial and rural areas to monitor any significant changes in the air quality which may be harmful to human health and the environment.

Automatic monitoring is designed to collect/measure data continuously (24 hours a day). The CAQM Stations typically include:

- a. Measurement instrumentation (for both pollutant gases and meteorological parameters)
- b. Support instrumentation (support gases, calibration equipment)
- c. Instrument shelters (temperature controlled enclosures)
- d. Data acquisition system (to collect and store data)

The CAQM station provides near real-time air quality data which is transmitted to the Environmental Data Centre (EDC) on a scheduled basis. The air quality status is reported as Air Pollutant Index (API). The API is calculated based on the concentration of six major pollutants which are ground level of ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), particulate matter 10 microns or less in diameter (PM₁₀) and particulate matter 2.5 microns or less in diameter (PM_{2.5}). API is calculated based on the 24 hours data retrieved from the CAQM stations throughout the country and updated hourly. Data retrieval process will need a complete cycle of one hour before API readings can be obtained. The API data is always being displayed in the Air Pollutant Index Management System (APIMS) website.



Figure 2-13: One of the DOE Continuous Air Quality Monitoring Stations in Malaysia

2.2.13.2 Continuous River Water Quality Monitoring

The DOE monitors the country's river water quality through a network of 1,353 manual monitoring stations and 30 automatic continuous river monitoring stations and corresponding water intakes (Environmental Quality Report, 2018). The Water Quality Index (WQI) is used to indicate the level of pollution and the corresponding suitability in terms of water uses according to the National Water Quality Standard for Malaysia (NWQSM). The WQI takes into consideration parameters Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammoniacal Nitrogen (NH₃-N), Suspended Solids (SS) and pH.



Figure 2-14: One of DOE Continuous River Water Quality Monitoring Stations in Malaysia

The Continuous River Water Quality Monitoring (CRWQM) network provides continuous river water quality data which is transmitted to the Environmental Data Centre (EDC) on a scheduled basis. The river water quality parameters measured at the CRWQM stations are generally considered as the key parameters to the assessment of river water quality and includes parameters that allow for the generation of the WQI. Data from the CRWQM network is used to assess the raw water quality before it reaches the water treatment plant. Pre-determined alert levels allow for the timely recognition of potential pollution event that may compromise the treatment capability of the downstream treatment plant. In addition to the appropriate mitigating measures that are activated at the treatment plant, such alerts also prompt DOE, supported by PSTW field staff to identify the source of the pollution so that appropriate actions can be taken. Out of the 30 CRWQM stations in Malaysia, two are located in Sarawak; one at Sungai Sarawak Kiri, and the other one at Batang Sadong near Tebakang.

2.2.13.3 Continuous Marine Water Quality Monitoring

The DOE monitors country's marine water quality through a network of 388 Manual Marine Water Quality Monitoring (MMWQM) stations and ten Continuous Marine Water Quality Monitoring (CMWQM) stations. Out of the ten CMWQM stations, one is located in Kuching, Sarawak.

The Continuous Marine Water Quality Monitoring (CMWQM) network has been established under the Environmental Quality Monitoring Programme (EQMP) to provide continuous marine water quality data to detect marine pollution and potential land-based discharges using dissolved organic matter and chlorophyll-a as indicator. The data is transmitted to the Environmental Data Centre (EDC) on a scheduled basis. The network comprises monitoring stations that are located in waters that are prone to pollution, in particular from oil spillage and discharge as well as algal bloom arising from excessive nutrient levels.



Figure 2-15: One of the DOE Continuous Marine Water Quality Monitoring Stations in Malaysia

For MMWQM, each station is being monitored six times a year. In situ measurement and sampling is being carried out manually, and the data obtained from laboratory testing is analysed, compiled and published in DOE annual environmental quality report which is generally available for download from DOE website.

2.2.13.4 GeoEnviron by NREB Sarawak

The Natural Resources and Environment Board (NREB) has taken initiative to minimise hard-copies of environmental data and convert them into digital copies, and then transfer them into their database system, namely GeoEnviron. GeoEnviron is a dedicated database system developed in year 2006 to handle and manage environmental data and information. The system was established for storing, managing, analysing and reporting a wide range of environmental data generated from various activities under the jurisdiction of the NREB.

The environmental data is collected from various groups of users, consisting of internal users (NREB) and external users (relevant government agencies). The agencies are the Ministry of Local Government and Community Development, Department of Irrigation and Drainage Sarawak, Public Works Department, Sewerage Services Department, Land and Survey Department, Department of Agriculture, State Planning Unit, Kuching Water Board, Sarawak Rivers Board, Padawan Municipal Council and Department of Environment.

The data stored in the GeoEnviron comprises the following three categories:

- (i) Recipient – Recipient is the medium where pollutants are deposited, eg. water bodies, land and air, where environmental performance has to be measured.
- (ii) Site – The locality of activities that may have the potential to impact the environment. Sites are locations that are of interest to the NREB due to issues related to compliance with environmental legislation. Information attached to this data group includes the monitoring and enforcement activities related to the site, administrative information such as address, contact, type of activities and etc.
- (iii) Samples – Samples are the collection of data to elaborate environmental performance in qualitative ways. Performance of the environmental quality is defined qualitatively based on the results of chosen parameters against agreed standard. The NREB maintains records of Environmental Impact

Assessment, Environmental Management Plan (EMP), Environmental Monitoring Report (EMR), public complaints cases, solid waste management, water quality and leachate monitoring.

In GeoEnviron, the Pollution Prevention Control (PPC) is the module that has been designed and customised, as a tool for users to deal with EIA and EMP data, as well as approval processes.

2.2.13.5 Water Quality Monitoring

Under the River Water Quality Monitoring Programme (RWQMP) established in the year 1999, the Natural Resources and Environment Board (NREB) collects, collates, analyses, interprets and reports on the water quality of the major rivers and other water bodies in Sarawak. The monitoring covers 53 rivers, three lakes and three dams with a total of 239 sampling points in Sarawak (Environmental Quality Report, 2010). The RWQMP provides useful and extensive information, particularly on general health and status of river water and water bodies. The sampling is done manually on a scheduled basis, depending on the relevancy and sensitivity of the rivers. Water quality data is obtained through in situ measurements and laboratory analyses. Water quality appraisal is interpreted based on Water Quality Index (WQI) and National Water Quality Standard (NWQS) for Malaysia. The water quality analysis information is kept in the GeoEnviron system in the NREB, and the data is published in the Environmental Quality Reports.

In the Sri Aman Division, there are six river water monitoring stations along Batang Lupar, namely Lingga Wharf, Bakong R.C. Jetty, Kubu Alice Jetty, Kpg Melayu Hulu, Batang Lupar Bridge and Pasar Engkilili; four river monitoring stations along Batang Undup, namely Pasar Batu Lintang, Sungai Tandok, Jambatan Batang Undup and Bayai JKR Raw Water Intake; and four dam monitoring stations for Batang Ai Dam at MDLA Shophouse Btg Ai Jetty, Hilton Btg Ai Resort Jetty, Jambatan Btg Ai and Lubok Antu Town Jetty.

2.2.13.6 Malaysian Meteorological Department

The Malaysian Meteorological Department published the Fire Danger Rating System (FDRS) products in their website daily. FDRS is a system that monitors the risk of forest fire/vegetation fire and provides such information for fire management. FDRS products are used as a guide to predict the fire behaviour for policy makers to make decisions on fire mitigation and smoke haze pollution in order to protect lives, the environment and properties. FDRS uses measured meteorological variables such as temperature, relative humidity, rainfall and windspeed collected from meteorological stations in the Southeast Asia region. The FDRS products available for viewing at Malaysian Meteorological Department website include Fire Weather Index (FWI), BuildUp Index, Initial Spread Index, Drought Code, Duff Moisture Code, and Fine Fuel Moisture Code.

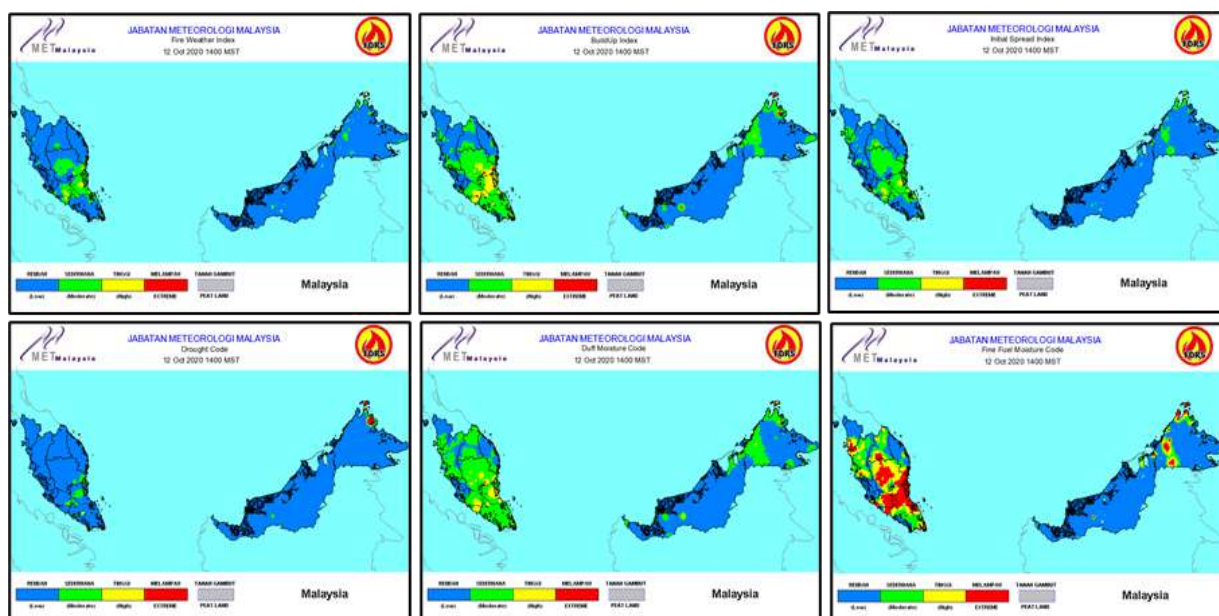


Figure 2-16: Samples of FDRS Products available at Malaysian Meteorological Department Website

Source: Malaysian Meteorological Department website

2.2.14 Issues, Challenges & Opportunities

2.2.14.1 Degraded Forest Condition

The larger landscape of Sri Aman Division in terms of area is under logged-over forest, shifting cultivation or secondary forest of various stages of growth. Natural undisturbed forest exists only on the steeper and higher slopes particularly on the Sarawak-Kalimantan border. Rehabilitation of the poor forest condition can help to sustain water supply, enhance ecological value of the forest, protect soils on the slopes from being eroded, maintain forest resources, besides greening the landscape and creating a source a timber in the future.

2.2.14.2 Decline in Wildlife Population

The decline in wildlife population particularly the keystone species can be attributed to the loss of wildlife habitat, illegal poaching, and wildlife trafficking. Furthermore, most national parks and protected areas are too small to allow the wildlife to disperse to find food, mates, avoid inbreeding and shift locations due to climate change (Brodie et. al., 2015). According to IUCN Red List, the population of Borneo orangutans has decreased by more than 60% between 1950 and 2010, and a decline of 22% is projected to occur between 2010 and 2025.

Sri Aman has a large totally protected area in Sarawak, created solely for the protection and conservation of the Borneo orangutans. The proposed Ulu Sungai Menyang National Park has also been identified as an important habitat for Borneo orangutans. Hence, the gazettelement of these habitat areas should be expedited to ensure wildlife persistence.

Furthermore, proper forest management is also essential to ensure that protected areas and wildlife corridors are safe from hunting and illegal encroachment, ensuring a thriving wildlife population.

2.2.14.3 Peat Fire and Haze

Logging and peat development, especially drainage in peat areas, cause drying of the peat forest which increases the risk of burning in peat forest. Peat forest fire contributes to air pollution and occurrences of haze in the region. The New Straits Times (2019) reported forest and peat land fires in Sri Aman which affected approximately 202 ha of land in September 2019.

2.2.14.4 Lack of Proper Waste Management Site

Presently, solid waste collected in Sri Aman are sent to Entulang Dumpsite and Pantu Dumpsite. Lubok Antu and Engkilili are equipped with level 1 landfills. Level 1 landfill is similar to a dumpsite except that the solid waste is dumped in a controlled manner (controlled tipping). Hence, there is yet to be a proper landfill area in the Sri Aman Division.

Similarly, the sewage management and treatment in Sri Aman rely on individual septic tanks. De-sludging of septic tanks are conducted when they are overflowing. Furthermore, there has yet to be a proper septic sludge treatment facility in Sri Aman. However, through the Eleventh Malaysia Plan, a Sri Aman-Betong Septic Sludge Treatment Plant with the designed capacity of 100 m³/day has been proposed next to Betong Landfill to cater for the septic sludge from Sri Aman and Betong.

2.2.14.5 Deterioration of River Water Quality

Moderate to moderately high levels of total suspended solids (TSS) and turbidity were recorded at the downstream stretches of the Batang Lupar. This can be attributed to soil erosion where organics and sediments are being washed into the rivers. Furthermore, moderate levels of faecal coliform count (FCC) were recorded at most of the monitoring points established along Batang Lupar and Batang Undup, suggesting sewage pollution within the catchment.

2.2.14.6 Decline in Terubok Population

In terms of conservation and biodiversity, *Tenualosa toli* and *Tenualosa macrura* are listed as Vulnerable and Near Threatened, respectively, in the IUCN Red List of Threatened Species (IUCN, 2018). Furthermore, the terubok fish (*Tenualosa toli*) is an endemic species. The terubok fish is a prized fish due to its flavour and its eggs or roe. The decline of *Tenualosa toli* catch landing since 1980s resulted in the state government of Sarawak commissioning a collaborative research undertaking with the Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia (Ministry of Agriculture and Community Development, 1994).

SECTION 2.3 PLANNING AND POLICY FRAMEWORK

2.3.1 Sri Aman and the State of Sarawak

The Regional, Spatial and Land Use Planning sector has adopted an appropriate planning framework for the formulation of suitable regional, spatial and land use strategies from 2020 and beyond in order to achieve the government's aspirations and the aspirations of the people of Sri Aman.

The study has adopted "an integrated holistic" planning approach that takes into account the various planning sectors (cross-sectoral inputs and integration) and the multitude of supporting and planning parameters that is not limited to environment, infrastructure, utility, connectivity and social development.

- Baseline Data

The preparation of the regional planning framework involves literature reviews of available publications, data, and current regional planning strategies for Sarawak, Sri Aman- Betong region and other adjacent administrative areas namely Kuching, Sibu and Samarahan. On-going Projects, Plans and Studies including strategic planned/approved Government infrastructure projects and private sector initiatives have also been identified. The findings have helped in identifying information gaps, drivers of change, key regional planning issues, including cross-sector integration. Most of the primary and secondary regional planning data has been included in this Report.

- Strategic Positioning

Urban and rural planning guiding principles and supportive objectives have been guided by government national and state visions and goals, and relevant international best practice. The recommendations of the Economic Development Plan and Human Capital Development modules and Environmental findings have been incorporated to establish a spatial development framework for the Sri Aman region including interconnections with neighbouring divisions, the state SCORE and the international economic growth corridors. The spatial development framework will incorporate a network of linked and resilient settlements and specific locality needs, for equitable and inclusive economic development and preservation of the natural environment. The spatial development framework will be presented for review and discussion during the draft final stage.

2.3.1.1 Sarawak – Indonesia Cross Border

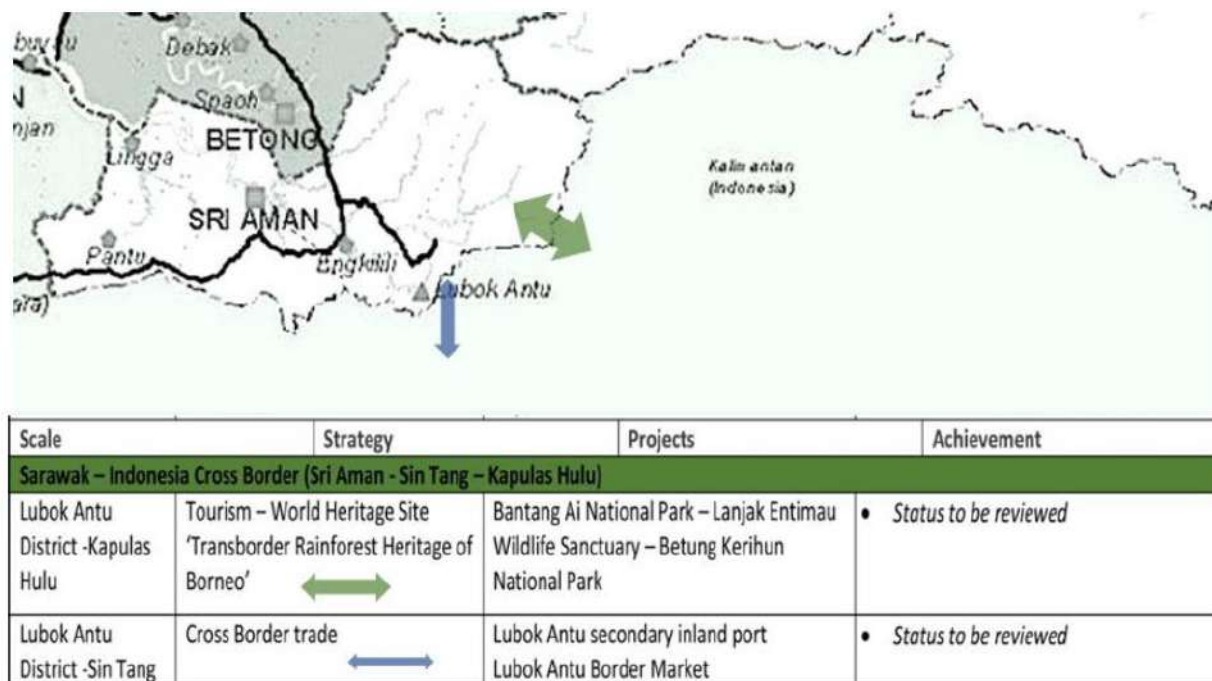


Figure 2-17: Cross-Border – Value Chain Enhancement

Source: Daya Rancang

Sri Aman's proximity to Kalimantan needs to be viewed as a potential development advantage. The potential of cross-border activities, trade and hinterland economic activities are complementary and could be identified and further explored. Some of the key points are summarized as follows:

- Through greater investment in logistics and infrastructure, Sarawak and Kalimantan can further strengthen their productivity and competitiveness. They can gain more from improved connectivity – such as cross-border transport corridors on land and a series of feeder ports and regional hubs – for promoting exports and imports.
- Connectivity can be increased by improving overall efficiency by building, rehabilitating, upgrading and modernizing infrastructure services, equipment and facilities that support capacity building for asset management and maintenance also by coordinating cross-border services and harmonizing regulations, procedures and standards and facilitating trade and customs. Various stakeholders need to work together to ensure success in this difficult area.
- Both Sarawak and Kalimantan governments can take several steps to ensure these considerations are taken into account. The candidate projects and programs for cross-border infrastructure should be identified to enhance the region's trade and integration agenda.
- Strong political leadership is needed to support such cross-border infrastructure arising from a vision of regional cooperation and integration based on improvements in transport and logistics efficiency and market expansion for the entire region. Both the state governments need to reorient existing partnership to deliver greater regional connectivity.

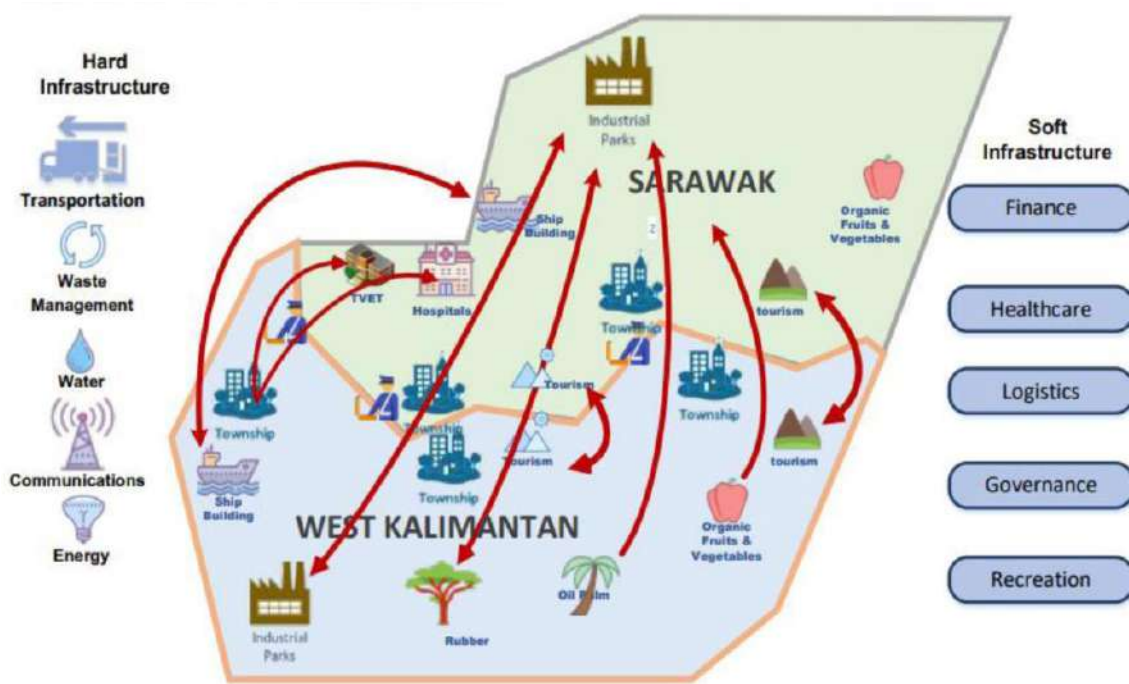


Figure 2-18: Sarawak – Indonesia Cross Border (Sri Aman – Sintang – Kapuas Hulu)

Source: Daya Rancang

The Lubok Antu District plays a major role in the cross-border development corridor between Sarawak and Indonesia through Sri Aman – Sintang – Kapuas Hulu. An alternative project, which is in the reviewing stage as of the time of writing this report, can provide an attraction to tourist both local and international with the World Heritage Site in Transborder Rainforest Heritage of Borneo and also from the trading program. The tourist attraction in Lubok Antu has been proposed within the district such as Batang Ai National Park, Lanjak Entimau, Wildlife Sanctuary, Betung Kerihun National Park. Lubok Antu is to be proposed for the secondary inland port and border market for the cross-border trade and it is needed to be reviewed.

2.3.2 National Framework and Policies

Malaysia is a federal constitutional monarchy and the government is divided into three levels: the federal government, the state governments (13) and the local authorities (149 local authorities; 12 town councils, 39 municipal councils and 98 district councils).



Figure 2-19: National Development Framework

Source: Daya Rancang

Under the Town and Country Planning Act, 1976, national strategic spatial planning, the National Physical Plan (NPP), is controlled by the federal government, while regional plans of projects involving two or more states are used to resolve any major strategic issues.

Following the National Framework for Physical Development, policies and strategies are converted into State Structure Plans, which include policies on land development and land use in the state. Local plans are then prepared at the local level, detailing comprehensive and site-specific facilitation and control of growth.

Alternatively, a special area plan is drawn up in Figure 2-21 to include detailed preparation for areas requiring special care. The following section will address specific policies and initiatives at both national and regional level.

The Town and Country Planning Act 1976 (Act 172) however does not apply to Sarawak. As land is a state matter under the Federal Constitution, Sarawak's spatial, town and country planning matter is governed by the Sarawak's own Land Code.

The planning and development of Sri Aman Division would need to consider the national planning framework imbedded in the various Policy documents.



Figure 2-20: Relevant National Policy Documents

2.3.2.1 Sri Aman Regional Planning Framework – National Perspective

Malaysia is currently embarking on a new term within its Malaysia Plan (RMK12) along with the associated Spatial Framework of the National Physical Plan⁴ (RFN4) and it is expected to be completed in early 2021. Although the documents like the RFNs may not have legal implication on Sarawak, these documents are a bridge for Sarawak to align itself with the Global sustainable development agenda. The planning and development of Sri Aman Division would need to consider the national planning framework embedded in the various Policy documents.

2.3.2.2 The Eleventh and Twelfth Malaysia Plan

The five-year Malaysia Plans remained key documents for policy review, while the 11th Malaysia Plan and its midterm review (RMK11) are the study's point of reference the 12th Malaysia Plan (RMK12) were referred to as soon this was released. The SAMP study period will cover the 12th and 13th Malaysia Plan period.

In addition to these, there are other policy documents that have been identified for the sector's technical assessment in the technical/interim stage. Figure 2-22 shows a partial tabulation of these documents. Review of these documents provides a reference as to the national aspiration in the context of the country social, economic and regional development.



Figure 2-21: 6 Strategic Thrusts of Eleven Malaysia Plan 2016-2020

Source: UNIMAS Holdings, Frost & Sullivan, 11th Malaysia Plan 2016-2020

The Eleventh Malaysia Plan 2016-2020 introduced six strategic thrusts in an attempt to boost economic growth and promote the well-being of the people first in development planning (refer Figure 2-23). These strategic thrusts were amplified in another “policy framework” of the “Dasar Kemakmuran Bersama- 2030”.

The 11MP detailed and streamlined existing policies in the form of strategic directions, strategies and implementation actions to strengthen implementation of the existing policies. Emphasis on the relevance of economic, social and environmental aspects as a key component of sustainable development is embedded in the 11-MP three (3) main pillars -Urban and Rural Dynamic Growth, Spatial Sustainability and Resilience to Climate Change and Inclusive Residential Community Development.

The 6 Key Drivers of Change that will act as catalysts for significant shifts in economic growth and enhance the wellbeing of the rakyat in an inclusive manner delineated in the 11th MP are as follows.

1. Unlocking the potential of productivity
2. Translating innovation into wealth
3. Increasing the percentage of middle-class society
4. Mainstreaming technical and vocational education and training (TVET)
5. Embarking on green growth; and
6. Investing in competitive cities

In addition to the national development agenda, there are several regional platforms with neighbouring countries that are particularly relevant to the study. Listing and summary of these regional platforms are provided in Table 2-40.

With the planned relocation of the Indonesian Capital to Borneo, there will be bilateral and multi-lateral development agendas that would be required to be explored and adopted by both nations. Sarawak and Sri Aman in particular will be at the centerstage of this strategic development by Indonesia.

For Sarawak initiatives under the 11th Malaysia Plan refer to Section 1.4.3.4.

Table 2-40: International Development Platform

No.	Global Agenda	Relevance to Malaysia, Sarawak and Sri Aman
1	Association of Southeast Asian Nations (ASEAN)	Transforming the plans based on the ASEAN agenda towards the protection of human rights and the liberty of the local community, a safe and harmonious environment. This agenda also brings economic consistency among ASEAN members.
2	Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT)	In creating the IMT-GT as a reference in further strengthening the pattern of economic development, especially for the innovative agricultural, industrial and tourism sectors. The implementation of cross-border technology further strengthens relations between the countries involved.
3	Indonesia- Malaysia-Singapore Growth Triangle (IMS-GT)	Plan economic growth for the RFN-4 towards nurturing and appealing foreign investment and expanding the export market in line with the country's role as a member of IMS-GT. Strengthening regional cooperation can be encouraged to ensure sustainable economic growth.
4	Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA)	In translating the national economic planning based on the intention of establishing BIMP-EAGA to maximize revenue and contributions from the industrial sector and supported by the provision of viable and complementary infrastructure facilities for all economic sectors.
5	Kalimantan-Sarawak-Sabah (KASABA)	To ensure that the RFN-4 in translating the aspects that need to be taken into account for development in endangered areas as well as the conservation of natural resources, minerals, fisheries and security planning factors such as the issue of illegal entry of labour. This study will also take note of the proposal to create a new administrative centre in Kalimantan that will have a direct impact on the state of Sarawak in particular. It can also be used as a potential to develop the state in a more competitive direction.

Source: UNIMAS Holdings, Frost & Sullivan, 11th Malaysia Plan 2016-2020

2.3.2.3 Shared Prosperity Vision 2030

The Shared Prosperity Vision 2030 is a document that outlines the 10-year goals to restructure Malaysia from a low-skill labour-intensive economy to a knowledge-based economy. The "Shared Prosperity Vision 2030 is a commitment to make Malaysia a nation that achieves sustainable growth with fair and equitable distribution, across all income groups, ethnicities and regions. The vision calls for strengthening political stability, enhancing the nation's prosperity and ensuring that the rakyat is united whilst celebrating ethnic and cultural diversity. Figure 2-22 shows the eight (8) Shared Prosperity Vision enablers that were formulated to be the catalysts contributing to the success of Nation Shared Prosperity Vision 2030.

EIGHT SHARED PROSPERITY VISION ENABLERS

Capabilities, resources and catalysts contributing to success of Shared Prosperity Vision

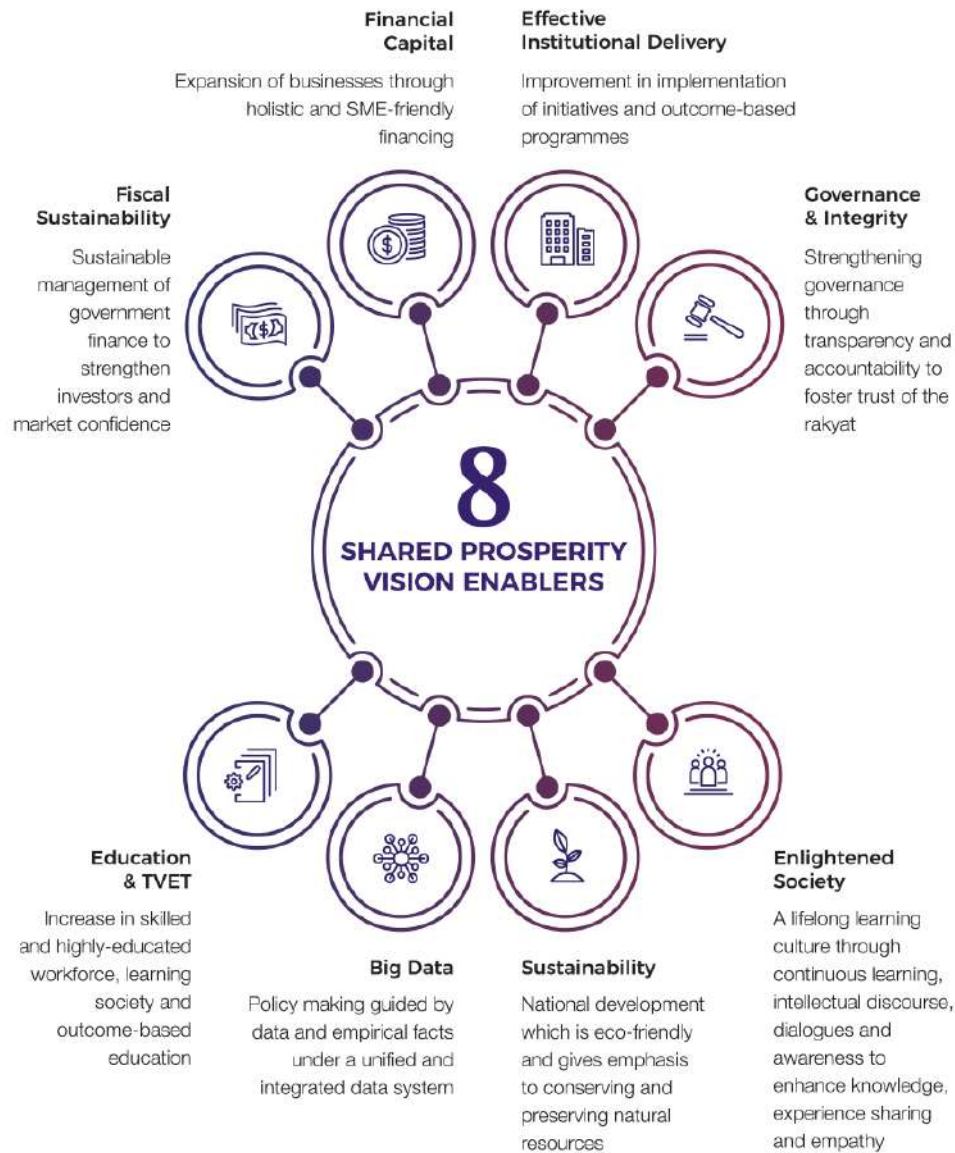


Figure 2-22: Shared Prosperity Vision Enablers

Source: UNIMAS Holdings, Frost & Sullivan, Shared Prosperity Vision 2030

2.3.2.4 Third National Physical Plan

The 3rd National Physical Plan (NPP-3) intends to guide Malaysia to be a resilient and liveable nation through 3 strategic thrusts (Figure 2-23). There are numerous strategies and actions planned in the NPP3 that translated into nine (9) Spatial Management Plans which should be considered and adapted as the basic framework for development and spatial planning of Sri Aman.

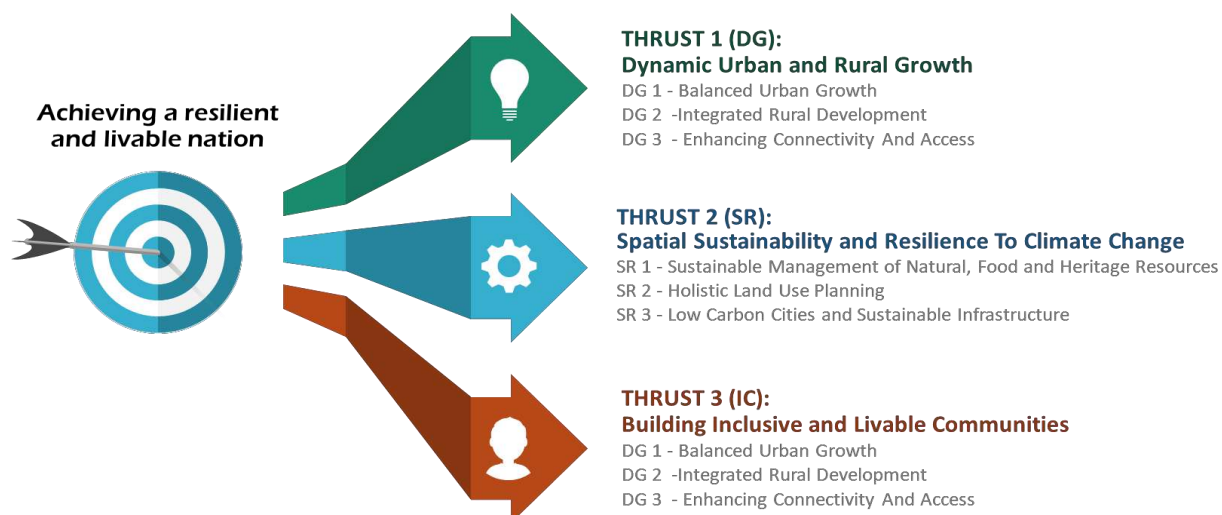


Figure 2-23: Strategic Thrusts in NPP-3

Sources: UNIMAS Holdings, Frost & Sullivan, 3rd National Physical Plan (NPP-3)

2.3.2.5 National Agrofood Policy

The National Agrofood Policy was established in 2010/2011, with the main emphasis on improving the productivity of the agrofood sector by develop 15 industries in Malaysia as shown in Figure 2-26. The following diagram shows the policy objectives, main ideas, and the strategic direction towards improving the efficiency of the national agrofood sector.

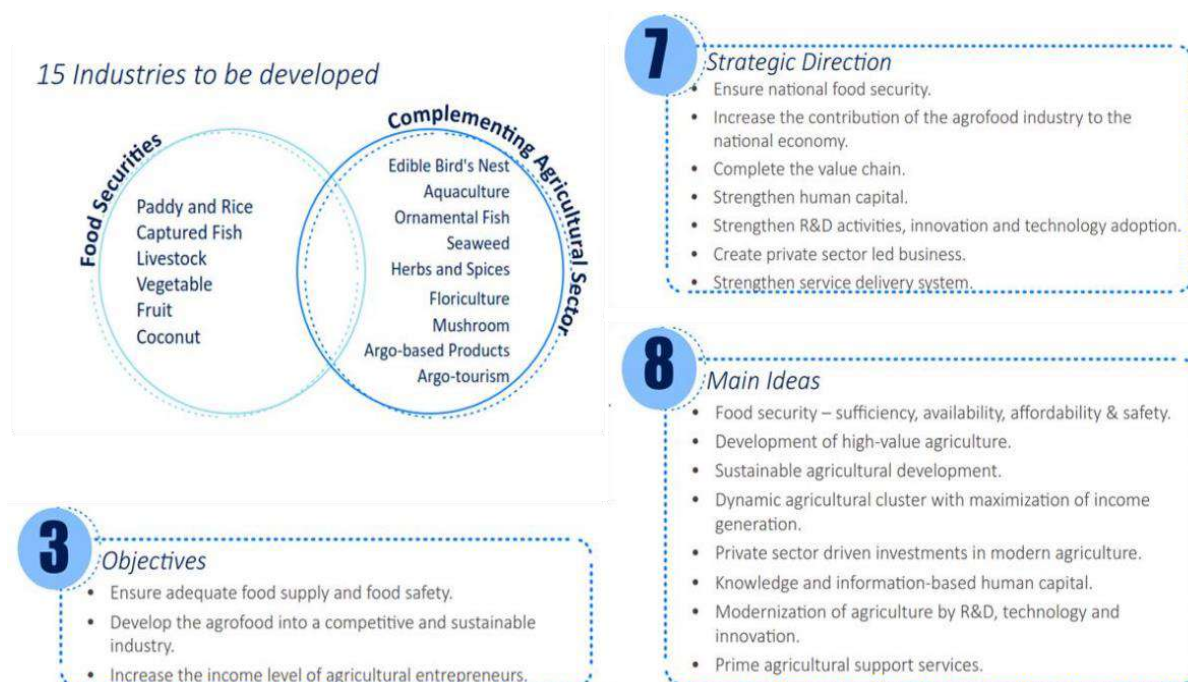


Figure 2-24: National Agrofood Policy

Sources: UNIMAS Holdings, Frost & Sullivan, National Agrofood Policy (2011-2020)

2.3.2.6 National Ecotourism Plan (2016-2025)

Summary: The National Ecotourism Plan was developed with the aim to serve as one of the instruments for overall sustainable development of Malaysia and also as a tool for conserving ecotourism sites. The plan focuses on 5 focus areas which are further broken by 19 strategies and 86 granular action items.



Figure 2-25: Overview of National Ecotourism Plan

Source: UNIMAS Holdings, Frost & Sullivan, National Ecotourism Plan (2016-2025)

As part of the Ecotourism Cluster focus area, the plan has identified 60 such clusters of which nine are in Sarawak including Sri Aman (Simanggang) - Batang Ai - Ulu Sungai Menyang – Maludam. Developing and promoting the nine ecotourisms clusters is the main focus for the Sarawak Ministry of Tourism, Creative Industry and Performing Arts (Ministry of Tourism, 2016).

Developing Sri Aman (Simanggang) - Batang Ai - Ulu Sungai Menyang – Maludam cluster brings about immense potential in terms of revenue generation, employment opportunities as well as overall infrastructure development for Sri Aman Division.

2.3.2.7 National Mineral Policy 2

The National Mineral Policy 2 was published by the Ministry of Natural Resources and the Environment in January 2009 and aims to develop strategies for the extraction of raw materials in the country for the production of energy, construction and manufacturing industries. The policy guarantees that best mining practises are implemented to protect the environment in the direction of sustainable growth.

The National Mineral 2 Policy is directed towards the following:

- Expand the mineral sector.
- Provide a conducive business climate.
- Incorporate environmental stewardship.
- Enhance research and development.
- Develop the relevant human resource.
- Establish integrated mineral information.
- Establish support from the local community and stakeholders as a social responsibility.
- Promote, market and brand the mined products.
- Encourage use of publicity and public relationship agricultural sector.

2.3.2.8 Sustainable Development Goals (SDGs)

Malaysia has expressed its commitment, along with 193 other countries, in support of the Sustainable Development Goals (SDGs) during the United Nation assembly in New York in September 2015. SDG is a framework to guide the world nations towards establishing action plans and achievable targets in their development plans geared towards sustainable development that is fair, inclusive and responded to the calls for the protection of environment and promote the fulfilment of basic human needs.



Figure 2-26: Five principles of Sustainable Development Goals (SDGs)

Source: UNIMAS Holdings, Frost & Sullivan, United Nation Sustainable Development Goals (2015)

Among the 17 SDGs goals, the main objective is for nations to embark on physical development, ensuring that “No One is Left Behind”. The five (5) general principles of the SDGs are Planet, People, Partnership, and Peace & Prosperity. As represented in Figure 2-28, the SDGs 5P is all inclusive; it promotes integrated development with an aim among others to make urban areas- cities and settlements more inclusive, safe, resilient and sustainable.



Figure 2-27: Sustainable Development Goals (SDGs)

Source: United Nation Sustainable Development Goals (2015)

2.3.3 Borneo Island

The Island of Borneo is the third-largest island globally and the largest island in Asia. About 73% of the island belongs to Indonesia while the rest belongs to Malaysia and Brunei. Brunei occupies approximately 1% of Borneo Island. The Island is rich in natural resources and the area belonging to Kalimantan is covered by rainforests and has a population of 16 million people. Kalimantan consists of five provinces namely North Kalimantan, South Kalimantan, East Kalimantan, West Kalimantan and Central Kalimantan, all located on the island of Borneo. The Government of Indonesia has decided to relocate the capital city of Indonesia from Jakarta to Kalimantan. This will create growth opportunities not only for Kalimantan, but also for the Malaysian State of Sarawak which shares its border with Kalimantan. More specifically, since Sri Aman Division, which is the focus of the current study, is located on the border with Kalimantan, there will be several growth opportunities as a result of Indonesia's capital relocation.

The new capital will be relocated to 180,000 hectares of land considered to have relatively low risk of earthquakes, flooding and volcanic eruptions (compared with its current location on Java). The Government of Indonesia plans to establish and build new infrastructure including airports. The first phase of the capital relocation is targeted to be completed by 2024. This will contribute not only to the overall economy of Kalimantan, but will also provide growth opportunities for East Malaysian States such as Sarawak. Sri Aman Division is connected by road to Kalimantan and will also benefit from the relocation of Indonesia's capital city, Kutai Kartanegara Regency and Penajam North Paser Regency. Sri Aman Division shares borders with West Kalimantan and the activities of West Kalimantan will have the most impacts on the economy of this division, the entirety of Kalimantan is expected to grow by the relocation of Indonesia's capital city.



Figure 2-28: Borneo Island and the Proposed Location of Indonesia's New Capital

Source: Frost & Sullivan, 2021

2.3.4 The Region and Global Framework (ASEAN, Asia Pacific, etc.)

Existing policies, and reports will be taken into account in reviewing the Integrated Regional Development Framework so that precise and relevant goals for creating balanced regional development can be achieved. In this study, policies are at the global, national, regional and state levels. A literature review and analysis will be conducted in accordance with the goals and objectives of the policy and the subsequent analysis is to process the appropriate strategies that can be applied in the study of this Integrated Regional Development Framework.

2.3.4.1 Global

This analysis of global policies involves several policies and strategies adopted by the Malaysian government. Policies at the global level are also reviewed and translated based on the requirements for the study of the Integrated Regional Development Framework (RWB). Among the policies that were taken into account of this study are:

- i. Sustainable Development Goals (SDGs)

- ii. New Urbanization Agenda (NUA)
- iii. ASEAN Community Vision 2025
- iv. IMT-GT Vision 2036

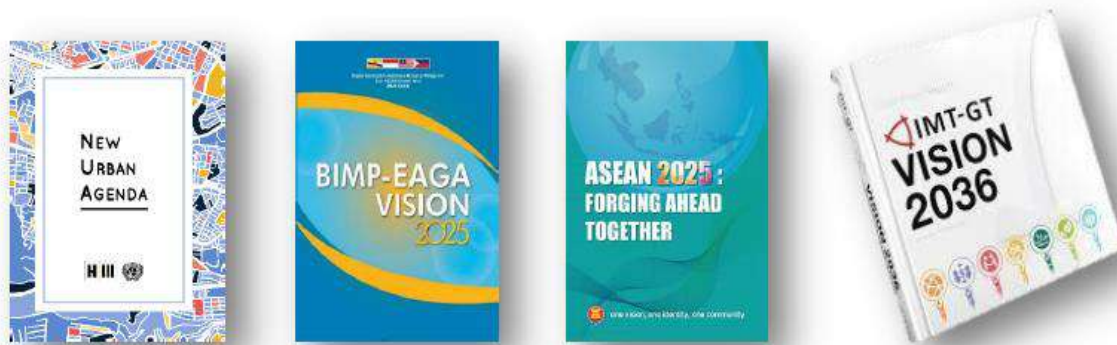


Figure 2-29: Region and Global Framework Documents

Source: Frost & Sullivan, 2020

This policy review involves looking into a number of subjects such as the vision, goals and also objectives of each policy or policy related to the study of this Integrated Regional Development Framework. This policy review also takes into account the core, principles, and strategies outlined by global policies in order to be applied and interpreted for this study.

2.3.4.2 ASEAN Community Vision 2025



Figure 2-30: ASEAN Community Vision 2025

ASEAN is working towards a society that is “cohesive, economically integrated, and socially responsible”. The ASEAN 2025 Document is the result of comprehensive annual planning and discussions and this reflects the commitment of member countries to move forward with the development of ASEAN.

The vision of ASEAN is visionary, progressive and forward-looking to reflect the aspirations of ASEAN countries in the future. It aims to maintain the momentum of regional integration and in turn contribute to the strengthening of ASEAN community development efforts.

2.3.4.3 The main aspiration of ASEAN COMMUNITY VISION 2025

The main aspirations in ASEAN 2025 and the interpretations in the RWB study are based on the three pillars of ASEAN as follows:

Political Security Community



Figure 2-31: ASEAN Political Security Community Blueprint 2025

Aims to ensure the countries in the region cooperate between member countries in a fair environment, democratic and harmonious. The focus is on:

- Political development
- Shaping and sharing prosperity
- Conflict prevention; conflict resolution
- Creating peace after conflict
- Implementation mechanism.

Socio-Cultural Community

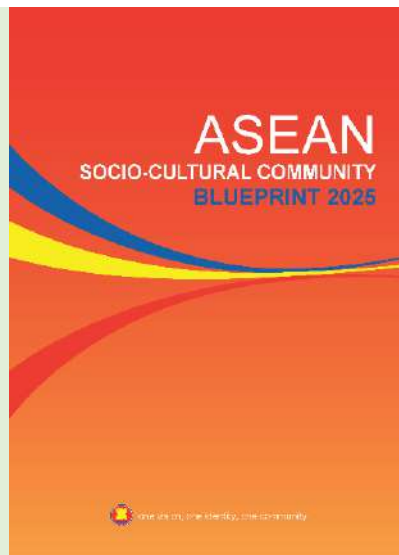


Figure 2-32: ASEAN Socio Cultural Community Blueprint 2025

Inclusive and community-oriented communities as well promote a high quality of life and prioritize access to all and involve the parties relevant stakeholders in social planning and culture of a community. The main objective of this document is:

- Sustainable communities that encourage development social and environmental protection
- A resilient community to continue to adapt with current challenges and new threats
- A dynamic, open, creative and adaptive community reflects pure personality and values

Economic Community



Figure 2-33: ASEAN Economic Community Blueprint 2025

Priority is given to an integrated economy, integration and related to the global economic system. The main scopes are:

- Business-friendly environment, a market forecast inspired investors
- A region that has an important role in the global value chain
- Encouraging competitive and dynamic region innovation
- Economic integration is equitably shared among countries including micro, small and medium enterprises, entrepreneur's youth and women
- Improvements in transportation networks and infrastructure help businesses move efficiently and work more productively across borders and expanding market reach.

SECTION 2.4 STRATEGIC POSITIONING

2.4.1 Sri Aman Division Plan

2.4.1.1 Current Plans and Studies

2.4.1.1.1 Sarawak Socio-Economic Transformation Plan (SETP) 2030

Sarawak's power system is planned and implemented sustainably with an optimal capacity mix that is predominantly renewable hydropower with the balance from coal and gas for energy security. New hydro, coal and gas plants are implemented when there is a need to meet planned or forecast demand of domestic, commercial and industrial local organic loads, from Sarawak Corridor of Renewable Energy (SCORE) bulk-energy industries, and to support Sarawak's digital economy initiatives.

Remote rural sites have small scale solar or mini-hydro schemes, or generators, for independent local supply. SEB is investigating the use of solar farms located on the hydro lakes to supplement mains supply.

The Ministry of Utilities and Telecommunication through Sarawak Energy has a mission to provide all the rakyat with reliable, affordable 24-hour electricity. Sarawak's power development also includes strategies to electrify rural areas. Infrastructure development such as associated roads required for accessibility to hydropower sites such as Bakun, Murum and Baleh has brought connectivity to these remote areas, providing opportunities to bring these once inaccessible rural areas into the mainstream of socioeconomic growth and development.

2.4.1.1.2 Rural Power Master Plan 2025

Strategy for full rural electrification coverage by 2025 was formulated in 2015 under the Rural Power Master Plan. The plan aims to accelerate rural electrification through a variety programmes with government funding programs which are; Rural Electrification Scheme (RES), Sarawak Alternative Rural Electrification Scheme (SARES), Hybrid and Rural Power Supply Scheme (RPSS). The simultaneous implementation of these programs will speed up the government's electrification plan, catalysing rural development to close the gap between rural and urban communities, enabling the State's digital economy agenda to reach our rural communities to help realise Sarawak's vision to become a developed state by 2030.

2.4.1.1.3 Rural Electrification Scheme (RES)

In 2017, RM3.5 billion was spent under the Rural Electrification Scheme (RES) under 11th Malaysia Plan to electrify approximately 102,000 households up to 2016 and 110,000 households in about 4,000 scattered villages. The overall state domestic electricity coverage was increasing to about 95% with 90% of rural population electricity coverage as shown in Figure 2-34.



Figure 2-34: Percentage Coverage SARES in Sarawak at (2009-2025)

Source: Sarawak Energy Berhad (SEB)

The Sarawak Government, in collaboration with Sarawak Energy Berhad (SEB), are aiming to connect more than 30,000 rural households towards achieving full electrification by 2025. Their vision is to ensure all rural communities including the most remote and inaccessible upriver communities are connected to constant 24-hour electricity supply. The focus on rural electrification is to extend the grid to reachable areas while standalone systems employing alternative electricity sources are used for regions too remote for grid connection so communities can do away with expensive and noisy diesel generators.

2.4.1.1.4 Sarawak Digital Economy Strategy 2018-2022

The Sarawak Digital Economy Strategy 2018-2022 is one of Sarawak's approaches to harnessing the digital economy through seven focus areas which are Digital Infrastructure, Cyber Security, Talent Development, E-commerce, R&D in digital technology, Digital Innovation Entrepreneurship and Digital Government. The Strategy's vision, mission and benefit are shown in Figure 2-35.



Figure 2-35: Vision and Mission in Sarawak Digital Economy Strategy

Source: EPU Sarawak

2.4.2 Spatial Strategies

2.4.2.1 Sri Aman Regional Positioning

The Sri Aman Division is optimally positioned to be developed as a hub for Agriculture and Responsible Tourism activities, together and in collaboration with such opportunities available within the surrounding Divisions of Betong, Samarahan, and the broader geographical area of the internal regions of Kalimantan (accessed through the border crossing at Lubok Antu) (Figure 2-36).

The first focus area of the economic development model would build upon its strength in agriculture and tourism, Figure 2-36. The developmental focus in the next 10 years being orientated towards; unlocking the regional potential to enhance existing and open up new avenues for increasing productivity, widen the variety of offerings, and addressing fundamental infrastructure gaps critical to increasing the efficiency of logistics.

The subsequent focus area is the development of three key areas of opportunity that include digital services, cross-industry activities, and increasing exports.

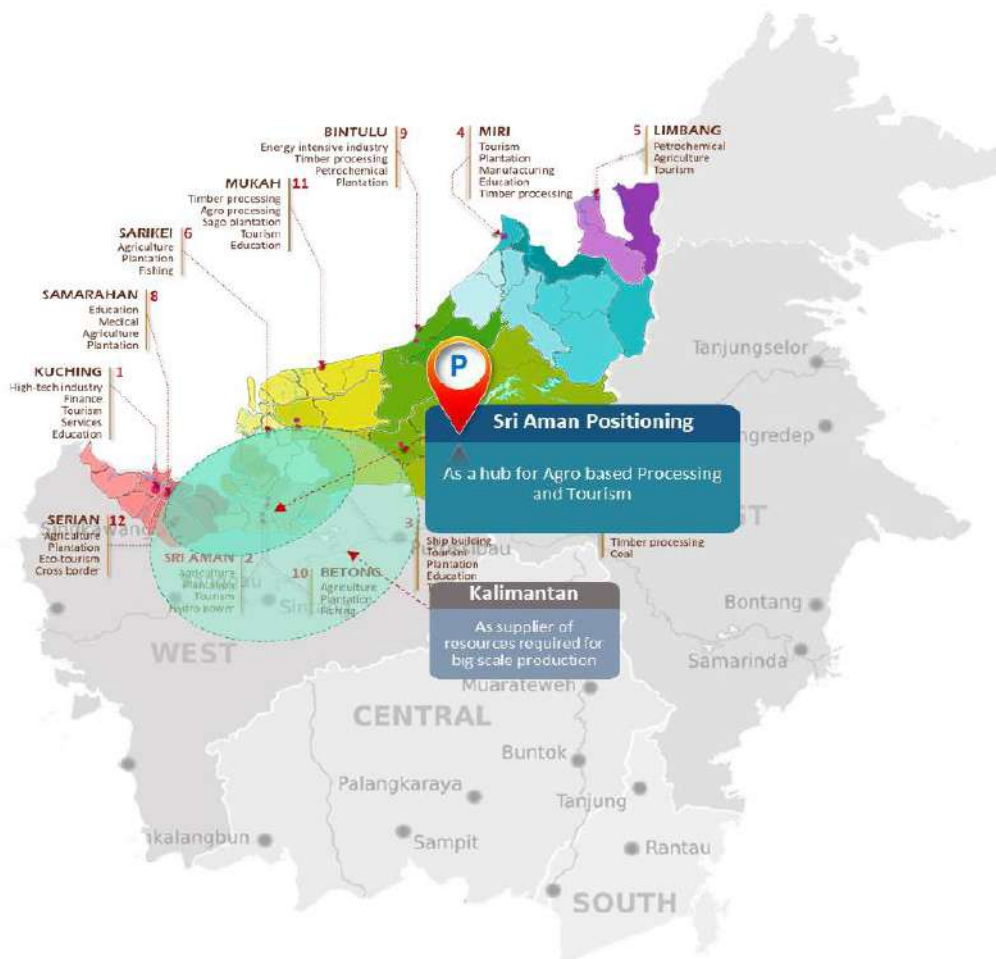


Figure 2-36: Sri Aman Agriculture and Tourism Hub Positioning

Source: MINTRED, UNIMAS Holdings and Frost & Sullivan Analysis

2.4.2.2 Digital Services

The establishment of digital services such as eCommerce platforms will facilitate greater market access for the core productive sectors of Sri Aman Division. In addition, digital services may be developed as a standalone productive sector, for instance, in the provision of shared services/Global Business Services to clients in the regional and global markets.

2.4.2.3 Cross Industry Activities

Potential has been identified across productive sector activities, for instance, a hybrid of an agriculture farm and tourism attraction.

2.4.2.4 Export orientation

The development of exports to the rest of Malaysia and abroad is one of the key strategies in increasing the economic contributions of the division. The development of export requires strong production volumes and it is best achieved through collaborative initiatives that consolidate production volumes from not only within Sri Aman Division but also from surrounding divisions such as Samarahan and Betong. An effective approach towards development exports would be through a collaborative initiative

with business associations which has access to investors and customers throughout Sarawak and overseas.

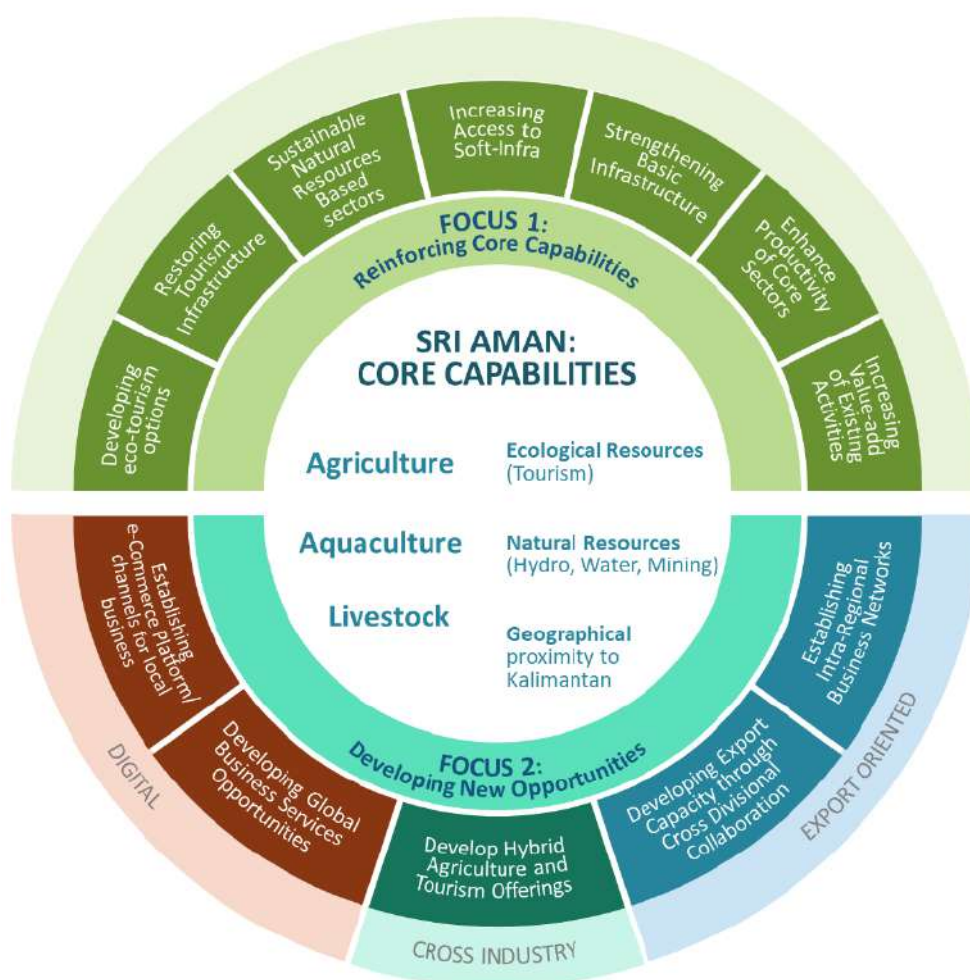


Figure 2-37: Economic Development Model

Source: Frost & Sullivan

2.4.2.5 Capacity Building of Key Productive Sectors

This sub-section touches upon findings on the need for capacity building of the key production based economic sectors of Sri Aman that include agriculture, aquaculture and livestock.

At present, farming activities exist in the form of small-scale production of which its capacity is largely orientated towards local consumption with relatively limited instances of export activities, primarily in palm oil production and aquaculture. Distribution of production is largely through local markets of various town centres across the Sri Aman Division. The status quo of production volumes is not able to support a production consolidation centre in a manner that is economically sustainable while the lack of a proper consolidation facility impedes the market access and growth of the industry.

As such, industry development initiatives primarily target (1) Production capacity and efficiency; (2) Production quality; (3) Consolidation and logistics; and (4) Market access. These initiatives must be developed in tandem, to establish a sustainable and efficient manufacturing and supply chain for the agriculture sector to succeed in the export market.

The broad strategy needed to raise production efficiencies revolves around larger scale farming business models that is better able to adopt modern farming techniques to achieve economies of scale. The consolidation of farming capacity may be achieved through one of the following approaches that include cooperative, contract farming, land lease, and land sale. Among one of the key impediments to consolidating farming capacity is that existing farms are located in small, often disparate plots and are individually owned and operated.

2.4.3 Sri Aman and Kalimantan

The presence and close proximity of Sri Aman to Kalimantan with its vast resource potential and human capital might have significant influence in the future development in Sri Aman (Figure 2-40). Kalimantan has seen an increased in strategic and development initiatives mooted by the Indonesian government. The potential impact of growth in Kalimantan would have likely direct and indirect impacts on Sri Aman and Sarawak in general, e.g., agricultural and natural resources, transportation networks, tourism, and labor pool.

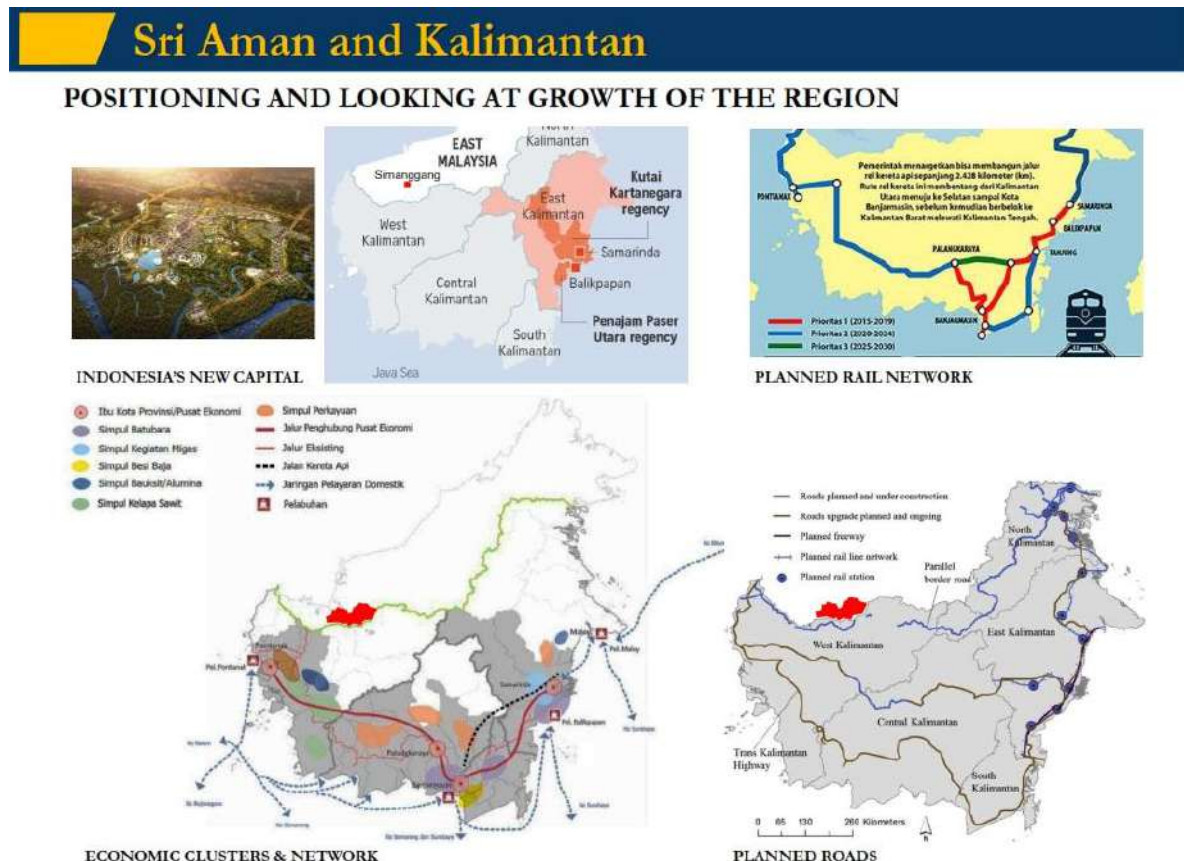


Figure 2-38: Sri Aman and Kalimantan

Source: Frost & Sullivan

Sri Aman is located adjacent to the Kapuas Hulu and Danau Sentarum Region, which is well known for its rich natural resources and vast agriculture development potential. It is also known for its scenic environment and body of water which is part of the Heart of Borneo (HoB) initiative. Sri Aman is in the best position to capture the growth potential of this region as it is located at its doorstep when compare to its Capital –Pontianak and other major cities.

Figure 2-38 also highlights the strategic road network of Kalimantan which can be connected to Sarawak through future improvement to the existing regional network, and which Sri Aman is strategically positioned to take advantage of the consequent development opportunities within Kalimantan.

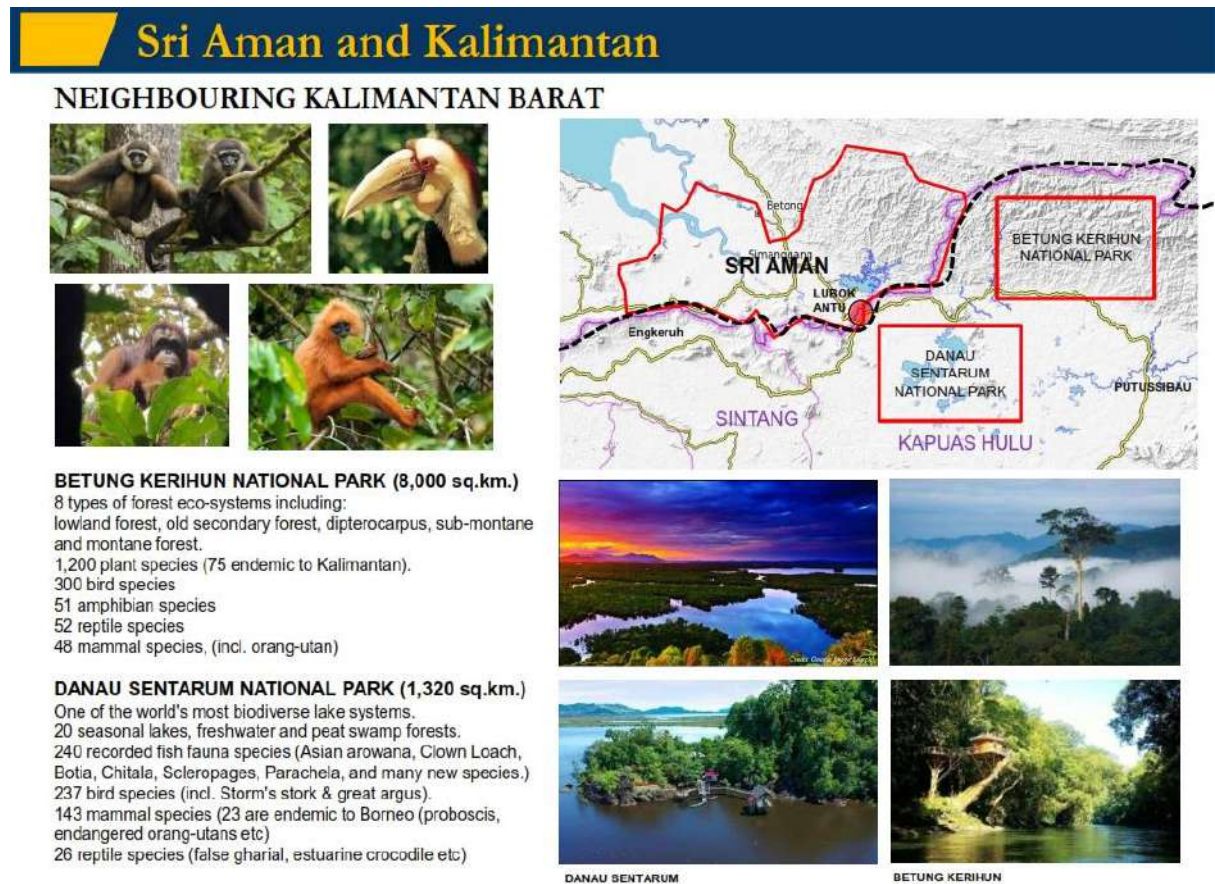


Figure 2-39: Kalimantan National Park

Source: Daya Rancang

Figure 2-39 shows the two important national parks of Danau Sentarum and Betung Kerihun that are located near the Sri Aman on the Kalimantan side of border. Travelling by road from Lubok Antu to Danau Sentarum would take only about 10 to 20 minutes. Its ecosystem is one of the most diverse in the world and is important to look at and to have it as a resource.

Across the border from Sri Aman, is large almost landlocked area of Kalimantan north of the Kapuas River, as shown at the top-left of Figure 2-40. The population of which is around 1.2 million, which has relatively direct access with Sri Aman.



Source: Daya Rancang



Source: Daya Rancang

The economic and spatial indicators in Figure 2-41, show that Sri Aman has well-established cross border trade at Lubok Antu and the potential land capacity to increase development to service the expansion

of trade. These attributes position Sri Aman and Lubok Antu as a center for global e-commerce activities and its supporting business and service industries.

For example;

- Compared to the one-way border trade through Aruk and Entikong, Lubok Antu is the largest in terms of border import and export from Kalimantan, at over RM130 million worth of trading.
- Sri Aman has some two thousand acres of plantation at Lubok Antu which could be developed for trade border services.
- Global e-commerce, applies throughout the supply chain - processing, marketing, trading, logistics and digital connectivity - and future development at the border is will be essential component in driving the agricultural growth of Sri Aman.

2.4.3.1 The Border

The border between these two countries lies along the entire southern boundary of Sri Aman. There are two minor rural border post crossings operating for the purpose of cross border visitation within Sri Aman. The main inter country border crossing for trade within the division is Lubok Antu (ICQ) checkpoint – Nanga Badau check point, see Figure 2-44) on the Federal Route 3. The main produce imports into Sri Aman is predominantly crude palm oil and some timber, both being processed within Sarawak. The exports from Sri Aman and other southern divisions of Sarawak into northern areas of West Kalimantan are building materials, although up to 2017 it was sugar.



Figure 2-42: Main Inter Country Border Crossing within Lubok Antu (ICQ) – Nanga Badau

Source: Daya Rancang

Distance is a key factor in the transportation of produce both in terms of cost and the quality of perishable goods arriving at the destination. A further factor is the standard of the roads; if the main routes are also serving many villages, then traffic speeds will be significantly reduced. The distance from the border to Sintang sub district urban centre in West Kalimantan is around three times further from the border than Simanggang is to Lubok Antu. In this case, the development potential for cross border trade related industry development is on the Sri Aman side of the border.

The eastern section of the border passes through the remote protected tropical rainforest uplands of the Gunung Berumpat mountain range. On Sri Aman side this includes both Batang Ai National Park and

Lanjak Entimau Wildlife Sanctuary. The Kalimantan side contains the Betung Kerihun National Park. Both are important areas for the protection of natural flora and fauna ecosystems and as such have attracted ecotourism development.

The border crossing provides an important area for initiating opportunities for new development in support of development within digital services, cross-industry activities, and increasing exports, for example investment in trade, processing of raw produce, as well as ecotourism within Sri Aman and Kalimantan.

2.4.3.2 *Planned Initiatives for Sri Aman – West Kalimantan Cross Border Development*

The following planned initiatives are likely to be implemented within the master plan's time frame and should act as catalysts for attracting investment and development of adjacency and complementary and business, commercial and manufacturing support services.

Sri Aman:

- Infrastructure;
 - The new Kuching-Sibu Second Trunk Road (STR) link to Simanggang and ultimately to the major urban centres of Betong and Sibu north of Sri Aman, provide more direct access and shorten travel time to Kuching, besides increasing property values along its route.
 - The border security road, see Figure 2-45, which should help to eliminate backdoor labour and illegal cross border trade and increase labour and trade flows through the Lubok Antu - Nanga Badau crossing.
- Manufacturing;
 - The goal set by Government to establish at least two CPPC's within Sri Aman along the Pan Borneo Highway will help expand the supply and value chain for exported and imported produce within the Division.

West Kalimantan:

- Infrastructure;
 - The planned border security road within West Kalimantan will parallel the Sarawak security road, through some 15 to 40km south of the actual border, see Figure 2-46.
 - A planned new road link to Selimbau city at the southern edge of Taman Nasional Danau Sentarum, that will link with the main road networks in Central and Southern Kalimantan
- Development;
 - Manufacturing, logistics and housing, although limited construction works are in progress around Nanga Badau the ultimate development is not known.
 - Tourism, potential for ecotourism is focused on Taman Nasional Danau Sentarum, some 20km south of Nanga Badau, see Figure 2-46.



Figure 2-43: Border Security Road in Sarawak

Source: Daya Rancang



Figure 2-44: Planned Border Road in West Kalimantan

Source: Public Works Department, dayakdaily.com/sarawak-to-build-border-security-road-network-at-rm24bil-masing/

2.4.3.3 Strategic Planned Development in Kalimantan

Committed and planned road, rail and airport development lie well beyond the immediate hinterland of the border crossing, e.g. linking the main coastal cities of Pontianak, Banjarmasin and the future national capital at Balikpapan (Figure 2-45). It is likely that any noticeable trade and development from these strategic initiatives will not affect the Sri Aman border hinterland until far beyond the Sri Aman Master plan time scale.



Figure 2-45: Planned Rail Network in Kalimantan

Source: Daya Rancang

2.4.3.4 Sri Aman and the Heart of Borneo (HoB)

The Heart of Borneo (HoB) Initiative is a unique government-led and NGO-supported programme that was initiated by a joint declaration by the governments of Brunei, Indonesia and Malaysia in 2007. The aim of the programme is to conserve the biodiversity of the Heart of Borneo for the benefit of the people who rely upon it through a network of protected areas, sustainable management of forests and other sustainable land uses. Sri Aman being part of the HoB area also has an unlimited potential to be the Gateway to the Heart of Borneo at the southern connection as shown in Figure 2-46 and can be used to link up to the whole HoB. As an environmental, conservation and socio-cultural initiatives, the HoB would bring about international recognition to the state and the federal government on its effort and contribution to the realization of this important global climate and environmental agenda. Conservation effort would be expected to contribute to increased community-based tourism and conservation projects that would direct and indirectly contribute to environmental education and employment.

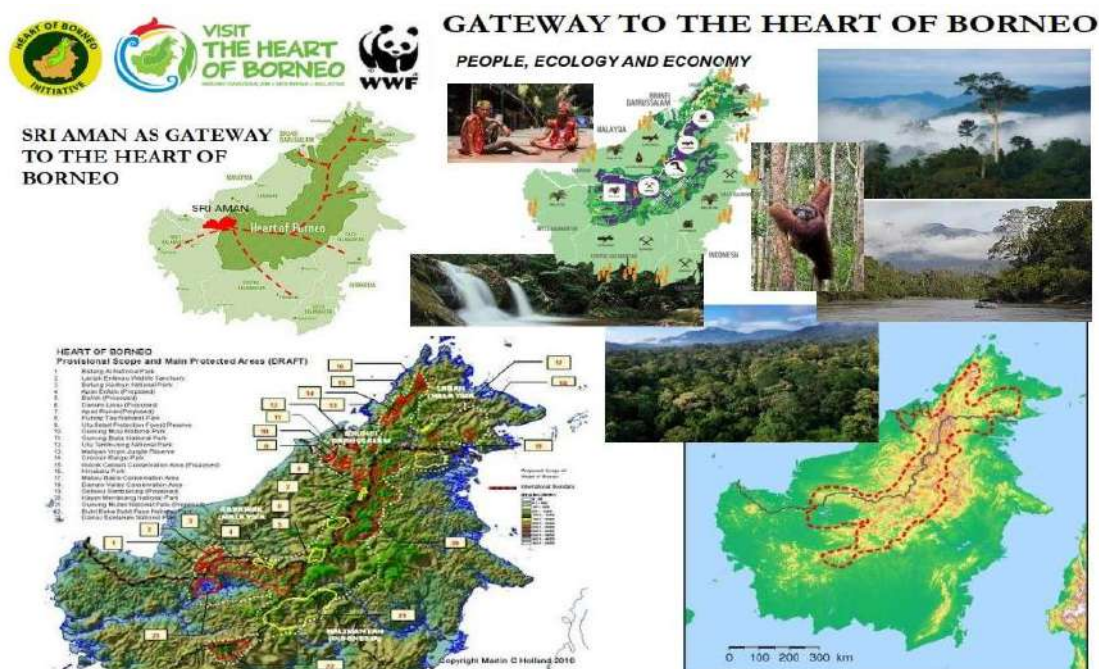


Figure 2-46: Sri Aman position as Gateway of the Heart of Borneo

Source: Daya Rancang

SECTION 2.5 SOCIO-ECONOMIC PROFILE

2.5.1 Population Profile (Secondary Sources)

2.5.1.1 Population Structure and Composition

Sri Aman Division Total Area: 5466 km²

Sri Aman District: 1,042.9km²

Lingga District: 447.9 km²

Pantu District: 833.2km²

Lubok Antu: 3,143 km²

Sri Aman Division Population Density: 20.4 peoples per km² (2020)

Sri Aman District Population Density: 53.9 peoples per km² (2021)

Lingga District Population Density: 27.4 peoples per km² (2021)

Pantu District Population Density: 13.4 peoples per km² (2021)

Lubok Antu District Population Density: 10.5 peoples per km²(2020)

Sarawak population density was 23.4 peoples per km² (2020)

The Sri Aman Division had an estimated population of 111,400 in 2020, while its population was only 85,324 in 1980, 40 years ago. The number has since increased by 26,076 or 30.6% over the last 40 years. The plausible forecast population for Sri Aman Division in 2030 will reach 132,244 or at an average annual growth rate of 1.73% (Table 2-6, Population Forecast (2)).

Sri Aman Division had two districts originally; they were Sri Aman District and Lubok Antu district. Sri Aman district had included Pantu and Lingga sub-districts. Lubok Antu district included Engkilili sub-district. However, Pantu and Lingga sub-districts had been upgraded to district status by the Sarawak government on 1st December 2021. Sri Aman Division now has four (4) districts, namely, Sri Aman, Pantu, Lingga and Lubok Antu districts, and one sub-district, Engkilili.

Before the boundary changes, Sri Aman Division comprises two (2) districts, namely, the Sri Aman and Lubok Antu districts. The current population of the Sri Aman district was 78,300, and the Lubok Antu district, was 33,100, The rate of increase of population for the two districts for the last 50 years, 1980 to 2020 shows that Sri Aman district population increased slower at only 19.4%, while Lubok Antu district population increased faster at 67.7% (Table 2-36). The trends of population increase remain intact in these two districts, even with a higher increase of 55% for Sri Aman division, 41% for Sri Aman district, and 99.9% for Lubok Antu district in 2030. This reflects a much higher increase of population in Lubok Antu district than Sri Aman district for the entire period of this study. Sri Aman district will expect to have a population of 92,495 or at an average annual growth rate of 1.68%, while Lubok Antu's population will be 39,449 or at an average annual growth rate of 1.77% in 2030 (Table 2-7, Population Forecast (2)).

Sri Aman Division population was made up by 70.3% of Sri Aman district population and 29.7% of Lubok Antu district population in 2020, the composition changed very little, just a minimal difference of 0.1 or

0.2 %. Sri Aman district will still cover 70% of Sri Aman division's total population in 2030, while Lubok Antu will share the other 30%.

The composition of Sri Aman Division population gave evidence that Sri Aman district population was 6.9% lower now than it was 60 years ago, while Lubok Antu district population was higher now, from 23.1% in 1980 to 29.8% in 2030 (Table 2-41).

By looking into the size and population increase of Betong, Sarikei and Sibul districts, the districts neighbouring Sri Aman and Lubok Antu districts, for the last 50 years, it was found that Betong district had a population of 73,600 in 2020, while Sarikei had 67,400 and Sibul, 288,000. The growth of population reflects that Betong population increased 99.9%, Sarikei increased 63.7% and Sibul increased 129.9% over the last 50 years (Table 2-42, col.6 & 7).

Table 2-41: Sri Aman Division Population by Districts, 1980,1991,2000,2010, 2020 and 2030

Year	District	Sri Aman District		Lubok Antu District		Sri Aman Division	
		No.	%	No.	%	No.	%
1980		65,589	76.9%	19,735	23.1%	85,324	100.0%
1991		58,639	72.5%	22,234	27.5%	80,873	100.0%
2000		64,475	72.9%	23,966	27.1%	88,441	100.0%
2010		66,790	70.5%	27,984	29.5%	94,774	100.0%
2020		78,300	70.3%	33,100	29.7%	111,400	100.0%
2030*		92,495	69.9%	39,449	29.8%	132,244	99.8%
Pop Diff 1980-2020		12,711	19.4%	13,365	67.7%	26,076	30.6%
Pop Diff 1980-2030		26,906	41.0%	19,714	99.9%	46,920	55.0%

Sources: 1980 Population and Housing Census of Malaysia, Vol.2, June 1983, pp.22-23.

1991: Compiled from Monthly Statistical Bulletin Sarawak, Mac 2004, p.9.

2000: Ethnic Breakdown: Monthly Statistical Bulletin Sarawak, Mac 2004, pp.18-19. 2010: Monthly Statistical Bulletin Sarawak, June 2012, pp.19-20.

2020: Population by age group, sex and ethnic group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak.

2030 figures are forecast population (2) in Table 2-7.

When the population size and the rate of population increase of these five districts were compared, it was found that the Sri Aman district has had a larger population than Betong and Sarikei, but smaller than Sibul for over the last 50 years. However, the Lubok Antu district has had the smallest population among all the five districts all this while. The population increase rate reflects the increase of the Sri Aman population which was much lower in comparison to Betong, Sarikei and Sibul, while the increase of Lubok Antu district population, though lower than Betong and Sibul districts, was higher than the increase of Sarikei district population (Table 2-41 & Table 2-42, last column).

Table 2-42: Neighboring District Population by Betong, Sarikei and Sibul, 1980, 1991, 2000,

District	1980	1991	2000	2010	2020	Diff. btw 1980 & 2020(%)
Betong	36,821	43,993	51,428	62,131	73,600	36,779 (99.9)
Sarikei	41,158	49,631	56,992	58,021	67,400	26,242 (63.7)
Sibul	125,254	170,399	209,012	247,995	288,000	162,746 (129.9)

Sources: 1980 Population and Housing Census of Malaysia, Vol.2, June 1983, pp.22-23., 1991: Monthly Statistical Bulletin Sarawak, Mac 2004, p.9., 2000: Ethnic Breakdown: Monthly Statistical Bulletin Sarawak, Mac 2004, pp.18-19. 2010: Monthly Statistical Bulletin Sarawak, June 2012, pp.19-20. 2020: Population by age group, sex and ethnic group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak.

2.5.1.1.1 Population in Sri Aman Administrative Districts

Sri Aman District had six (6) administrative districts before 1 December 2021, and Sri Aman Townland (Simanggang) was the most populous administrative district, with a projected population of 12,837 or 13.9 % of the total Sri Aman District population in 2030, followed by Melugu bazaar, 2071 or 2.2%, Banting, 677 or 0.7%, Pantu bazaar, 588 or 0.6%, and Lingga bazaar, 218 or 0.3%. However, there were 76,104 people or 82.3% who lived scattered in villages and kampungs in these administrative areas of the Sri Aman District (Table 2-42, col. (4)).

Table 2-43: Adjusted Forecast Sri Aman District Population by Administrative Districts, 2010, 2020 and 2030

(1) Area	(2) Population 2010	(3) Proportion of Population 2010 $P=X/n$	(4) Forecast Population. 2020*	(5) Forecast Population. 2030*
Sri Aman district	64,500	64,500	78,300	92,495
Banting Bazaar	472	0.73	573	677
Lingga Bazaar	152	0.24	185	218
Melugu Bazaar	1,444	2.24	1,753	2,071
Pantu Bazaar	410	0.64	498	588
Simanggang	8,952	13.88	10,867	12,837
Kawasan Selebih M.D.	53,070	82.28	64,425	76,104

Notes: Adjusted forecast population distribution, 2020 for Simanggang was 61,309; Lingga(+Banting), 4,228; and Pantu(+Melugu), 12,763. For 2030, Simanggang was 72,424; Lingga(+Banting), 4,994; and Pantu(+Melugu), 15,077.

*2020 and 2030 population distribution figures for Administrative Districts are forecast figures by direct proportional method ($P=X/n$), where P is the proportion, X is the number of part population and n is the number of whole population, based on 2010 official figures in the Monthly Statistical Bulletin Sarawak, June 2012, p.13.

**The Kawasan Selebih M.D population was proportionally distributed to the respective Bazaar (sub-district), by $P=X/n$; i.e. the respective bazaar pop/Kawasan Selebih M.D pop, multiplying the forecast total population 2020 and 2030.

*** The entire Kawasan Selebih M.D population had been re-distributed proportionally to the respective bazaar (sub-district) population.

Sources: 2020 total population was compiled from Population by Age Group, Sex and Ethnic Group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak; and 2030 figures are forecast population (2) Table 2-7.

The current demographic features of Lingga, Pantu and Sri Aman districts show that Lingga district's land area is 447.9 sq.km; Pantu, 833.2 sq. km; and Sri Aman district, 1042.9 sq. km in 2021. The projected population was 12,263 for Lingga district, 11,194 for Pantu district and 56,158 for Sri Aman district in 2021. This gives evidence that Lingga's land size has topped up 184 sq. Km to become 447.9 sq.km, or 70% larger now than before, while Pantu has increased 102.1 sq.km to become 833.2 sq.km or 14% larger now. The absorption of population from the alienated areas has accorded Lingga with extra 5,913 people, making up a total population of 12,263, or 93% more than before, while Pantu has absorbed 1,151 people to form a population of 11,194 or 11% increases. It is apparent that the delineated areas and the re-distribution of population of Lingga district are mainly attributed to Sri Aman district boundary, while the delineated area and the re-distribution of population of Pantu district are mainly caused by Sebuyau sub-district boundary (Table 2-44).

Table 2-44: Lingga, Pantu and Sri Aman District Population, 2021

District	Area				Population			
	Old	New	Total	Difference	Old	New	Total	Difference
Lingga*	263.9	+184	447.9	+70%	6,350	+5,913	12,263	93%
Pantu*	731.1	+102.1	833.2	+14%	10,043	+1,151	11,194	11%
Sri Aman	1329.0	-286.1	1042.9	-21.5%	63,222**	-7,064	56,158***	11.2%

Source: *Figures were derived from "New Administrative Boundaries of Sarawak (Serian, Samarahan and Sri Aman Divisions)", Unit Pentadbiran, Jabatan Ketua Menteri Seksyen Pentadbiran Bahagian, 2021.

**Compiled from "Sri Aman Population Projection, 2020-2030", SAMP, 2020-2031 Final Report, Table 2-7 "based on 2020 population by age group, sex and ethnic group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak.

*** (4) Sri Aman district, 2021= (5) - (2) - (3).

2.5.1.1.2 Population in Lubok Antu Administrative Districts

The Lubok Antu District has four (4) administrative districts, namely, in order of population number in 2030, Kawasan Selebih M.D, 35,701 or 90.5%; Engkilili Bazaar, 1,492 or 3.8%; Skrang Bazaar, 1,455 or 3.7%; and Lubok Antu Townland, 800 or 2.0% (Table 2-45, col.(4)).

Table 2-45: Lubok Antu District Population Distribution by Administrative Districts, 2010, 2020 and 2030

(1) Area	(2) Population 2010	(3) Proportion of Population 2010 $P=X/n$	(4) Forecast Population 2020*	(5) Forecast Population 2030*
Lubok Antu District	27,363	27.363 (100.0)	33,100	39,448
Administrative-districts:				
Engkilili Bazaar	1,035	3.78	1,252	1,492
Lubok Antu townland	555	2.03	671	800
Skrang Bazaar	1,009	3.69	1,221	1,455
Kawasan selebih (M.D.)	24,764	90.50	29,956	35,701

Note: *2020 and 2030 population distribution figures for Administrative-Districts are forecast figures by direct proportional method ($P=X/n$), where P is the proportion, X is the number of part population and n is the number of whole population, based on 2010 official figures in the Monthly Statistical Bulletin Sarawak, June 2012, p.13.

Sources: 2020 total population was compiled from Population by Age Group, Sex and Ethnic Group, Administrative District of Sri Aman and Lubok Antu, 2020, Department of Statistics, Sarawak; and 2030 figures are forecast population (2) Table 2-7.

2.5.2 Population Growth

Further looking into the pattern and trends of population growth of these five districts, it was found that the average annual growth rate of the Sri Aman and Lubok Antu districts population for the last 50 years had displayed a low growth for the first 40 years, especially for the Sri Aman district. The district's population shrunk by 1.02% from 1980 to 1991, while Lubok Antu had only 0.83% growth between 1991 and 2000. Besides, the annual population growth rates of these two districts fluctuated greatly, Sri Aman district had recorded a minus 1.02% growth between 1980 and 1991, it rose to 1.05% between 1991 and 2000, lowered to 0.35% between 2000 and 2010, it rose sharply to 1.59% between 2010 and 2020, and rose further to 16.8% between 2020 and 2030 (Table 2-46).

Table 2-46: Average Annual Growth Rate of Population* of Sri Aman Division, Sri Aman District & Lubok Antu District, 1980-2020

District	1980-1991	1991-2000	2000-2010	2010-2020	2020-2030*
Sri Aman District	-1.02	1.05	0.35	1.59	1.68
Lubok Antu District	1.08	0.83	1.55	1.68	1.77
Sri Aman Division	-0.49	0.99	0.69	1.62	1.73

Note* Calculated by exponential growth rate based on total population in Table 2-36. Exponential growth rate formula is as below.

$$r = 100 \left(\frac{\log \log e \frac{P_2}{P_1}}{t} \right)$$

r is the growth rate

P2 is the total population of the previous census

P1 is the total population of the current census

t is the total number of years

By comparing the average annual population growth rate of Sri Aman and Lubok Antu districts with Betong, Sarikei and Sibul districts, it was found that Sibul attained the highest annual growth rate of 2.79% and 2.27% in 1980 to 1991 and 1991 to 2000 respectively, while Betong had the highest annual growth rate of 1.89% and 1.69% in 2000 to 2010, and 2010 to 2020 respectively. However, Sarikei's annual population growth rate was high at 1.70% and 1.54% in the early years of 1980 to 1991, and 1991 to 2000, it falls to 0.18% in 2000 to 2010, and rose to 1.50% in 2010 to 2020 (Table 2-47).

Table 2-47: Average Annual Growth Rate of Population of Neighboring Districts, Betong, Sarikei & Sibul, 1980-2020

Division	1980-1991	1991-2000	2000-2010	2010-2020
Betong	1.62	1.73	1.89	1.69
Sarikei	1.70	1.54	0.18	1.50
Sibul	2.79	2.27	1.71	1.50

Note* Calculated by exponential growth rate based on total population in Table 2-37

In general, the Betong district had always maintained a stable annual population growth compared to the other districts, and its annual population growth rate was the highest among all the districts in recent years. It is observed that the annual population growth rate of Sri Aman and Lubok Antu districts had steadily risen with convincing rate at 1.59% for Sri Aman district and 1.68% for Lubok Antu district in 2010 and 2020. The forecast average annual growth rate of population in Sri Aman division, Sri Aman district and Lubok Antu district will be slightly increased to 1.73%, 1.68% and 1.77% respectively in 2030 (Table 2-45 and Table 2-46).

The average annual growth rate of Sarawak population from 1980 to 2020 was from as high at 2.60 % in 1980 to as low at 1.63 % in 2020 (Table 2-45).

Table 2-48: Average Annual Growth Rate of Sarawak Population (%) *, 1980-2020

Year	1980-1991	1991-2000	2000-2010	2010-2020
Percentage	2.60	2.60	1.80	1.63

Note* Calculated by intercensal exponential growth rate based on total Sarawak Population of 1980,1991, 2000 and 2010 and 2020.

2.5.2.1 Distribution of Population of Sri Aman Population by Broad Age Groups

The composition of the population in the Sri Aman Division, Sri Aman district and Lubok Antu district by 5-year age groups for 2000, 2010 and 2020 as shown in Appendix 10, Appendix 11, and Appendix 12 indicating that the percentage of the youngest age group, 0-4 years old to the total Sri Aman Division population was 9.7% in 2010, it declined to 7.4% in 2020. The proportion of the immediately following age group of 5-9 was 10.8% in 2010; it declined larger to 7.1% in 2020. The proportion of population in the 0-4 age group for Sri Aman district and Lubok Antu district was 9.8% and 9.6% respectively in 2010, and 6.9% and 8.5% respectively in 2020. The proportion of 5-9 years age group shows 10.8% for Sri Aman district in 2010 and 10.6% for Lubok Antu district. And the proportion of population in this age group was 6.6% and 8.2% for Sri Aman and Lubok Antu districts respectively in 2020. The patterns of progressively smaller proportion of younger population in Sri Aman Division and districts indicate fewer births and slower growth of Sri Aman's population Appendix 4, Appendix 5, and Appendix 6.

The distribution of the total population of the Sri Aman Division by three broad age groups given in Table 2-43 shows that 30.5% of the population in Sri Aman Division were in the 0 to 14 age group, 63.8% in the 15 to 64 age group, and 5.4% in the 65 and over age group in 2010. The proportion of the corresponding age group in 2020 shows a big decline of the younger age group (0-14) population, and an increase of the mature age group (15-64) to 69.5%, and the older age group to 8.2%. The pattern of distribution of population in the division for 2030 remains more or less the same perhaps a larger decline in the younger age group (Table 2-49). The progressively smaller proportion of the younger population in Sri Aman Division and districts indicates a fewer births and slower growth of Sri Aman's population.

The distribution of population in the Sri Aman district and Lubok Antu districts for the years 2010 and 2020 shows that the proportion distribution of 0-14 age group was consistent at 30% for the two districts in 2010, but the proportion of this age group had dropped quite substantially to 21.3% and 24.5% respectively in 2020, and the proportion declined further to 18.4% for Sri Aman division, 16.5% for Sri Aman district and 23.0% for Lubok Antu district in 2030. While the mature age group population increased moderately from 2010 to 2030 in the three areas, the rate was from 63.5% to over 71.8% in Sri Aman district, and 63.8% to 66.1% in Lubok Antu district. The older age group shows a rapid increase in proportion in Sri Aman district, amounting to 11.7% in 2030, and the increase for Lubok Antu district was 10.9%, and 11.3% in Sri Aman Division in 2030 (Table 2-49 and Table 2-50). The distribution of population by broad age groups in Sri Aman Division and its two districts indicates that its population has approached to the mature age population, and gradually in the number of older people.

Table 2-49: Population by Broad Age Group to Total Population of Sri Aman, Division, Sri Aman

Age Group	0-14		15-64		65+		Total Population '000	
Year	2010	2020	2010	2020	2010	2020	2010	2020
Sri Aman Division	30.5	22.3	63.8	69.5	5.7	8.2	94.7	111.4
Sri Aman District	30.8	21.3	63.5	70.4	5.7	8.3	66.5	78.3
Lubok Antu District	30.5	24.5	63.8	67.7	5.7	7.9	28.2	33.1

Source: Population of the three age groups are compiled from SAMP, Appendix 4-12.

Table 2-50: Projected Population by Broad Age Group to Total Population of Sri Aman, Division,

2030				
Age Group	0-14	15-64	65+	Total
Sri Aman Division	24.3 (18.4)	93.0 (70.3)	14.9 (11.3)	132.2 (100.0)
Sri Aman District	15.2 (16.5)	66.4 (71.8)	10.9 (11.7)	92.5 (100.0)
Lubok Antu	9.1 (23.0)	26.1 (66.1)	4.3 (10.9)	39.5 (100.0)

Source: Total population based on Population Project 2. in Table 2-7.

*Note: The projected 2030 broad age group population was computed based on 2010 and 2020 population, by using proportion method. It is first to calculate changes in number and % of each age group of the 2010 and 2020 population; then calculate the changes of proportion of

each group to the total population; the forecast proportion 2030 was computed by adjusting the changed %; and the resulted forecast proportion multiply the total population to form the 2030 broad age group population.

The gender composition of the population of the Sri Aman Division and its two districts had a preponderance of females before 2010, except Lubok Antu district which still had more females than males in 2010. The current gender ratio inclined more toward males than females, but the difference was small (Table 2-51). It is expected that the gender ratio in Sri Aman will change very little in the future.

Table 2-51: Sri Aman Population, by Male and Female, 1991, 2000, 2010 & 2020

Division	1991		2000		2010		2020	
	Male	Female	Male	Female	Male	Female	Male	Female
Sri Aman Division	1000	1041	1000	1,020	1000	984	1000	970
Sri Aman District	1000	1048	1000	1016	1000	972	1000	959
Lubok Antu	1000	1053	1000	1016	1000	1028	1000	992

Sources: 1991 and 2000 Monthly Statistical Bulletin Sarawak, Mac 2004; 2010 Monthly Statistical Bulletin Sarawak, June 2012; and 2020 Population by Age Group, Sex and Ethnic Group, Administrative District of Sri Aman and Lubok Antu, Department of Statistics Sarawak, 2020.

Of the total population of the Sri Aman Division by ethnicity, the Iban population was the largest amongst all the 6 major ethnic groups for the last 50 years. The Iban population comprised 67% of the total population in 2020, followed by Malay at 18.9%, Chinese at 10.5% and other minor ethnic groups making up the rest. The composition of ethnic population for the Iban and the Malay in Sri Aman division changed very little for the past years, but a significant decline of 3% for the Chinese population was recorded. Iban constituted the largest ethnic group, followed by the Malay and Chinese in Sri Aman Division (Table 2-52).

By looking into the population by ethnic groups in the two districts of Sri Aman Division separately, it was found that the Iban population in Lubok Antu district comprised more than 87% of the local population, while the Chinese outnumbered the Malay population by 2.7%, almost double the size of Malay population in the district (Table 2-53).

Table 2-52: Sri Aman Division Population by Ethnic Groups, 1980,1991,2000,2010 & 2020

Ethnic Group	1980	1991	2000	2010	2020
Iban	57,292 (67.1)	53,027 (65.6)	58,066 (65.7)	63,797 (67.3)	74,700 (67.0)
Malay	15,445 (18.1)	15,516 (19.2)	18,442 (20.8)	17,831 (18.8)	21,100 (18.9)
Chinese	11,521 (13.5)	11,029 (13.6)	10,524 (11.9)	10,541 (11.1)	11,700 (10.5)
Bidayuh	460 (0.5)	551 (0.7)	526 (0.6)	617 (0.6)	800 (0.7)
Orang Ulu	95 (0.1)	132 (0.2)	151 (0.2)	553 (0.6)	900 (0.8)
Melanau	262 (0.3)	166 (0.2)	262 (0.3)	318 (0.3)	300 (0.3)
Others	249 (0.3)	109 (0.1)	35 (0.04)	312 (0.3)	400 (0.4)
Non-Malaysian		343 (0.4)	435 (0.5)	951 (1.0)	1,600 (1.4)
Total	85,324 (100.0)	80,873 (100.0)	88,441 (100.0)	94,774 (100.0)	111,400 (100.0)

Sources: 1980 Population and Housing Census of Malaysia, Vol.2, June 1983

1991; Yearbook of Statistics Sarawak, 1998, Department of Statistics Malaysia (Sarawak Branch), Oct, 1998, PP.28-30; 2000 Ethnic Breakdown: Monthly Statistical Bulletin Sarawak, Mac 2004, pp.18-19. 2010: Monthly Statistical Bulletin Sarawak, June 2012, pp.19-20.

Table 2-53: Lubok Antu District Population by Ethnic Groups, 1980, 1991, 2000, 2010 and 2020

Ethnic Group	1980	1991	2000	2010	2020*
Iban	16,525 (83.7)	18,951 (85.2)	20,729 (86.5)	24,712 (88.3)	28,900 (87.3)
Malay	766 (3.9)	646 (2.9)	694 (2.9)	842 (3.0)	1,000 (3.0)
Chinese	2,254 (11.4)	2,326 (10.5)	2,262 (9.4)	1,677 (6.0)	1,900 (5.7)
Bidayuh	82 (0.4)	90 (0.4)	73 (0.3)	149 (0.5)	200 (0.6)
Orang Ulu	22 (0.1)	52 (0.2)	40 (0.2)	160 (0.6)	300 (0.9)
Melanau	23 (0.1)	13 (0.1)	15 (0.1)	32 (0.1)	100 (0.3)
Others	63 (0.3)	19 (0.1)	5 (0.02)	117 (0.4)	200 (0.6)
Non-Malaysian		137 (0.6)	148 (0.6)	313 (1.1)	600 (1.8)
Total	19,735 (100.0)	22,234 (100.0)	23,966 (100.0)	27,984 (100.0)	33,100 (100.0)

*Note: Projected Sri Aman Population from Statistical Department Sarawak.

Table 2-54 shows that the Iban population was still the largest among all the other ethnic groups in Sri Aman district, but the number and % had not been significantly large as it was in Lubok Antu, as both the Malay and the Chinese population had taken away and shared the population number and %. of the Malay population comprised one quarter, and the Chinese, 13% of the total population In Sri Aman district in 2020.

Table 2-54: Sri Aman District Population by Ethnic Groups, 1980, 1991, 2000, 2010 & 2020*

Ethnic Group	1980	1991	2000	2010	2020
Iban	40,767 (62.2)	34,076 (58.1)	37,337 (57.9)	39,085 (58.5)	45,800 (58.5)
Malay	14,679 (22.4)	14,870 (25.4)	17,748 (27.5)	16,989 (25.4)	20,100 (25.7)
Chinese	9,267 (14.1)	8,703 (14.8)	8,262 (12.8)	8,864 (13.3)	9,800 (12.5)
Bidayuh	378 (0.6)	461 (0.8)	453 (0.7)	468 (0.7)	600 (0.8)
Orang Ulu	73 (0.1)	80 (0.1)	111 (0.2)	393 (0.6)	600 (0.8)
Melanau	239 (0.4)	153 (0.3)	247 (0.4)	158 (0.2)	200 (0.2)
Others	186 (0.3)	90 (0.2)	30 (0.05)	195 (0.3)	200 (0.2)
Non-Malaysian		206 (0.3)	287 (0.4)	638 (1.0)	1,000 (1.3)
Total	65,589 (100.0)	58,639 (100.0)	64,475 (100.0)	66,790 (100.0)	78,300 (100.0)

*Note: Projected Sri Aman Population from Statistical Department Sarawak.

Source: Compiled from Monthly Statistical Bulletin Sarawak, June 2012, pp.19-20.

1991: Yearbook of Statistics Sarawak, 1998, Department of Statistics (Sarawak Branch), October, 1998, pp28-30.

The urban population in Sri Aman Division grew at an average growth rate of minus 0.28% per cent per annum resulting in urban areas having 21,243 people or 33.8% of the population in 2010. There was very low urbanization in Sri Aman division, and Lubok Antu district is all in rural areas (Table 2-55).

Table 2-55: Sri Aman Division Population in Urban and Rural areas, 2010

Area	Urban	Rural	Total
Sri Aman	21,243(33.8)	41,532(66.2)	62,775(100.0)
Lubok Antu*	--	23,255(100.0)	23,255(100.0)

Note: * Lubok Antu was 100% rural in 2010.

Source: Compiled from Monthly Statistical Bulletin Sarawak, June 2012, p.10.

2.5.2.2 Conclusion

The analysis of demographic and population data of Sri Aman provides the baseline information for the planning and implementation of the Sri Aman Master Plan, 2020-2030. The analysis was completed using longitudinal and retrospective desk research, using appropriate demographic techniques to analyze and tabulate demographic data for Sri Aman's population over the last 50 years, from 1980 to 2020. The analysis applied data drawn from the government census reports from over the last 50 years (1980, 1991, 2000, 2010 and 2020), annual and monthly statistical reports and births and deaths registration statistics. They are valuable and reliable sources for measuring demographic differentials, dynamics of growth and change of the population.

Additionally, the findings of the pattern and trends of Sri Aman's population will inform the social and economic progress of its population because social and economic conditions are background variables which influence population pattern and trends.

The desk research concluded the following salient demographic characteristics of Sri Aman.

Sri Aman has a relatively small population. Its population of 111,400 in 2020 is small and the forecasted increase of its population to 132,000 in 2030, which was just slightly over 20,000 for ten (10) years, is still small in absolute numbers. The small and sparsely distributed population of Sri Aman has impeded commercialization, industrialization and mechanization in agriculture in the Sri Aman Division due not only to the lack of domestic market but also to the lack of a sufficient labor force and infrastructure.

Sri Aman's population growth rate is low and the increase is slow. The low growth of Sri Aman's population is largely due to factors such as the low crude birth rate, which was 10.5 per thousand populations; and comparatively high crude death rate, which was 7; this has resulted in a low natural increase rate (NIR) of 3.5 in 2018. The natural increase rate at 3.5 in 2018 when compared with Betong and the Sarawak average of 8.2 was 2.3 times lower. This was extremely low relatively speaking, thus producing a slow population increase. An increase of just 26,076 people or 30.6% over the last 50 years, 1980 to 2020, was clearly a remarkably slow increase. At the community leader discussions, it was confirmed that 66% of the families were small in size, with 1 to 3 children, while 34% were medium-sized, with 4 to 6 children; there was no large-sized family in the area (Table 2-3(3)).

Sri Aman has a low proportion of younger aged residents within the population. The distribution of the total population of the Sri Aman Division (Tables 2-43 & 2-44) shows that 30.5% of the population in the Sri Aman Division were in the 0 to 14 age group in 2010, but the proportion of this age group is expected to decline to 18.4% in 2030. The progressively smaller proportion of the younger population in the Sri Aman Division and districts indicates overall fewer births and slower growth of Sri Aman's population (Appendix).

There is a significant proportion of mature and old aged population in Sri Aman. The mature aged group, 15 to 64 years old population was 63.8% in Sri Aman in 2010, and the number in this age group is expected to rise to 70.3% by 2030. The proportion of the older aged group (65+) population is expected to increased from 5.7% in 2010 to 11.3% in 2030. The distribution of the 15-64, and 65 years and above groups in the Sri Aman Division (Table 2-49 & Table 2-50) indicates that its population has shifted into an ageing population and will gradually grow in the number of older people.

The gender-ratio amongst the population shows that the population of Sri Aman had a significant prevalence of females before 2010, except for the Lubok Antu district which still had more females than males in 2010. The current gender ratio has inclined more toward males than females, but the difference is small (Table 2-51). It is expected that the gender ratio in Sri Aman will change very little in the future.

The population composition by ethnic groups in Sri Aman shows that the Iban population was the largest amongst all the 6 major ethnic groups for the last 50 years; comprised 67% of the total population in 2020, and it followed by Malay at 18.9%, Chinese at 10.5% and other minor ethnic groups making up the rest. It is anticipated that the pattern of ethnic composition of population for Sri Aman will change very little for the future years. (Table 2-52).

The urban/rural distribution of Sri Aman's population indicated that the proportion of urban population in Sri Aman in 2010 was less than one-third (1/3) of its total population, therefore, it is mostly rural in nature (Table 2-55).

The pattern and trends of out-migration in Sri Aman as shown in the findings of the cross-sector field survey by the SAMP consultants, show that out-migration was frequent and intensive, at 23% among all the ethnic communities in Sri Aman; and the high tendency of out-migration is reinforced by the community leaders at discussions which pointed up to 79% in their villages. The primary purposes for the local people to migrate were employment, followed by accompanying family and education. The duration in which the migrants had stayed away from the villages was mostly fewer than 10 years. This is a short-term out migration, reflecting the desire of movers to return to their home village after engaging in temporary employment outside the village. It is foreseen that the increased freedom of movement of Malaysian and Indonesian living in Sri Aman Division, particularly in the border areas of Lubok Antu district and Engkilili, Pantu and Batu Lintang sub-districts upon the implementation of tourism, medical service, agriculture, industrial projects under the SAMP, 2020-2030 will be intensified. Many of the villages on both sides of the border in these areas are conveniently accessible. Some are located at a short distant, roughly just two hours walking. More so, is the fact that majority of the people who live on both sides of the border are sharing the same language, the origin of culture and close kinship ties. This is a dynamic force for social coherence and harmony in the border areas. Besides, these areas are strategically located, with improved infrastructure, facilities and good administration which facilitate cross-border movement. The selling and buying of goods and materials can be expected to be large and voluminous.

It is expected that when SAMP development comes into force in Sri Aman, it will be able to generate improved social and economic conditions, and create more conducive jobs for people, especially those modern wage-earning jobs, including mechanized farm work, to curb heavy out migration of the locals to cities for employment. In lieu, it can lure those who have migrated to cities to return; and it is equally important to attract qualified people to take up employment in Sri Aman. With all these measures implemented, Sri Aman will have a stable and sufficient population for the various development projects. Additionally, it will keep in tack the functions and structure of the family and society for there is no need for separate living arrangements away from families as a result of out-migration.

Furthermore, the new in-migrants who take up employment in Sri Aman can impart their technology know-how, skills and capital for the holistic and integrated developments of Sri Aman.

The newly upgraded Lingga and Pantu from sub-districts to districts which are facilitated with improved service facilities, and productive industries for many viable development projects initiated by SAMP, 2020-2030 in agriculture, livestock rearing, aquaculture, tourism, agro-based manufacturing, business and digital services. These projects have created more conducive jobs for the locals, and will reduce out-migrations. The new jobs will also induce in-migrants to work in these two districts. It is therefore expected that a higher population growth rate and a larger population can be realistically effective in Lingga and Pantu districts.

Sri Aman's population at 132,244 is small in absolute numbers. But the various development projects initiated by the SAMP, 2020-2030, are expected to create 14,414 new jobs (Chia, SAMP, 2021), and generate up to 33,916 in the new population (Chia, SAMP, 2021) for Sri Aman Division in 2030. The increase in the new in-migrants population will pump up another 30.5% to Sri Aman's population growth rate of 18.7%, from the total population of 111,400 in 2020 to 166,160 in 2030. The total population of Sri Aman Division will increase 49.2% for the next 10 years up to 2030. The moderate sufficient size of population will make developments in Sri Aman division more feasible and viable, and it will fulfill people's aspiration for higher income and better standard of living in the future.

The increase of new population into Sri Aman division, in return has contributed to a positive net-migration rate of 8.4% of Sri Aman's population in 2030.

2.5.3 Socio Economic Survey

2.5.3.1 Objectives

The objective of a socio-economic survey is to obtain baseline data on the socio-economic information as depicted in Figure 2-47.

Existing Socio-Economic Profile	Income Education Workforce Access to employment
Existing Profile of Economic Activities	Livelihood activities Natural resource use/land use Existing potential products & activities that can be further developed
Overview of Land Use Pattern	Existing land use Land use change Land ownership
Expectations of the Communities	Future aspects Willingness to change Aspirations

Figure 2-47: Major Components of the Socio-Economic Information

Source: UNIMAS Holdings and Frost & Sullivan

To obtain the primary data from the community that encompasses the major components of the socio-economic aspects by districts, this project conducted a questionnaire survey. The sample size for this survey is reflective of the population distribution in the two districts: Sri Aman and Lubok Antu. The former covers Simanggang, Pantu and Lingga sub-districts, while the latter covers Lubok Antu and Engkilili sub-districts. As the unit of analysis for the survey is household, the number of households by district and sub-district is projected from 2010 figures based on:

- The projected average population growth figures based on average population growth rate in Sri Aman Division
- average household size of 4 persons per household in Malaysia for the year (Statistical, 2019)
- The estimation of household population by sub-district, district and division is given in Table 2-56. The estimation is based on the projected Sri Aman's population in 2020 and the average Malaysian household size of 4 for 2019. Once the number of household population size is estimated, the sample size is determined based on 95% confident interval with 10% margin of error. According to Table 2-56, the minimum valid samples to be collected is 468 for the whole division.
- To ensure the selected samples are not only reflective of the sub-districts but also fulfill the ethnic composition, the household population is estimated and reported in Table 2-57.

Table 2-56: Estimated Sri Aman Division Number of Households and Sample Size by Location, 2020

District/Sub-district	Population*	Household Nos.**	Sample Size***
Sri Aman District	78,300	19,575	279
Lingga	4,230	1,057	89
Pantu	12,680	3,170	94
Sri Aman	61,390	15,348	96
Lubok Antu District	33,100	8,275	189
Engkilili	20,224	5,056	95
Lubok Antu	12,876	3,219	94
Total	111,400	27,850	468

Notes: * Projected from 2010 figures based on average population growth rate in Sri Aman Division.

** Based on average household size of 4 in Malaysia for 2019.

*** Based on 95% confident interval with 10% margin of error.

Table 2-57: Estimated Number of Households by Ethnicity in Sri Aman Division, 2020

No.	Ethnicity	Sri Aman	Lubok Antu	Total
1	Iban	11,450	7,225	18,675
2	Malay	5,025	250	5,275
3	Chinese	2,450	475	2,925
4	Bidayuh	150	50	200
5	Orang Ulu	150	75	225
6	Melanau	50	25	75
7	Others	50	50	100
8	Non-Malaysian	250	150	400
	Total	19,575	8,275	27,850

Note: * Based on estimated population in Sri Aman in 2020 and average household size of 4 in Malaysia for 2019.

Total Population = 987

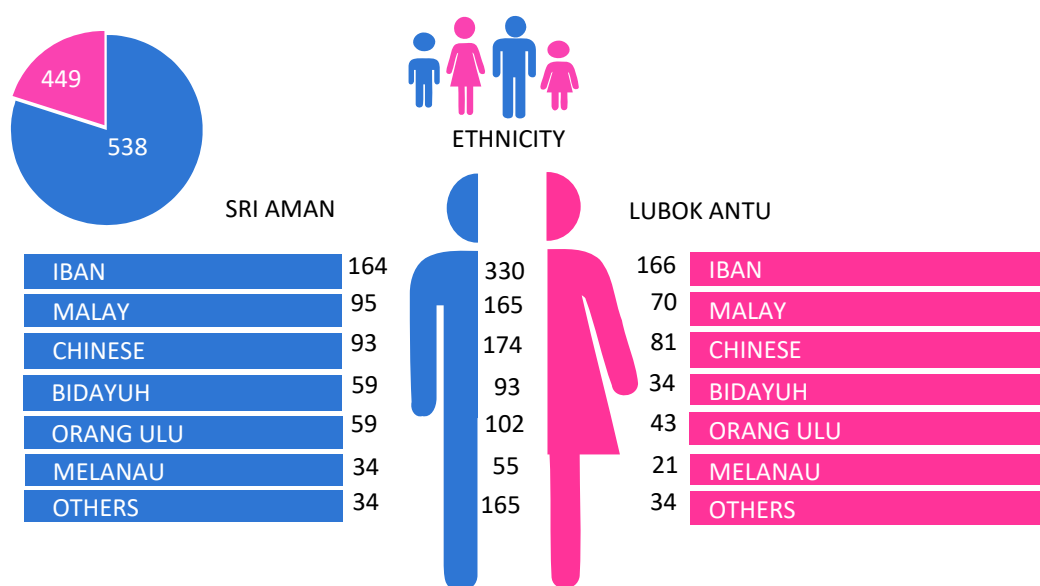


Figure 2-48: Household Sample Size based on Ethnicity, 2020

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.3.2 Instrument

For the purpose of the survey, a questionnaire was constructed. There are altogether 13 pages excluding the cover page, which comprises of the following 10 sections:

- A. Background information on respondent and household
- B. Economic activity and income of household head.
- C. Household expenditure
- D. Home status and furnishing, housing location and public facilities
- E. Household land ownership and usage, vehicles ownership
- F. Household participation in agriculture activities
- G. Household participation in jungle product collecting, hunting and fishing activities
- H. Cross border issues
- I. Resilience issues
- J. Suggestion

Some 80 structured and open-ended questions are included in the survey, in order to tap into the required information for the construction of the socio-economic baseline of the community in Sri Aman. The questionnaire adopted in this study was provided in Appendix 1 of the Inception Report.

2.5.3.3 Data Collection

The survey was conducted over the period of 5 days, from 14th September to 18th September 2020. Six survey sites were selected with the intention of ensuring the diverse socio-economic characteristics of the region are being fairly represented. Towards this end, the survey sites encompassed not only town areas, but also the border town localities of Lachau, Batu Lintang and Lubok Antu, in addition to relatively difficult to access areas such as Banting. To ensure the quantity and also quality of the surveys are being met, the survey sites are sampled from “Ketua Kaum Rasmi Bahagian Sri Aman” (Updated as of 23rd February 2020). A total of 1,015 respondents from some 81 villages, longhouses and housing areas had participated in this study (Table 2-58 and Table 2-59). Each interview session lasted about 1 to 1 ½ hour. Of these samples collected, 999 of them are valid and usable after verification. The

distribution of these valid samples across various survey sites is summarised in Table 2-60. Table 2-61 shows that the total valid samples are more than the required sample size from the aspect of sub-districts, districts and division levels.

Table 2-58: Places Surveyed in Sri Aman District

Date	Simanggang & Batu Lintang	Pantu/Lachau	Lingga
14/9/2020	Kampung Hilir, Sri Aman Kampung Resak, Sri Aman Jalan Brayun, Sri Aman Kampung Sri Wangi, Sri Aman Kampung Entebar, Batu Lintang Kampung Titikah, Batu Lintang Batu Lintang Bazaar	Lachau Ili Lachau Baru	Kampung Hulu, Stumbin Kampung Hilir, Stumbin Kampung Masjid, Lingga
15/9/2020	Selepong Jingga, Sri Aman Selepong Lop, Sri Aman Selepong Kunang, Sri Aman Gua Sukat, Sri Aman Gua Ming, Sri Aman Kampung Kenyungan, Batu Lintang	Lachau Bazaar, Lachau Pantu Bazaar, Pantu Marau, Pantu	Skirau Tengah, Tanjung Bijat Rawan Ili, Tanjung Bijat Kampung Tanjung Panggu, Banting, Lingga Kampung Chabu Ulu, Banting, Lingga Kampung Batu Tembang, Banting, Lingga Kampung Chabu Ili, Banting, Lingga
16/9/2020	Kampung Sabu, Sri Aman Taman Sri Jaya, Sri Aman Kampung Samak, Batu Lintang	Lachau Ulu Lachau Padang Pasir	Seduku Panjai, Lingga Tajor Ulu, Lingga Sebakak, Tanjung Bijat Tawang Tengah, Tanjung Bijat Kampung Nansang Ili, Banting, Lingga
17/9/2020	Kampung Hulu Lemanak, Sri Aman Kampung Muhibbah, Sri Aman Jalan Main Bazaar, Sri Aman Jalan Batang Lupa, Sri Aman Kampung Temudok, Sri Aman Kampung Sebangkoi, Batu Lintang	Sebemban Jampu, Pantu Sebemban Asal, Pantu Sebemban Selanjan, Pantu	Kampung Hilir, Stumbin Skait, Tanjung Bijat Kampung Pangkat, Tanjung Bijat
18/9/2020	Jalan Kapitan, Sri Aman Jalan Pasir Panas, Sri Aman Jalan Foochow, Sri Aman	Sungai Tebelian, Pantu Rapak Tepus, Pantu	Lingga Bazaar

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-59: Places Surveyed in Lubok Antu District

Date	Lubok Antu	Engkilili
14/9/2020	Bintong, Lubok Antu Nanga Mepi, Lubok Antu	Marup Atas, Engkilili Stuga, Engkilili
15/9/2020	Nyemungan Panjai, Lubok Antu Sebangki Panjai, Lubok Antu Empit, Lubok Antu Kampung Melayu, Lubok Antu	Marup Cina, Engkilili Pekan Engkilili Kampung Melayu Engkilili
16/9/2020	Lubok Antu Bazaar, Lubok Antu Kampung Hilir, Lubok Antu Nanga Pan, Lubok Antu Nanga Jela, Lubok Antu	Kumpang Langgir, Engkilili Kumpang Paoh A, Engkilili Kumpang Paoh B, Engkilili Kandis, Engkilili
17/9/2020	Bui Panjai, Lubok Antu Skarok, Lubok Antu Tinting Lalang, Lubok Antu	Jelukong, Engkilili Kampung Selindong Ulu, Engkilili Kampung Selindong Ili, Engkilili Kampung Merbong, Engkilili
18/9/2020	Wong Panjai, Lubok Antu Rakut, Lubok Antu	Soh, Engkilili

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-60: Distribution of Valid Samples Collected from Various Locations

Division	District	Sub-District	Survey Site	Valid Sample
Sri Aman	Sri Aman	Simanggang	Simanggang	193
			Batu Lintang	57
		Pantu	Lachau	79
			Pantu	23
		Lingga	Lingga	104
			Tanjung Bijat	61
			Banting	43
	Lubok Antu	Lubok Antu	Lubok Antu	250
		Engkilili	Engkilili	189
		Total		999

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The distribution of these samples was based on districts and ethnicity is reported in Table 2-61. Note the during the field work for data collection, the locations and ethnicity of the collected samples were monitored at the end of each day. Extra effort had been given to include as many Bidayuh, Orang Ulu, Melanau, Bajau and other ethnics households as possible. Nevertheless, these households were hardly found on the ground. As a result, majority of the respondents were from Iban, Malay and Chinese households, see Table 2-61. Hence, it is worth-noting that, in terms of ethnicity, the survey findings primarily focused on representatives from the 3 major ethnics.

Table 2-61: Valid Samples according to Districts and Ethnicity

Race	Sri Aman	Lubok Antu	Total
Iban	324	285	609
Malay	138	58	196
Chinese	92	88	180
Bidayuh	4	3	7
Orang Ulu	1	0	1
Melanau	1	2	3
Bajau	0	3	3
Total	560	439	999

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.4 Data Analysis

The validated survey responses were analysed and presented in the forms of graphs, frequency tables, cross-tabulations, as well as numerical description. The outputs are included, interpreted and discussed by various clusters in the respective sections.

2.5.5 Socio Economic Survey Findings

The discussion in this section takes a comparative approach to enable understanding the trend and also externalities facing each particular sub-district's community. Table 2-62 shows the respondents' demographic details. The survey which was predominantly conducted with the head of the households, shows that males outnumbered females in all the districts covered. This is indicative of the general trend whereby male member of the family tend to be the leader in the household. In terms of age, majority are within their middle to late 50s, which is in line with the demographic profile of Sri Aman division that is edging toward the aging population.

Table 2-62: Respondents' Demographic Details

Survey Sites	Respondents' Details				
	Gender		Average Age	Marital Status (%)	
	Male (%)	Female (%)		Married	Single
Simanggang	71	29	58	76	24
Pantu	66.3	33.7	57	61.5	38.5
Lingga	55	44	59	61	40
Lubok Antu	59	41	55	74.4	25.6
Engkilili	70	30	58	81.5	18.5

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-62 shows that the household's ethnic distribution closely correlates with the geographic locations of Sri Aman's districts and sub-districts. Iban constitute the majority, where they are prevalent in all localities, while the Malays are mostly located in the Lingga and Simanggang areas, and Chinese within the urban & commercial areas such as the Bazaar areas of each sub-districts.

Table 2-63: Ethnic Background of the Household

Survey Sites	Ethnic Background (%)			
	Iban	Malay	Chinese	Others
Simanggang	50	22.4	25.2	2.4
Pantu	76.5	0	23.5	0
Lingga	57.7	39.4	2.4	0
Lubok Antu	76.4	10.8	11.2	1.6
Engkilili	49.7	16.4	31.7	2.1

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Overall, the average size of the households within the Sri Aman division is relatively small, with the majority having only 3 to 4 people residing within the same house (33%), while those having more than 10 people constitutes less than 2% (Table 2-64). At the divisional level, this shows that having a lot of children or extended family living in the same household is not a common phenomenon. From a sub-district's level, Simanggang people have a higher household size with more than 30% of household having 5 to 6 people residing. This may be due to the lower number of people out-migrating as these areas are relatively more affluent and have more job opportunities to offer. Adversely, economic squeeze and higher living might prolong adult children living at home. Pantu presents the lowest household size with around 70% of household that have 4 and less people. In the cases of rural sub-districts, the growth of urban employment opportunities and decreasing land plots have led to out-migration of the younger generation. They migrated to either town area of Simanggang, or outside Sri Aman division to Sarawak city centres of Kuching, Miri, Sibu and Bintulu, while the popular destination outside of Sarawak are Johor and Singapore for the Chinese and Iban communities. This phenomenon has led to small households with senior citizens heading the households.

Table 2-64: Number of People Residing in Household

Survey Sites	No. of People in Household							
	1-2	3-4	5-6	7-8	9-10	11-12	13-14	≥ 15
Simanggang	49 (19.6%)	79 (31.6%)	80 (32%)	29 (11.6%)	8 (3.2%)	3 (1.2%)	1 (0.4%)	1 (0.4%)
Pantu	34 (33.3%)	37 (36.3%)	21 (20.6%)	9 (8.8%)	0	1 (1%)	0	0
Lingga	76 (36.5%)	60 (28.8%)	50 (24%)	17 (8.2%)	5 (2.4%)	0	0	0
Lubok Antu	50 (20%)	91 (36.4%)	70 (28%)	27 (10.8%)	6 (2.4%)	5 (2%)	1 (0.4%)	0
Engkilili	48 (25.4%)	66 (34.9%)	45 (23.8%)	25 (13.2%)	3 (1.6%)	1 (0.5%)	1 (0.5%)	0

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.6 Findings & Discussion

The discussion in this section takes a comparative approach in order to present a better understanding of the trends as well as the externalities facing each particular sub-district's community. Table 2-65 shows the respondents' demographic details. The survey which was predominantly administered to the head of the households, shows that males outnumbered females in all the districts covered. This is indicative of the general trend whereby male member of the family tend to be the leader in the household. In terms of age, majority are within their middle to late 50s, which is in line with the demographic profile of Sri Aman division that is edging toward the aging population.

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	Male (%)	Female (%)		Married	Single
Simanggang	71	29	58	76	24
Pantu	66.3	33.7	57	61.5	38.5
Lingga	55	44	59	61	40
Lubok Antu	59	41	55	74.4	25.6
Engkilili	70	30	58	81.5	18.5

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-66 shows that the household's ethnic distribution closely correlates with the geographic locations of Sri Aman's districts and sub-districts. Iban constitute the majority, where they are prevalent in all localities, while the Malays are mostly located in the Lingga and Simanggang areas, and Chinese within the urban & commercial areas such as the Bazaar areas of each sub-districts.

Table 2-66: Ethnic Background of the Household

Survey Sites	Ethnic Background (%)			
	Iban	Malay	Chinese	Others
Simanggang	50	22.4	25.2	2.4
Pantu	76.5	0	23.5	0
Lingga	57.7	39.4	2.4	0
Lubok Antu	76.4	10.8	11.2	1.6
Engkilili	49.7	16.4	31.7	2.1

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Overall, the size of the households within the Sri Aman division are relatively small, with the majority having only 3 to 4 people residing in the same house (33%), while those having more than 10 people constitute less than 2% (Table 2-67). At the divisional level, this shows that having a lot of children or extended family living in the same household is not a common phenomenon. From a sub-district's level, Simanggang people have a higher household size with more than 30% of household having 5 to 6 people residing. This may be due to the lower number of people out-migrating as these areas are relatively more affluent and have more job opportunities to offer. Adversely, economic squeeze and higher living might prolong adult children living at home. Pantu presents the lowest household size with around 70% of household that have 4 and less people. In the cases of rural sub-districts, the growth of urban employment opportunities and decreasing land plots have led to out-migration of the younger generation. They migrated to either town area of Simanggang, or outside Sri Aman divisions to Sarawak city centres of Kuching, Miri, Sibul and Bintulu, while the popular destination outside of Sarawak are Johor and Singapore for the Chinese and Iban communities. This phenomenon has led to small households with senior citizens heading the households.

Table 2-67: Number of People Residing in Household

Survey Sites	No. of People in Household							
	1-2	3-4	5-6	7-8	9-10	11-12	13-14	≥ 15
Simanggang	49 (19.6%)	79 (31.6%)	80 (32%)	29 (11.6%)	8 (3.2%)	3 (1.2%)	1 (0.4%)	1 (0.4%)
Pantu	34 (33.3%)	37 (36.3%)	21 (20.6%)	9 (8.8%)	0	1 (1%)	0	0
Lingga	76 (36.5%)	60 (28.8%)	50 (24%)	17 (8.2%)	5 (2.4%)	0	0	0
Lubok Antu	50 (20%)	91 (36.4%)	70 (28%)	27 (10.8%)	6 (2.4%)	5 (2%)	1 (0.4%)	0
Engkilili	48 (25.4%)	66 (34.9%)	45 (23.8%)	25 (13.2%)	3 (1.6%)	1 (0.5%)	1 (0.5%)	0

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.7 House Ownership

The majority of the heads of household owned their houses either through purchase or inheritance. Table 2-68 illustrates that more than 95% of the household head owned their house in both the Sri Aman and Lubok Antu district. There is around less than five per cent of the respondents who did not own the house and preferred to rent a house instead and this happened to be in places like Simanggang (4.10%), and Engkilili (3.20%) followed by Lubok Antu (1.20%). Another finding from the survey is that in the Engkilili subdistrict 1.10% of the houses are provided by an employer. Other reasons for not owning the house such as preferring to stay in the family house only accounted for 0.80% and 0.50% for Simanggang and Lingga, respectively.

Table 2-68: Type of Ownership Status

Survey Sites	House Ownership's Status (%)				
	Owned House	Rented House	Staying in other people/family house	Accommodation provided by employer	Others
Simanggang	95.1	4.1	0.8	0	0
Pantu	99	1.0	0	0	0
Lingga	96.1	1.0	0.5	0	2.4
Lubok Antu	98.4	1.2	0	0	0.4
Engkilili	94.7	3.2	0	1.1	1.0

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

In the Sri Aman division, there were not many respondents who did not own a house. For those who did not own a house, the major reason was unaffordability, see Table 2-69. This is clearly demonstrated by the cases of Simanggang (66.67%) and Lingga (75%). The other reason was that respondents already have a family home to stay in. It was also noted that at least one respondent from both Pantu and Lingga that had the same reason for not owning a house as they were staying with their family. Similar to Simanggang and Lingga, Engkilili 37.50 per cent of the non-owning respondents mentioned that they cannot afford a house, 25 per cent of them staying at their family house while other reasons for not owning the house remained 37.50 per cent in Lubok Antu's district. From Lubok Antu side, there is at least one respondent who is opting for renting while the remaining are staying at their family house instead of owning one.

Table 2-69: Reasons for not Owning a House

Survey Sites	Reasons for Not Owning House			
	Unaffordable	Prefer to Rent	Have Family House	Others
Simanggang	4 (66.67%)	0	2 (33.33%)	0
Pantu	0	0	1 (100%)	0
Lingga	3 (75%)	0	1 (25%)	0
Lubok Antu	0	1 (33.3%)	1 (33.3%)	1 (33.33%)
Engkilili	3 (37.50%)	0	2 (25%)	3 (37.50%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

According to the Table 2-70, house rental rate per month is varied across locations. Being nearer to town areas particularly in Simanggang and Pantu, both locations have the highest rental rate, while Lingga ranked the lowest. In Simanggang, the house rental per month can be priced as high as RM500 and RM200 at minimum. For Pantu's case, the house rental rate is fixed at RM500 while Lingga's rental rate is affordable at RM300 per month. The house rental in Lingga is surprisingly low as compared to other survey sites since the rental fees can be priced as low as RM63 per month. Because of its low price, people tend to rent instead of buying or owning the house since they can easily pay the cheaper rental fees. It can also be noted that there is a huge disparity in housing rental rate in Lubok Antu district. Both Engkilili and Lubok Antu are known for their expensive house rental rate with an amount of RM1200 per month which is the maximum and the minimum rental rate is RM90 per month. The rental fee trend is common among the Lubok Antu district and hence, a lack of affordable housing can be seen from the previous survey particularly in Engkilili due to costly rent.

Table 2-70: Monthly Rental Rate

Survey Sites	House Rental Rate (RM per month)		
	Min	Max	Median
Simanggang	200	500	250
Pantu	500	500	500
Lingga	63	300	181.5
Lubok Antu	90	1200	300
Engkilili	90	1200	300

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Based on Table 2-71, the majority of respondents from Simanggang which is 80.6% own 3 or more sleeping rooms, 17.2% have two bedroom and only five per cent have a single bedroom in one house. In Lubok Antu district, both subdistricts are accounted for having 3 or more bedrooms per house and there are 51.4% and 61.1%, respectively. From the perspective of toilet facility, 13.5% of the respondents in Simanggang have Tandas Curah, 85.7% have Tandas Tarik/Pam and 0.8% have no toilet (Table 2-71). In Lubok Antu district, the majority of the respondents are using *Tandas Tarik/Pam* with 70.5% and 80.0% in Lubok Antu and Engkilili. The finding also illustrates that at least 0.80% from the households surveyed do not own a toilet in their house particular in Simanggang and Pantu and 0.40% from Lubok Antu's survey. The implication from not owning a toilet will lead to a lack of sanitation and other health related issues.

Table 2-71: Housing Structure and Design

Survey Sites	House Structure / Design			Toilet Facility (%)		
	1 Bedroom	2 Bedrooms	3 or More Bedrooms	Tandas Curah	Tandas Tarik/ Pam	No Own Toilet
Simanggang	5 (2.2%)	40 (17.2%)	187 (80.6%)	33 (13.5%)	210 (85.7%)	2 (0.8%)
Pantu	14 (15.4%)	24 (26.4%)	53 (58.2%)	38 (35.2%)	68 (63.0%)	2 (1.9%)
Lingga	37 (19.0%)	66 (33.8%)	92 (47.2%)	103 (50.7%)	100 (49.3%)	0 (0.0%)
Lubok Antu	50 (23.6%)	53 (25.0%)	109 (51.4%)	73 (29.1%)	177 (70.5%)	1 (0.4%)
Engkilili	30 (16.7%)	40 (22.2%)	110 (61.1%)	39 (20.0%)	156 (80.0%)	0 (0.0%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The proportion of households with access to electricity and water supplies is very high in both districts. More than 95% of the respondents can easily access the electricity supply from Sarawak Energy Board and less than 3% are using other resources such as solar energy, generator, kerosene lamp and hydro energy. Certain areas in Simanggang and Lingga that are unable to access to 24-hours electricity supply only accounted for 2% and 0.6%, respectively. As for water supply, there is about 59.2% of the respondents from Simanggang getting their water supply from the Water Board, 25.20% from gravity feed pipe, 12.4% from the river and the remaining water supply is through either well or rain as their source of water. For Pantu's case, 48% of the respondents rely heavily on the gravity feed pipe and only use 17.6% water from the water board. As for Lingga subdistrict, 95.8% of water supply is coming from water board, 49.1% from the rain and 19.40% is through gravity feed pipe. In Lubok Antu district, both locations shown higher usage of water supply from Water Board which is 83.6% and 72.5%, respectively. However, it is notable that certain areas in Engkilili, 20.6% of them are getting their water supply from the river as compared to other sub-districts.

Table 2-72: Number of People Residing in Household

Survey Sites	No. of People in Household							
	1-2	3-4	5-6	7-8	9-10	11-12	13-14	≥ 15
Simanggang	49 (19.6%)	79 (31.6%)	80 (32%)	29 (11.6%)	8 (3.2%)	3 (1.2%)	1 (0.4%)	1 (0.4%)
Pantu	34 (33.3%)	37 (36.3%)	21 (20.6%)	9 (8.8%)	0	1 (1%)	0	0
Lingga	76 (36.5%)	60 (28.8%)	50 (24%)	17 (8.2%)	5 (2.4%)	0	0	0
Lubok Antu	50 (20%)	91 (36.4%)	70 (28%)	27 (10.8%)	6 (2.4%)	5 (2%)	1 (0.4%)	0
Engkilili	48 (25.4%)	66 (34.9%)	45 (23.8%)	25 (13.2%)	3 (1.6%)	1 (0.5%)	1 (0.5%)	0

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-73 illustrates the basic home appliances owned per household. Some of the basic home appliances are computer, radio, television, handphone, electric/gas stove and wooden stove. Based on the findings above, Simanggang is considered to be a more developed area and, as such, more exposed to technology as compared to other subdistricts due to its complete infrastructure like network coverage and school facilities. Therefore, the percentage that owns computers and handphones are high in Simanggang which are 30% and 70%, respectively. Basic necessities such as television and stove particularly wooden stove are common among the households and hence, the percentage encountered for each home appliances are more than 94% in both Sri Aman and Lubok Antu districts. Similarly, the practice of using electrical or gas stove is fairly low in certain subdistricts. For instance, Simanggang used

the least amount of electric or gas stoves among the Sri Aman district, while the number of respondents using electric, or gas stove are equally balance in Lubok Antu subdistrict which accounted for more or less 21%.

Table 2-73: Home Appliances

Survey Sites	Home Appliances					
	Computer	Radio	TV	Handphone	Electric / Gas Stove	Wooden Stove
Simanggang	75 (30%)	182 (72.8%)	242 (96.8%)	175 (70%)	36 (14.4%)	249 (99.6%)
Pantu	15 (14.7%)	68 (66.7%)	96 (94.1%)	32 (31.4%)	39 (38.2%)	102 (100%)
Lingga	12 (5.8%)	165 (80%)	191(91.8%)	87 (42%)	92 (44.2%)	205 (98.5%)
Lubok Antu	44 (17.6%)	139 (55.6%)	241 (96.4%)	139 (55.6%)	54 (21.6%)	248 (99.2%)
Engkilili	53 (28%)	103 (54.5%)	182 (96.3%)	58 (30.7%)	38 (20.1%)	187 (98.9%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.8 Educational Status Profile

Table 2-74 shows that, across the two districts, a high number of the household heads only completed standard 6 and below of the primary school education (on average, 34%), while those having no formal education comprises 24%. Simanggang has the most educated groups of household heads with the majority having Upper Secondary School's qualification, and also the highest number of Diploma and Degrees holders in comparison to the other sun-districts. The figures are not surprising given the close proximity of this area to the division's educational institutions and commercial centers. In contrast, Lubok Antu and Lingga have the highest percentage of heads without any formal education. See also Table 2-75 for household members' educational attainment.

Table 2-74: Educational Level of Household Head

Survey Sites	Highest Educational Qualification Attained by Household Head									
	No formal Education	Primary School Standard 1,2,3	Primary School Standard 4,5,6	Lower Secondary School	Upper Secondary School	Diploma	Degree	Master	PhD	Vocational
Simanggang	25	16	57	46	67	8	5	0	0	0
Pantu	17	13	37	15	10	0	0	0	0	0
Lingga	63	19	64	17	11	3	0	0	0	1
Lubok Antu	73	20	42	36	42	5	0	0	0	1
Engkilili	35	14	48	25	30	4	4	0	0	1

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-75: Household Members' Educational Attainment

Survey Sites	Educational Attainment		
	Minimum	Maximum	Average
Simanggang	No Formal Education	Master	Upper Secondary School
Pantu	No Formal Education	Master	Upper Secondary School
Lingga	No Formal Education	Degree	Upper Secondary School
Lubok Antu	No Formal Education	PhD	Upper Secondary School
Engkilili	No Formal Education	Master	Upper Secondary School

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Based on the survey, the benefits of education are widely appreciated by both the household heads and also members across all the sub-districts. For these households, they strive to provide the best education for their family members, and are willing to forego their children's assistance in helping with daily chores such as doing agriculture activities. However, this has both positive and negative implications on the types of jobs that the household heads deemed as suitable to commensurate with their children's education attainment. That is, those family members that completed upper secondary schools viewed agriculture jobs that involved physical labour as not being befitting, thus, the tendency for jobs within the plantations being not as highly sought by these demographics. Thus, this leads to outmigration when there are no perceived suitable jobs within the village vicinities. This lack of job opportunities has even led to some households having cases of school dropouts among their younger generation as they opt for full time wage labour or helping their family members with agriculture activities. Both these scenarios have implications not just on the economic resources of these households, but the importance that these households place on educational attainment among his/her household member.

2.5.9 Types of Jobs Undertaken

Due to the relatively older age-bracket (more than 50 years), a high number of the heads are not working either due the fact that there are only physical types of jobs available, or they are pensioners. For those that are still in active labour, the highest number of employment activity is farming, followed by business activities (Table 2-76). Lubok Antu has the highest number of household heads being farmers, while business and government office workers are the most prevalent vocations within the Simanggang's household heads. Structural change in the community such as decreasing land plots, increased transportation and communication linkages, urbanization in certain subdistricts etc., have led to growth of the non-agriculture-based economy.

Table 2-76: Main Occupation of Household Heads

Survey Sites	Main Occupation										
	Farmer	Animal/Fish Breeder	Fisherman	Construction Worker	Mining Worker	Transportation Worker	Businessman	Government Office Worker	Private Office Worker	Not working	Others
Simanggang	56	0	0	10	0	5	29	25	9	89	1
Pantu	38	0	0	5	0	0	25	0	1	23	0
Lingga	52	5	8	15	0	0	10	4	0	78	6
Lubok Antu	107	6	2	12	0	1	25	10	7	42	7
Engkilili	65	0	0	6	0	1	30	9	5	41	4

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-77 shows that the majority of the household heads are self-employed mainly due to lack of job opportunities within the hinterland and rural areas. While wage earners constitute less than half of the employment status, they are divided into three distinct groups. Firstly, those within the bigger towns such as Simanggang where the majority are government office workers and mainly come from the Malay communities. The Iban and Chinese residents that are involved in this sort of work are mostly either private office workers, or at private sector establishments such as shops, restaurants, car dealerships, garages etc. Participation of such type of employment have been on the increase in smaller towns such as Lubok Antu. The second group involved in wage labour are those working as manual or low-level workers within bazaar areas of Pantu, Lingga and Engkilili. This includes working in shops, garages and other small establishments mainly within the services sectors. The third group are those working as casual workers who are recruited based on an as-need-basis and paid according to time- worked or output produced. Labour work within the village is very casualised and labourers work for many different people. These types of jobs are most prevalent in the agriculture or construction industries.

Table 2-77: Employment Status of Household Heads

Survey Sites	Household Head's Employment Status	
	Self-Employed (%)	Wage Earner (%)
Simanggang	61.8	38.2
Pantu	88.9	11.1
Lingga	69.7	30.3
Lubok Antu	78.7	21.3
Engkilili	75.5	22.5

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The majority of the households are involved in agriculture activities, with the sub-districts of Lubok Antu and Engkilili being the most prevalent at 76.4% and 65.6% respectively (Table 2-78). Sri Aman has the lowest percentage involvement in any sort of agriculture activities at only 51% of households. This scenario matches with the large land mass of the Lubok Antu's districts, as compared to Simanggang that has a relatively high build-up area.

Table 2-78: Involvement in Agriculture Activities

Survey Sites	No. of Households involved in Agriculture Activities	
	Yes (%)	No (%)
Simanggang	129 (51.6%)	113 (45.2%)
Pantu	70 (68.6%)	28 (27.5%)
Lingga	120 (57.7%)	82 (39.4%)
Lubok Antu	191 (76.4%)	59 (23.6%)
Engkilili	124 (65.6%)	65 (34.4%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Although agriculture is the main source of income for more than 70% of the households shown in Table 2-79, the activities are done in a small scale. In terms of the crops being planted, more than 60% plant subsistence crops. This means that the crops are mainly for the household's own, or fellow villagers' consumption, leaving surplus for sale. For these households, agriculture is associated with livelihood security because it reduces dependence on market purchases and therefore, a means to reduce their

expenditure burden. Most rely on family members to work the land. Furthermore, there is a lack of downstream food processing activities being done at the household or village level.

Table 2-79: Level of Dependency on Agriculture Activities as The Main Source of Income

Survey Sites	Agriculture as Main Source of Income		Type of Crops Planted		
	Yes	No	Subsistence	Commercial	Both
Simanggang	71 (56%)	55 (43.6%)	84 (66.1%)	14 (11%)	29 (22.8%)
Pantu	41 (58.6%)	29 (41.4%)	46 (65.7%)	10 (14.3%)	14 (20%)
Lingga	72 (60%)	48 (40%)	77 (64.2%)	6 (5%)	37 (30.8%)
Lubok Antu	97 (50.8%)	94 (49.2%)	88 (46.8%)	43 (22.9%)	57 (30.3%)
Engkilili	90 (72.6%)	34 (27.4%)	60 (48.4%)	30 (24.2%)	34 (27.4%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-80 indicates that Padi is the most popular crop for the households in Lingga (64%), Lubok Antu (41%) and Engkilili (48%). While for commercial crops, rubber is the top choice for Pantu (47%) and Lubok Antu (41%). This is followed by Palm Oil where it constitutes 46% of the type of commercial crops being planted by Engkilili householders. This diversity of crops being chosen by the householders for their subsistence and commercial purposes indicates the suitability of the lands for potential downstream processing or scale's expansion of the agriculture activities.

Table 2-80: Types of Crops Planted

Survey Sites	Types of Crops Planted by Households						
	Palm Oil	Rubber	Pepper	Cocoa	Padi	Fruits	Vegetables
Simanggang	15 (11.6%)	23 (17.8%)	17 (13.2%)	1 (0.8%)	25 (19.4%)	59 (45.7%)	66 (51.2%)
Pantu	23 (32.9%)	33 (47.1%)	3 (4.3%)	0	15 (21.4%)	30 (42.9%)	66 (94.3%)
Lingga	4 (3.3%)	5 (4.2%)	1 (0.8%)	0	77 (64.2%)	25 (20.8%)	34 (28.3%)
Lubok Antu	38 (19.9%)	79 (41.4%)	27 (14.1%)	0	79 (41.4%)	17 (8.9%)	54 (28.3%)
Engkilili	57 (46%)	39 (31.5%)	45 (36.3%)	7 (5.65%)	60 (48.4%)	21 (16.9%)	36 (29%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

According to Table 2-81, income is earned from the sales of various crops ranging from fast-growing fruits to relatively longer-yield crops such as palm oil and rubber. Rubber yields the highest returns for the five sub-districts, averaging from as high as RM841 per month for Lubok Antu's householders to RM427.5 in Lingga. Although Padi is the most widely grown subsistence crops, it constitutes a lower source of income in comparison to fruits or vegetables for householders in Simanggang, Pantu and Lubok Antu.

Table 2-81: Average Monthly Income Based on Types of Crops Sold

Survey Sites	Average Monthly Income (RM)						
	Palm Oil	Rubber	Pepper	Cocoa	Padi	Fruits	Vegetables
Simanggang	826.9	190.7	506.8	N/A	100	413	290.9
Pantu	748.1	47.8	125	N/A	40	147.2	210.2
Lingga	427.5	N/A	170	N/A	268.8	86.4	173.8
Lubok Antu	841	165	208	100	136	420	152
Engkilili	693	250	185	N/A	273	135	244

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-82 depicts that Lubok Antu has the highest number of households involved in the livestock/poultry rearing activities at 41.7%, while Engkilili recorded the lowest participation at only 19.6%. In terms of operations, the majority are doing them in small-scale citing lack of financial resources and limited land mass.

Table 2-82: Involvement in Livestock/Poultry Rearing

Survey Sites	Households Involvement in Livestock/Poultry Rearing	
	Yes (%)	No (%)
Simanggang	63 (26.9%)	171 (73.1%)
Pantu	40 (39.2%)	62 (60.8%)
Lingga	49 (24.3%)	153 (75.7%)
Lubok Antu	103 (41.7%)	144 (58.3%)
Engkilili	37 (19.6%)	152 (80.4%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The majority rear livestock or poultry for their own consumption, rather than as a source of income, see (Table 2-83). For instance, even in the more popular type of poultry rearing, less than 10% and 3% of chicken and ducks are for sale respectively. Goats are the least reared, while cows are non-existent in terms of livestock, mainly due to their relatively higher cost and maintenance, in addition to the land mass and amount of grass needed. Furthermore, these types of livestock are rarely considered liquid assets as it is not easy for households to sell their stocks in time of need. Aquaculture fishery is also not prevalent except for certain areas in Lubok Antu (that is, Batang Ai), even then, its mostly for the household's or villager's own consumption. The most popular livestock farming are pigs, which are predominantly for the community's own consumptions especially in the rural longhouses' localities.

Table 2-83: Distribution of Households Involved in Livestock/Poultry Rearing

Type of Poultry	Simanggang		Pantu		Lingga		Lubok Antu		Engkilili	
Chicken	41	-95.30%	22	-84.60%	24	-77.40%	58	-93.50%	27	-100%
	2	-46.50%	4	-15.40%	7	-22.60%	4	-6.50%	0	0%
Duck	12	-85.70%	3	-75%	6	-85.70%	23	-92%	5	-83.30%
	2	-14.30%	1	-25%	1	-14.30%	2	-8%	1	-16.70%
Cow	0		0		0		0		0	
	0		0		0		0		0	
Goat	0	0%	0		2	-100%	0		1	-100%
	1	-100%	0		0	0%	0		0	0%

Fish	4	-80%	1	-50%	3	-75%	6	-14.30%	1	-100%
	1	-20%	1	-50%	1	-25%	1	-85.70%	0	0%
Pig	21	-65.60%	19	-79.20%	13	-65%	50	-79%	17	-85%
	11	-34.40%	5	-20.80%	7	-35%	12	-21%	3	-15%
Others	0		0		0		1	-50%	0	
	0		0		0		1	-50%	0	

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Those that are involved in the gathering of jungle products mostly live-in rural villages bordering forests or virgin jungles (Table 2-84). Thus, it is not surprising that Engkilili constitute the highest number at 41.4%. These activities are done mainly for the household's own personal consumption, with surpluses being sold to surrounding areas or sub-district's bazaars. The type of jungle products collected include vegetables, herbs, fruits and various species of wild ferns.

Table 2-84: Involvement in the Collection of Jungle Products

Survey Sites	No. of Households Involved in Collecting Jungle Products		Purpose for Collecting Jungle Products (%)		
	Yes	No	Own Consumption	For Sale	Both
Simanggang	61 (24.9%)	184 (75.1%)	33.3	33.3	33.3
Pantu	27 (27%)	73 (73%)	36.3	31.8	31.9
Lingga	34 (16.5%)	172 (83.5%)	29.3	35.3	35.4
Lubok Antu	103 (41.4%)	146 (58.6%)	30.9	38.8	30.3
Engkilili	23 (12.17%)	166 (87.8%)	45.7	27.1	27.1

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

For those that gathered the jungle products for sale, the income generated is viewed as a supplement rather than the main source of income for the household. This is because the types and amount of jungle products collected are unpredictable subject to the season and timing, in addition to being highly dependent on the land mass and untouched nature of the jungle. Thus, the amount of income varies widely across the sub-districts, with Lubok Antu having the highest average income at RM109.17 per month, see Table 2-85.

Table 2-85: Monthly Income from the Sales of Jungle Products

Survey Sites	Monthly Income from Jungle Products' Sales (RM)	
	Average	Median
Simanggang	20	0
Pantu	18.57	0
Lingga	9.05	0
Lubok Antu	109.17	80
Engkilili	63.75	20.00

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-86 shows that, overall, not many households across the five sub-districts are involved in hunting activities. The highest percentage comes from the Simanggang at a mere 8.8%, follows by Pantu at 4%. For those that go for these hunting activities, the animals caught are mostly for their own consumption. The types of animals available for hunting in the two districts include wild boars, kijang, pelanduk, deer, fox, bats and monkeys.

Table 2-86: Involvement in Hunting Activities

Survey Sites	No. of Households Involved in Hunting Activities		Purpose for Hunting (%)	
	Yes (%)	No (%)	Own Consumption	For Sale
Simanggang	21 (8.8%)	219 (91.2%)	66.7	33.3
Pantu	5 (5%)	96 (95%)	90.5	9.5
Lingga	3 (1.5%)	202 (98.5%)	95	5
Lubok Antu	10 (4%)	237 (96%)	88.9	11.1
Engkilili	7	182	100	0

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

All the respondents treat hunting as a secondary source, rather than the main source of income. Due to uncertainty of the hunt, sometimes they do not get anything in a hunt, while other times they might be lucky. The time for hunting also varies, depending on the weather & availability of free time. So, for those that sell their hunt, when the amount was average out, it tends to vary considerably, with maximum at RM135 during a good hunt, while sometimes there is no catch at all to sell (Table 2-87).

Table 2-87: Monthly Income from the Sales of Hunted Animals

Survey Sites	Monthly Income from Hunted Animals' Sales (RM)	
	Average	Median
Simanggang	101.43	100
Pantu	135	135
Lingga	100	100
Lubok Antu	100.67	2
Engkilili	N/A	N/A

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-88 reveals that overall, less than 30% of the division's households are involved in fishing activities. At the sub-district's level, Pantu recorded the highest percentage at 19.8%, follows by Lingga (16%) and the lowest being Engkilili at 5.8%. The majority of the household member's that go fishing in Simanggang, Engkilili and Lingga do so for own consumption, while only Lubok Antu and Pantu have a majority that do so for commercial purpose, at 67% and 65% respectively.

Table 2-88: Involvement in Fishing Activities

Survey Sites	No. of Households Involved in Fishery		Purpose for Fishing (%)	
	Yes (%)	No (%)	Own Consumption	For Sale
Simanggang	28 (11.8%)	209 (88.2%)	78.6	21.4
Pantu	20 (19.8%)	81 (80.2%)	35	65
Lingga	33 (16%)	173 (84%)	51	49
Lubok Antu	35 (14.2%)	212 (85.8%)	33	67
Engkilili	11 (5.8%)	178 (94.2%)	63.6	36.4

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Although the household members have the options of fishing either on the river, seaside, or deep-sea areas, the most favoured locations are on the Sri Aman rivers (Table 2-89). This indicate that the marine life within these rivers are thriving and are able to provide good returns to the fishermen or anglers.

Table 2-89: Fishing Localities

Survey Sites	Fishing Localities (%)			
	River (%)	Seaside (%)	Deep Sea (%)	Others (%)
Simanggang	89.3	0	0	10.7
Pantu	100	0	0	0
Lingga	78.8	9.1	12.1	0
Lubok Antu	94	0	6	6
Engkilili	100	0	0	0

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Although the household members have the options of fishing either on the river, seaside, or deep-sea areas, the most favored locations are on the Sri Aman rivers. This indicate that the marine life within these rivers is thriving and are able to provide good returns to the fishermen or anglers.

2.5.10 Labour and Employment Issues

At the divisional level, more than 30% of household heads were found to be unemployed. The reasons for unemployment vary across the sub-districts, see Table 2-90. For Lingga, Pantu and Lubok Antu, the majority of these unemployed household heads cited health issues as the reason for not being able to work, at 85.5%, 81.3% and 72.2% respectively. In the case of Simanggang and Engkilili, the number of pensioners that have reached retirement age are relatively high at 56.3% and 48.2% respectively. There are also those that are not working due to the job available in their areas deemed as not suitable or related to their current skill, knowledge or ability.

Table 2-90: Household Heads' Reasons for Not Working

Survey Sites	Reasons for Not Working			
	Disable/Sick	Pension	Current Available Jobs Not Suitable/Related	Others
Simanggang	31 (35.6%)	49 (56.3%)	4 (4.6%)	3 (3.5%)
Pantu	13 (81.3%)	2 (12.5%)	0	1 (6.2%)
Lingga	65 (85.5%)	4 (5.3%)	6 (7.9%)	1 (1.3%)
Lubok Antu	52 (72.2%)	5 (6.9%)	11 (15.3%)	4 (5.6%)
Engkilili	18 (32.1%)	27 (48.2%)	8 (14.3%)	3 (5.4%)

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.11 Income, Expenditure, and Saving Habits

There is a huge gap in terms of the income earned between households across the survey sites. This is largely due to the types of occupation, employment status and also localities. Simanggang households reported the highest average household income per month (RM3,300), Engkilili with RM2,394, Lubok Antu (RM1,965) and Pantu (RM1,761). The mean household income for Lingga (RM1,368) is relatively the lowest in comparison to the rest of the sub districts. This ranking is consistent, in terms of median household income, that is Simanggang with a median household income RM2,300 per month, followed by Engkilili (RM1,583), Lubok Antu (RM1,200), Pantu (RM1,000) and Lingga (RM800). Thus, the median household income per month (RM2,300) could be attributed to those households that have members working in the various middle income-bracket jobs such as government servant or private sector workers. Other factors may be due to the source of income and employment status. It is found that the majority of the monthly household income that exceeds RM20,000 are those households that are involved in business activities rather than wage income. A low monthly income per household was also found to be attributed to certain factors such as the households' source income being from small-scale farming with low-yield, reliance on unstable commodity agriculture products etc. A number of factors could explain the huge disparity of household income between Lingga and the rest of the survey sites. Among them is the geographical factor. For instance, Simanggang, being the main town centre is endowed with better infrastructures and facilities such as educational institutions, government agencies, banks etc.

Table 2-91: Household Income

Survey Sites	Household Income (RM per month)			
	Min	Max	Median	Mean
Simanggang	133	35500	2300	3300
Pantu	71	14000	1000	1761
Lingga	100	40000	800	1368
Lubok Antu	100	22000	1200	1965
Engkilili	129	20000	1583	2394

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-92 categorizes the aid received by the households based on types and sources. It is found that the majority of the households have been receiving various type of aid ranging from industry-based assistance (agriculture, fishery etc.) to social aid for the needy, to the federal aids such as Prihatin etc.

Table 2-92: Types of Aids Received by Households

Survey Sites	Simanggang		Pantu		Lingga		Lubok Antu		Engkilili	
	No	%	No	%	No	%	No	%	No	%
District Office Cash (RM)	0		0		0		4	-1.10	1	-0.80
Social Welfare Department Cash (RM)	30	-13.50	20	-14.10	89	-45	29	7.70	16	-12.60
Fertilizer (Bag)	26	-11.70	47	-33.10	38	-19.20	126	-33.60	34	-26.80
Rubber Seedling (Tree)	0		0		0		4	-1.10	1	-0.80
Oil Palm Seedling (Tree)	0		2	-1.40	0		3	-0.80	4	-3.20
Weedicide (Bottle)	1	(0.5	8	-5.60	1	-0.50	8	-2.10	11	-8.70
Other Agriculture (RM)	0		0		5	-2.50	0		0	
Fish Cage, Feed etc. (Unit)	0		0		0		7	-1.90	0	
Federal Govt Cash (RM)	134	-60.40	51	-35.90	25	-12.60	139	-37.10	17	-13.40
Federal Govt House (Unit)	0		1	-0.70	0		2	-0.50	1	-0.80
State Government Cash (RM)	12	-5.40	9	-6.30	4	-2	26	-6.90	32	-32
Family Cash (RM)	19	-8.60	4	-2.80	36	-18.20	27	-7.20	10	-7.90
Others (Cash)	0		0		3	-1.50	0		0	

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The number of respondents that received financial aid from the federal government in Simanggang is 60.4%, Pantu 35.9% and followed by Lingga (12.6%). In Lubok Antu and Engkilili, cash from federal government accounted for 37.1% and 13.4% of aid, respectively. This is in addition to PPRT houses given to those that do not have proper accommodation. State government was also found to provide aid but at a lesser degree of 7% in Lubok Antu subdistrict, while Engkilili is at 32% of the households surveyed. The cash distribution was meant to lessen the burden on the households during the Covid19 pandemic. Another significant finding from this survey is the wide variety of aid given by the agriculture department in assisting the households in their agriculture activities. For instance, fertilizer and weedicide are the most common type of agriculture aids given to more than 30% of the respondents from Lubok Antu and Pantu respectively. Social welfare department also provide several financial aids ranging from *bantuan warga emas*, *bantuan kanak-kanak*, *bantuan OKU*, *bantuan ibu tunggal* and so forth. According to the table above, about 45% of the respondents from Lingga have received the most financial aid from the Social Welfare Department as compared to other districts. This may be due to the high number of the respondents living in Lingga particularly Banting who are from the disadvantaged demographic group. It also found that some households have been receiving assistance from family members that are living elsewhere, especially those households' heads that have adult children and grandchildren. This shows that out-migration can be a source of aid for all the five survey sites.

Table 2-93 illustrates the monthly household expenditure that covers expenses such as food, utility, transport, rental, instalment, children education and medical care. Households from Simanggang and Lubok Antu spent the most on rental, with rental fees accounting for RM818.67 and RM730 on average, respectively. Alternatively, utility constitute the least spending on average, ranging from RM77.32 to RM165.30 per month. The pattern of food expenditure is higher for both Simanggang and Engkilili whose householders spent about RM527 and RM520.80 on average respectively, whereas the remaining areas such as Pantu, Lingga and Lubok Antu's food expenditure ranges from RM350 to RM360. For instalment payment expenses, Engkilili has the highest amount at RM852 per household on average, whereas Lingga has the least instalment expenditure at RM569 on average. In terms of child education, the majority of households are willing to invest on the expenditure and this spending pattern is similar across the districts. They are inclined to spend as high as RM2000 for their children's' education and this indicates the importance of education to them. With regards to the medical expenditure, Lingga and Engkilili spent less on medical expenditure at RM96, while Simanggang's medical bill is around RM150 per month.

Table 2-93: Monthly Household Expenditure

Monthly Household Expenditure (RM)		Simanggang (RM)	Pantu (RM)	Lingga (RM)	Lubok Antu (RM)	Engkilili (RM)
Food	Min	100	50	30	30	50
	Max	200	3000	1500	3500	3000
	Average	527	351.53	361.7	360.62	520.8
	Median	460	250	300	300	400
Utility	Min	10	7	5	5	10
	Max	1000	1000	950	500	600
	Average	165.3	101.42	77.32	106.68	119.5
	Median	100	49	50	70	90
Transport	Min	16	10	6	4	5
	Max	3000	500	1000	1000	620
	Average	195.57	90	106.18	133.53	139.26
	Median	125	50	50	80	100
Rental	Min	30	30	63	41	47
	Max	3500	1000	300	3750	1200
	Average	818.67	238.5	181.5	730	305.88
	Median	350	66.5	181.5	300	175

Installment	Min	63.4	48	40	50	26
	Max	2500	2590	2000	3000	3200
	Average	722.38	798.31	569	546.35	852
	Median	600	475	394	250	700
Children Education	Min	10	15	10	30	5
	Max	2000	2000	1350	1000	2000
	Average	290.98	246.88	193.7	196.16	297.49
	Median	200	100	100	120	125
Medical / Health	Min	10	20	10	6	5
	Max	2000	500	700	2000	400
	Average	139.77	123.93	95.6	148.36	93.24
	Median	65	97.5	54	80	70
Others	Min	50	100	6.7	75	10
	Max	1063.4	150	285	75	700
	Average	493.36	125	90	75	198.3
	Median	390	35.36	35	75	100

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-94: Types of Saving and Investments by Households

Survey Sites	Household's Avenues for Savings & Investments (%)								
	Bank	Amanah Saham	Tabung Haji	Co-operative	Stock Market	Mutual Fund/ Unit Trust	Gold Market	At Home	Others
Simanggang	42.5	26	5.4	1	0.7	0.7	0.7	17.9	4.9
Pantu	32.4	21.8	4.9	0	1.4	0	2.8	23.9	12.7
Lingga	32.8	29.2	6.7	0	0	0.4	0	29.6	1.4
Lubok Antu	35	30.7	1	0.3	0	0	0	32	1
Engkilili	35.8	21.3	4.1	0.3	0	0.3	0	36.8	1.4

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Table 2-94 illustrates the types of saving and investments by households. Banks are the most common saving avenue for the households, follows by Amanah Saham and keeping money at home. For instance, 42.5% of the Simanggang's households put their savings in the bank, 26% in Amanah Saham and 17.9% in their own houses. This same saving pattern is prevalent in all the sub-districts. One possible reason could be the existing facilities in each district are rather limited and the householders feel more secure keeping their saving/investment in the bank or Amanah Saham. Furthermore, their limited gross income could mean that other saving avenues such as stock market, Mutual Fund, or gold market might not be deemed suitable for them.

Table 2-95: Reasons for Savings

Survey Sites	Reasons for Savings (%)						
	Emergency	Old Days	Children Education	House Furnitures	Vehicle	Inventory	Others
Simanggang	34.1	29.3	14.2	14.1	2.8	3.3	2.6
Pantu	26.1	21.2	18.5	20.1	5.4	4.9	3.8
Lingga	40.7	23	11.5	21.9	0.8	0.5	1.6
Lubok Antu	25.7	17.8	13.6	10.3	2.1	1.6	0
Engkilili	27.8	24.9	13.4	15	5.3	6.4	7.1

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

When asked for reasons for maintaining savings, a high number of the households in Simanggang (34.1%), and Lingga (40.7%) view it as a means to ensure they are well prepared in case of any emergencies, see Table 2-95. This sentiment is shared by their counterparts in the other sub-districts. The second major reason for saving is to ensure that they have enough money as preparation for old

age. Children education is also considered as an important factor, follows by home furniture purchase especially for those in Lingga that have been facing recurring flash floods.

2.5.12 Incidence of Poverty

The figures in Table 2-96 indicate the income from both the household head's main and side occupations. The fact that the majority of household heads have to take up a second job, even resorting to casual labour indicate the inadequacy of their primary income in maintaining a basic living standard. With the exception of Simanggang, the median income of the other survey sites is below both the poverty line. The lowest level of income is found to be within Pantu and Lingga with the median income of RM700 and RM775 respectively.

Table 2-96: Main and Side Incomes of Household Heads

Survey Sites	Statistics	Household Head's Main and Side Incomes (RM)	
		Main	Side
Simanggang	Minimum	100	33.33
	Maximum	8000	2050
	Average	1669.36	641.27
	Median	1200	470
Pantu	Minimum	71	10
	Maximum	12000	2019
	Average	1405.15	570.71
	Median	700	236
Lingga	Minimum	100	30
	Maximum	40000	1600
	Average	1205.51	351.53
	Median	775	250
Lubok Antu	Minimum	50	59
	Maximum	15000	4104
	Average	1078.94	577.57
	Median	700	320
Engkilili	Minimum	100	50
	Maximum	20000	4000
	Average	1385.98	798.68
	Median	925	500

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

Even with the additional income from side jobs, the income range is still below the poverty line for Pantu, Lingga, and Lubok Antu. This shows that there is a considerable gap between those localities that are nearer to towns, with both Simanggang and Engkilili having a higher wage range as compared to the other areas. Be that as it, it must be noted that across all districts, the income is still way below the national income average which indicate that majority of the Sri Aman's household are living below the poverty level.

When ask whether the current income from both the main & side jobs are adequate to cover the monthly expenses, majority view their income as inadequate, as shown in Table 2-97. Although the majority of these household heads are involved in side-job, this form of informal activity often has a low-rate of return. This continuous search for additional wage labour is indicative of a constant struggle for survival and has negative impact on the head's own main occupation. Although the side job can make irregular contribution to household income and/or help to smooth the income from the main

sources, it should not be part of an established long-term strategy to sustain the livelihood of the households.

Table 2-97: Adequacy of Head of Household's Income

Survey Sites	Are the current income adequate to cover monthly household expenses?	
	Yes (%)	No (%)
Simanggang	57.4	42.6
Pantu	41.8	58.2
Lingga	52.9	47.1
Lubok Antu	29.8	70.2
Engkilili	37.8	62.2

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.13 Quality of Life

In order to improve the quality of life in the Sri Aman division, it will be crucial to ensure that both economic and social needs of households are being addressed. Table 2-98 indicates the length of time that the household spend working towards the fulfilment of their economic needs. The amount of time varies according to location, with Lingga household devoting the highest number of hours, while Simanggang the lowest with median working hours of 40 hours per week.

Table 2-98: Working Hours Per Week

Survey Sites	Working Hours Per Week			
	Minimum	Maximum	Average	Median
Simanggang	10	112	41.98	40
Pantu	2	84	44.51	43
Lingga	6	140	46.28	48
Lubok Antu	12	91	42.56	42
Engkilili	10	96	43.74	42

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.5.14 Key Social Issues

Based on secondary data and discussions with relevant agencies, it was found that the Sri Aman Division also faces challenges in terms of its social problems. The main social issue concern is and, in the Division, and could be related to the other social ills, is drug and substance abuse. In 2017, there were 185 addicts in Sri Aman Division, which accounts for 1.67% of the total in Sarawak as a whole (source: Majlis Pembangunan Sosial). In terms of the number of arrests related to drug abuse, Sri Aman Division recorded approximately 2.9% of the total number of arrests for Sarawak as a whole in 2020. That figure corresponds to a total of 302 arrests. This figure is slightly lower from the 3.7% and 3.2% in 2019 and 2018 respectively, but higher than that of the 2011 (2.4%) and 2012 (2.6%).

According to the statistics obtained from Majlis Pembangunan Sosial (2021), the number of individuals tested positive for drug during testing by the National Anti-Drugs Agency (Agensi Antidadah Kebangsaan) has been inconsistent over the years. For instance, individuals tested positive was six (1.0%) in 2018, increased to 29 (2.0%) in 2019 and fell to five (0.5%) in 2020. The average is approximately 1.3% of the State's figure from 2018-2020. The statistics also shows that all of the

individual tested positives in 2018 and 2019 are males. The highest number of individuals tested positives for drugs are those in the 20 to 29 age groups (AADK, 2021). Statistics from the relevant agencies also indicated that students are also involved in drug and substance abuse. For instance, the number of students arrested by the PRDM for the period 2016-2020 was two, and that accounts for 1.9% of the State's figure. Meanwhile, the number of students tested positive for drugs in Sri Aman Division was seven (2.6%) and two (1.4%) in 2019 and 2020 respectively.

While the number involved (or stated in the aforementioned statistics) may not be very high, the consequences of their involvement may have implications on the future development of Sri Aman.

SECTION 2.6 COMMUNITY DEVELOPMENT AND EXPECTATION

2.6.1 Land Ownership and Use

There are three types of land tenure in the Division: Native Customary Rights (NCR) land, which has no title, titled Native Area Land (NAL) and titled Mixed Zone Land. Native customary land as defined by Section 2 of the Sarawak Land Code is the land in which native customary rights, whether communal or otherwise, have been lawfully created prior to the 1st day of January, 1958, and still subsist as such; land from time to time comprised in a reserve to which Section 6 of the Land Code applies; and interior area land upon which native customary rights have been lawfully created pursuant to a permit issued under Section 10 of the Land Code. Native Area Land is often defined as land other than Mixed Zone land, that are held by a native under a document of title and declared to be such.

In all the localities being surveyed, most of the respondents indicated that they own NCR or NAL land. As shown in Table 2-99, a larger proportion of the surveyed respondents in almost all survey sites have indicated that they own Native Customary Rights Land, which are not titled. Only Pantu shown a larger proportion of respondents owning the Native Area Land (i.e. 46.08%).

Table 2-99: Land Ownership

Area	Status	No. of Household	Percent of Total Household
Simanggang	NCR, no title	104	41.60%
	NAL, titled	57	22.80%
	MZL, titled	23	9.20%
Lingga	NCR, no title	119	57.21%
	NAL, titled	46	22.12%
	MZL, titled	5	2.40%
Pantu	NCR, no title	37	36.27%
	NAL, titled	47	46.08%
	MZL, titled	9	8.82%
Lubok Antu	NCR, no title	137	54.80%
	NAL, titled	25	10.00%
	MZL, titled	6	2.40%
Engkilili	NCR, no title	74	39.15%
	NAL, titled	58	30.69%
	MZL, titled	13	6.88%

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

The survey also found that, in terms of land productivity, all areas recorded a high percentage of productive land, ranging from 62.5% (in Pantu) to 100% usage (in Lingga). This can be seen from the following Table 2-100.

In terms of land tenure, it can be seen that the NCR landowners in the Division utilised between 67.58% to 96.17% of their land for activities, while the NAL landowners utilised between 68.26% to 96.02% of their land. The owners of Mixed Zone in Lubok Antu and Lingga tend to use their land more productively (approximately 96% and 100% respectively).

Table 2-100: Land size and Land Use

Area	Land tenure	Average size (acre)	Percent of productive land
Simanggang	NCR, no title	9.78	67.58%
	NAL, titled	89.20	96.02%
	MZL, titled	7.98	75.00%
Lingga	NCR, no title	3.81	72.15%
	NAL, titled	2.87	74.57%
	MZL, titled	1.70	100.00%
Pantu	NCR, no title	5.76	73.71%
	NAL, titled	4.96	77.04%
	MZL, titled	2.39	62.50%
Lubok Antu	NCR, no title	10.55	76.50%
	NAL, titled	2.17	79.58%
	MZL, titled	3.38	96.17%
Engkilili	NCR, no title	7.56	79.10%
	NAL, titled	4.99	68.26%
	MZL, titled	4.27	85.00%

Source: Sri Aman Master Plan Study-Socio-Economic Survey, 2020

2.6.1.1 Communities Affected by Batang Ai Hydro Dam

The Batang Ai hydroelectric Dam has caused a displacement of approximately 3,000 people from 29 settlements. The displaced communities were then resettled in the Batang Ai Resettlement Area, with 10 longhouses under Phase 1 in 1982 and 30 longhouses under Phase 2. The main pattern of land ownership in Batang Ai is non-inherited. This is mainly due to the fact that they have been displaced from their ancestral land and were relocated in the process of the Batang Ai Dam construction. According to the local communities interviewed, those who were relocated were compensated with 9 acres of land (1 acre for farming, 3 acres for cocoa, which was then replaced with oil palm, and 5 acres for rubber). Additionally, another 2 acres of land (for farming) were then compensated financially as no land was available within the vicinity. Discussions with village chiefs indicated that the original settlers were compensated RM2000 per acre (i.e. a total of RM4000 per household).

Land ownership issues are amongst the key problems in the Batang Ai resettlement scheme. The second and subsequent generations of settlers at Batang Ai Resettlement Scheme do not have access to land, thus relegating them to near landless status. The land compensation (mentioned earlier) was only meant for the original settlers and no new land is available for the 'new' generations. This lack of access to land (or their near landless status) affects their livelihood and ability to generate income. In particular, the second generation of settlers specified how this lack of land affect the way of life in two ways: (i) not enough land for them to build their own homes (after separating from the parents' household), and (ii) not enough land for farming. Several younger households even lamented that no land is available anymore even if they have money to buy land. This implies the critical issue of land availability in Batang Ai Resettlement Scheme. As an alternative to this limited access, the younger residents often choose to migrate to other places in order to seek employment (non-agricultural activities).

2.6.2 Social System

In this context, the social system refers to the formal structure of role and status within the surveyed community. The Sri Aman Division is predominantly occupied by Iban residents, followed by the Malay and Chinese groups. In the Iban community, their social system is centred around the longhouse and its organisation. In particular, the leader of a longhouse act as its *tuai rumah* (village headman) and that every longhouse is autonomous. The role of a *tuai rumah*, among others, includes resolving conflicts, act as a custodian of Iban *adat*, and liaison between the government and the community. Meanwhile, as a member of a longhouse (known as *anak biak*), there are rules/customs that need to be followed in order to retain their membership of a particular longhouse. It should be noted that, a person or a household can be considered a member of a longhouse community despite living and working in other area for most of the year. This explains the reason why there are unoccupied *bilik* in the longhouses. It should be noted that the organization of a Malay village is quite similar to its Iban counterpart. The headman, known as *ketua kampung*, is an influential figure. He is aided by his JKKK as well and also supported by the District Office and other agencies.

In terms of leadership structure, both in Iban and Malay communities, the headman (*tuai rumah* for the Iban and *ketua kampung* for the Malays) is the most influential as he/she is the first to be consulted when there are issues among his/her community. This is followed by the village committee (known as JKKK). The role of the JKKK here is to assist in the running of the village and usually comprises several small committees. Responses from the survey had indicated that the JKKK plays a role in terms of offering assistance during disaster (refer a section of resilience later in this chapter). In the case of the Chinese community, there is no clear community leadership structure. Although the Chinese community has their own Temenggong, Pemancha, Penghulu and Kapitan, the community is spread out spatially unlike the Malays and the Iban.

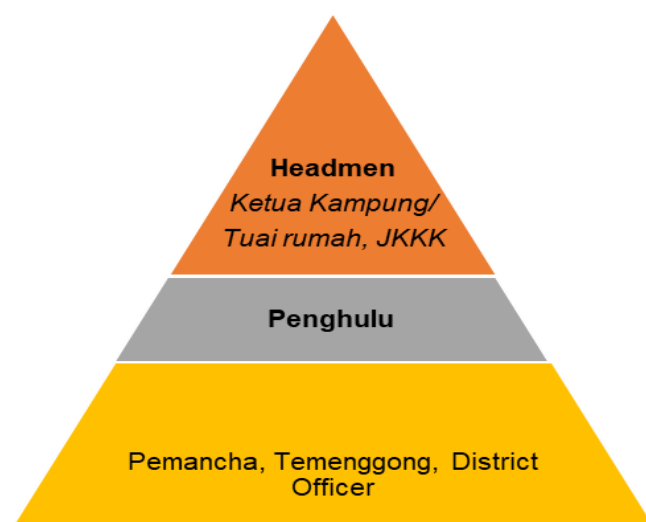


Figure 2-49: Leadership Structure for Communities in Sri Aman Division

Source: EPU Sarawak and UNIMAS Holdings

2.6.3 Educational and ICT Facilities

Based on the survey, it is found that there are differing level of access to educational facilities. In this survey, access to the nearest kindergarten, primary school and secondary school was highlighted in the following three charts (refer Figure 2-50, Figure 2-51 and Figure 2-52)

2.6.3.1 Kindergarten

Based on Figure 2-50, it can be seen that in all five areas, large proportions of respondents from each area has indicated that the nearest kindergarten is within 2km from their residences. Only Engkilili shown a slightly different pattern, with approximately 74% of the respondents indicating that their residences are within 5 km of the nearest kindergarten. The number of respondents who said they are within 2km is the same figure as those saying that they are living within 5km of the nearest kindergarten.

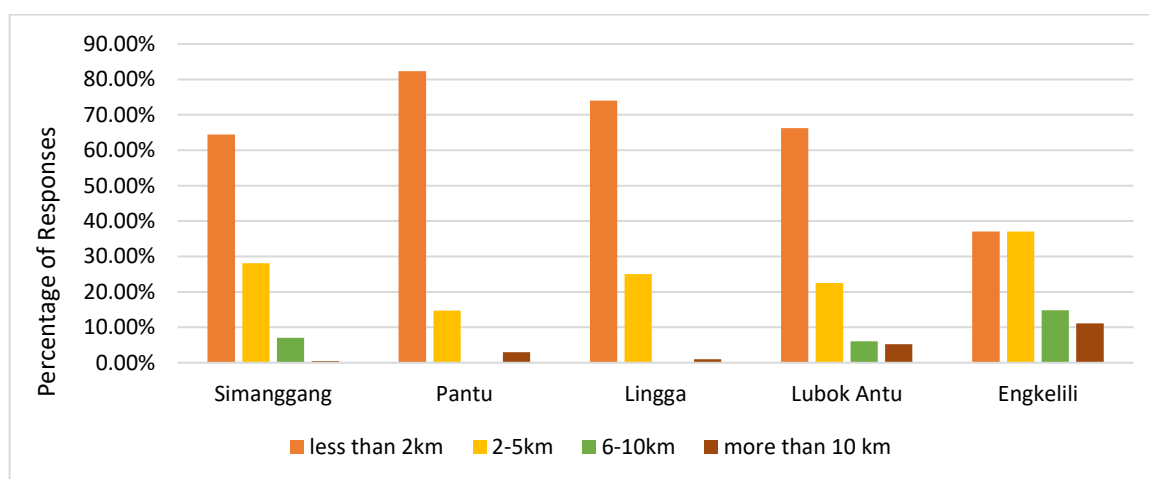


Figure 2-50: Nearest Distance to Kindergarten

Source: Sri Aman Master Plan Study-Household Survey, 2020

2.6.3.2 Primary School

Similar scenarios can be seen when looking at the access to primary schools in these five areas. As shown in Figure 2-51 below, the Sri Aman district, which covers Simanggang, Pantu and Lingga, exhibits a large percentage of respondents indicating that they are within 2 km of the nearest primary school. In fact, approximately, the percentages of distance of nearest primary school within 5 km from their homes are as follow: 89.45% in Simanggang, 91.18% in Pantu, 89.91% in Lingga, 85.14 Lubok Antu and 85.18% in Engkilili. These percentages indicate that the respondents (and their households) do not have problem when it comes to getting access to primary school.

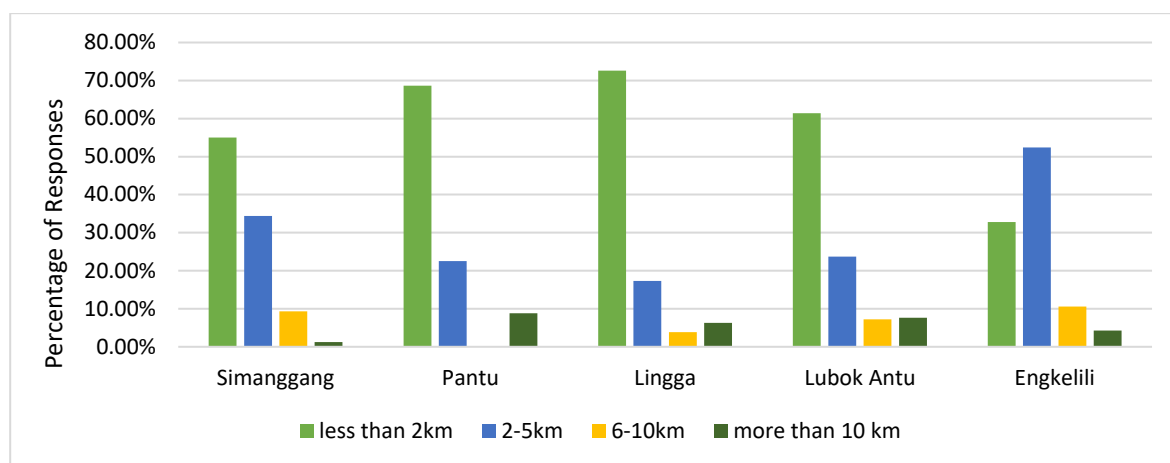


Figure 2-51: Nearest Distance to Primary School

Source: Sri Aman Master Plan Study-Household Survey, 2020

2.6.3.3 Secondary School

In terms of access to secondary school, the pattern differs from that of a kindergarten and/or primary school. In Lingga (98.56%) and Pantu (100%), for example, almost all of the respondents stated that the nearest secondary school is more than 10 km away. In Lingga, the nearest secondary school is SMK Lingga, which is approximately 7 km from the centre of Simanggang. There is no secondary school in the vicinity of Lingga Bazaar. According to the interviews with the local community, the siting of this school (SMK Lingga) had been subjected to much disagreement and dissatisfaction from the community in Lingga. Similarly, all the respondents from Pantu had indicated that the nearest secondary school is located more than 10km away. They are referring to the secondary schools in Simanggang (including SMK Melugu, and SMK Sri Aman).

Meanwhile in Lubok Antu, 25.70% of the respondents stated that the nearest secondary school is less than 2km away but a higher proportion stated that the nearest secondary school is between 6 to 10 km (i.e. 19.28%) and more than 10km away (i.e. 38.55%). In contrast, in Simanggang and Engkelili, the largest proportion of the respondents stated that the nearest secondary school is less than 2km away. These are elaborated in the following Figure 2-52.

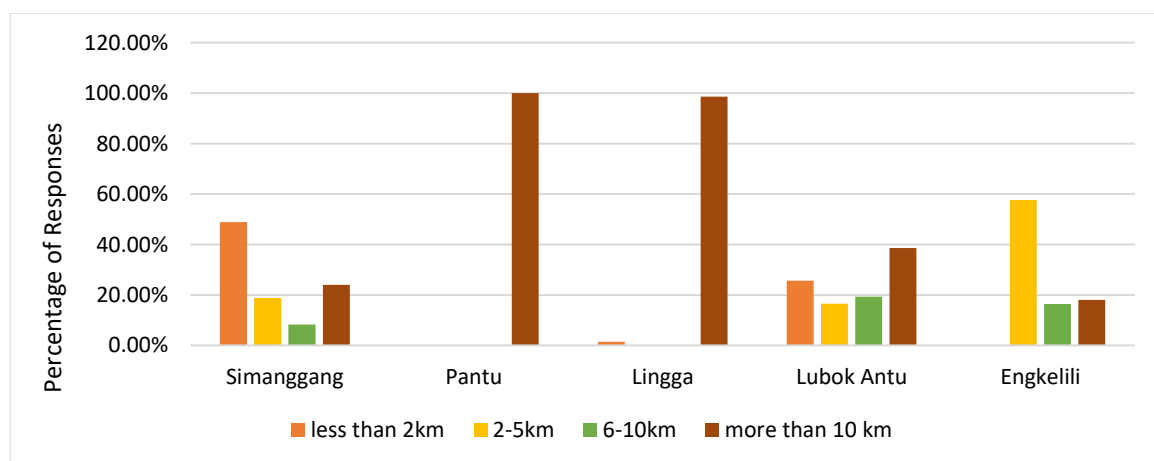


Figure 2-52: Nearest Distance to Secondary School

Source: Sri Aman Master Plan Study-Household Survey, 2020

2.6.3.4 Internet Centre

The survey also indicated that Pantu is the only district that does not have access to an internet centre. A large majority of the respondents in the other four areas had indicated that they are located within 5 km from the closest internet centres. In Simanggang, for instance, approximately 62.37% of the respondents are within 5 km of the internet centre and only 24.4% of the respondents are located more than 10 kilometers away from the nearest internet centre. In Lingga, almost half of the respondents (46.66%) had said that the internet centre is within 5 km of their places of residence. However, slightly over half (52.83%) of the respondents in Lingga said that the nearest internet centre is more than 10 km away from where they are located. Meanwhile in Engkilili, approximately 51.86% of the respondents stated that the nearest internet centre is less than 5 km away. Out of this figure, only 19.58% of the respondents are located within 2km of the internet centre and the other 32.28% are between two to five km of the centre. On the other hand, the scenario is different in Lubok Antu. More than half of the respondents (51.61%) have indicated that they are located more than 10km away from the nearest internet centre while only 35.08% are within 5km of the centre. This is summarized in Table 2-101

Table 2-101: Distance to Nearest Internet Centre:

	Responses	Less than 2km	2-5km	6-10km	More than 10km
Simanggang	202	37.62%	24.75%	13.37%	24.26%
Pantu	0	n/a	n/a	n/a	n/a
Lingga	165	36.36%	10.30%	0.61%	52.73%
Lubok Antu	248	22.58%	12.50%	13.31%	51.61%
Engkilili	189	19.58%	32.28%	30.69%	17.46%

Source: Sri Aman Master Plan Study-Household Survey, 2020

2.6.4 Health and Security Facilities

In terms of access to health facilities, it is found that, in the Sri Aman District, a large proportion of the respondents stated that they are within 5km of a government clinic (66.81%) and 5km of a hospital (61.57%). Additionally, more than half of the respondents from Simanggang (i.e. 59.36%) are located within 5km of private clinics. On the other hand, a large majority of respondents in Lubok Antu District indicated that they are more than 10km from its nearest hospital (97.99%) and private clinics (99.6%). This pattern of distribution may be explained by the spread of rural settlements in Lubok Antu District. These rural settlements, however, are served by government clinic (*Klinik Kesihatan*). In Lubok Antu, for instance, 62.25% are living within 5km of a government clinic and out of that figure, approximately 38.96% are within 2km from its nearest government clinics. Similar situations are observed in Pantu, Lingga and Engkilili.

Meanwhile, access to security facilities differ slightly. Respondents in Pantu and Lingga seem to have less access to police stations (i.e. security facilities) than their other counterparts in Engkilili, see Table 2-102. A great majority of the respondents in Pantu and Lingga, i.e. 89.80% and 67.79% respectively, stated that they are at least 10 km away from the nearest police station. Meanwhile, Simanggang, by nature of its role as the centre for the Division, has better access to the police stations. Approximately, 69% of the respondents in Simanggang stated that they are within 5km of the police station. Out of that, 33.47% with located within 2 km distance from the police station. In other words, access to police station for those further up in the interior is quite limited.

Table 2-102: Distance to Nearest Police Station

	Responses	Less than 2km	2-5km	6-10km	More than 10km
Simanggang	242	33.47%	35.54%	9.09%	21.90%
Pantu	98	8.16%	2.04%	0	89.80%
Lingga	208	28.37%	3.85%	0.00%	67.79%
Lubok Antu	249	21.29%	20.08%	20.48%	38.15%
Engkilili	189	11.11%	39.15%	24.34%	25.40%

Source: Sri Aman Master Plan Study-Household Survey, 2020

2.6.5 Marketing Facilities

The survey found that one of the key challenges being faced within the Division is its lack of marketing facilities. A majority of the village heads interviewed believed that the marketing facilities and/or market for their products are lacking. At present, most of the respondents in the area sold their products (mainly agricultural products) to their nearest market. As such, the Engkilili Bazaar, Lubok Antu Bazaar, Pantu Bazaar, Lachau Bazaar, Lingga Bazaar and Simanggang town are cited as their key markets. Other than that, respondents also sold their products at different places, namely within their own longhouses, to nearby villages or Bazaar, as well as in Simanggang (Pasar Tamu).

Discussion with respondents and the village headmen highlighted how they and the respondents felt about their failure and/or challenges they faced in marketing their products. A number of them said that they are able to work the land (e.g. rice and other labour-intensive agriculture project) but the problem lies in selling/marketing their products. They believed that markets should be created in order to enable them to work and supply the products. Almost all headmen interviewed said that facilities such as Centre for Collection and Processing and proper marketing facilities should be introduced in lagging areas (e.g., the villages in the interior, and areas that has limited access to 'proper' markets). One of the most frequently cited examples during the interviews is the impacts of the closure of rice mill (*kilang padi*) in Sri Aman on the rice farmers. They stated that the closure means they are unable to sell *padi* anymore and nowadays farmers have resorted to selling *beras* instead. The latter is being sold at markets (Tamu Sri Aman) and other places. This shift affects their income as well as their choices of livelihood activities. This is an issue in areas such as Stumbin and Tanjung Bijat.

Respondents and headmen from the other areas, such as Batu Lintang, Lubok Antu, Engkilili and Pantu, also highlighted similar challenges. In Lubok Antu and Engkilili, for instance, they lamented on the lack of markets for their aquaculture and farming products.

2.6.6 Choice of Resources and Activities for Development

Based on interviews with the headmen and community leaders, there are a number of resources in the Division that could be exploited. This includes its natural features such as waterfalls (e.g. Wong Ajung, Wong Jawi and Wong Karak in Engkilili; Wong Pupo in Undop), rivers, and forest (Gunung Lesung in Lingga, national park near Lubok Antu). Other potentials highlighted by the respondents are the Batu Nabau in Engkilili, tidal bore (*benak and Pesta Benak*), which is unique to Sungai Batang Lupar, the crocodile-related attractions (near Pulau Seduku), places of historical significance (e.g. Fort Alice).

Additionally, a number of respondents also stated that their NCR land are potential resources that can be developed. They acknowledged the complexities that might arise in plans to develop NCR land, but insisted that the NCR land must be given a proper title before the land can be further developed or used

for larger scale farming activities (e.g. rubber replanting scheme, oil palm scheme). This sentiment was expressed in various villages in Lubok Antu.

The respondents in these five areas also lamented on the lack of employment and training opportunities in the Division. They argued that many of their youths had to leave the area in search of employment opportunities outside of their district/sub-district. This was evident during the visits to a number of settlements and further reaffirmed by the various village headmen. They suggested the setting up of industries/factories in various locations, which brings development in two ways: firstly, to provide local employment opportunities and secondly, as a platform for them to sell/market their locally produced products. In general, the sentiment is that the types of industry/factory should take into account the local products (e.g. fish/aquaculture based in Lingga, rice-based in Stumbin/Bijat area, fruit and other agricultural products based in Lachau/Pantu area).

Aside from that, another preferred choice for the respondents is the setting up of educational or training centres. It was noted that, at present, Sri Aman Division does not have any training centres, particularly, for the school leavers and those who want to do upskilling and reskilling courses. On the other hand, there are views that said training centres are not needed as their area is mainly inhabited by the elder generations. In these cases, their idea of preferred development activities is subsidy or assistance for their existing farming activities.

SECTION 2.7 ECONOMIC DEVELOPMENT

Located in the South of Sarawak, the Sri Aman Division is one of the 12 administrative divisions of Sarawak, with an area of 5,446.3 square kilometre and a population of 108,225 people (Sarawak Government, 2010). The division constitutes four administrative districts namely Sri Aman formerly known as Simanggang, Lubok Antu, Lingga and Pantu and one sub-districts, Engkilili (Sri Aman Division Background).

The division is well-connected by road to Kuching, which is only 200 kilometers away allows tourists from within the state as well as tourists from outside the state, including international tourists.

The Sri Aman Division is relatively small in terms of its contribution towards Malaysia's GDP, representing 0.2% based on the latest available estimates for Sri Aman Division. It can be noted that the Division contributed 2.1% of Sarawak's GDP in 2016 and 2017.

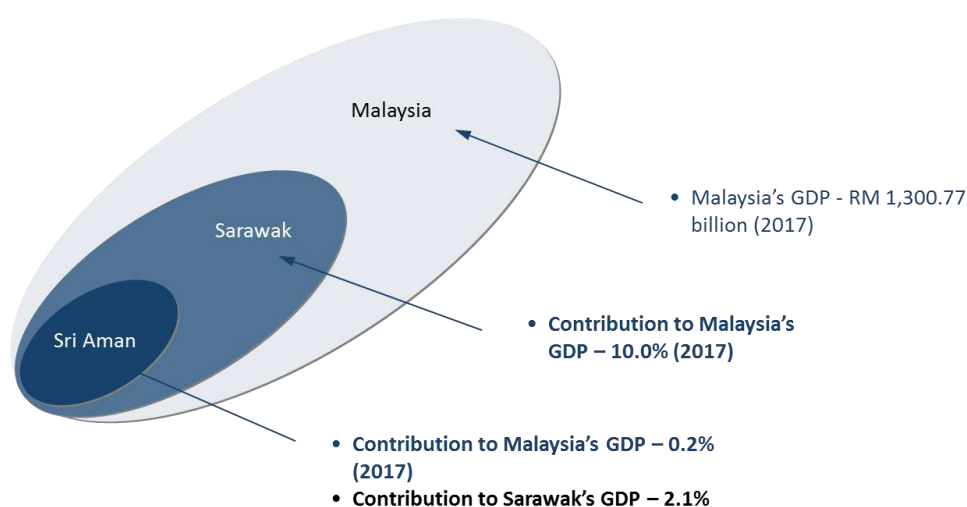


Figure 2-53: Snapshot of Economic Performance, 2017

Source: Frost & Sullivan, DOSM and Sarawak State Economic Planning Unit

2.7.1 Economic Development Perspectives

The economy within the Sri Aman Division at present is largely driven by localised consumption where the predominant economic activities are in areas of food and beverage, wholesale and retail, and agriculture. Agriculture is the largest non-services based economic sector contributing an estimated 16.7% of the GDP in 2017 of which plantations are the key focus. Other prominent economic activities include manufacturing which is primarily focused on processing of agriculture produce and construction catering to localised infrastructure development needs.

Economic activities are driven by local consumption and with an estimated year 2020 population base of around 108,225 in Sri Aman Division, the growth prospects remain limited. The collective population including neighbouring divisions of Samarahan, Betong, and Sibu is estimated to be around 655,830 in 2020 which still remains a small population base (Relative comparison: Kuching population 705,546).

Therefore, the economic development plans for Sri Aman Division shall focus on the prospects of capturing export markets not only in the perspective of accessing markets within Malaysia but also that of countries abroad.



Figure 2-54: Economic Drivers

Source: Frost & Sullivan Analysis

The Sri Aman Division's economy is composed of predominantly services-based activities that contributes approximately 66.9% of Gross Domestic Product (GDP) in 2017. Within the services sector, the largest number of establishments is in the categories of wholesale and retail trade and food and beverage activities; establishments in these productive sub-sectors caters primarily to local consumption of Sri Aman Division and has not been identified as a main focus area of economic development; the rationale is that these supporting services sector will develop as a consequence of increased employment in other productive clusters such as (1) Tourism activities, (2) Agriculture activities, and (3) Education.

Emphasis is given towards the wholesale and distribution for agriculture with an outbound orientation and that of the e-Commerce sector as a catalyst to increase market access.

The second largest category amongst the productive sectors is agriculture, contributing 16.7% of the GDP of the Sri Aman Division and has officially eight establishments in total. The statistical representation of eight establishments is likely an under-representation as the agriculture sector consists of largely sustenance-based farming activities. Agriculture has been identified as one of the potential areas of development as it has great potential to be exported out of Sri Aman Division. The research on the agriculture productive sector is available in greater detail in a separate section.

Manufacturing activities is the third largest productive sector in Sri Aman Division and at present consists predominantly of palm oil mills, rice mills, and various small cottage industries. The manufacturing sector in the context of processing of agriculture produce is identified as an area of potential development; processing of agriculture produce is a natural progression into value-added activities for the agriculture sector. While it is well developed for the palm oil sector there is much room for development for other forms of agriculture such as fruits, pepper, aquaculture produce, and rice.

Construction is the fourth largest economic contributor of the Sri Aman Division, with the exception of the Pan Borneo highway development, the construction sector is focused on domestic infrastructure development needs and has not been made as a primary focus of this study.

Mining and quarrying activities at present are primarily in the quarrying of granite stones. Coal mining exists in Sri Aman Division, however the Silantek mine has ceased operations due to safety concerns. Surface mining activities on river beds is discouraged due to concerns of disrupting the ecological balance of aquatic systems, as well as initiating riverine erosion.

Tourism is among one of the more underdeveloped productive sectors in Sri Aman Division. However, it has been identified to have good potential for growth. Some of the key attractions include Batang Ai, Gunung Lesong-Lingga Ecotourism Cluster, and Simanggang Town.

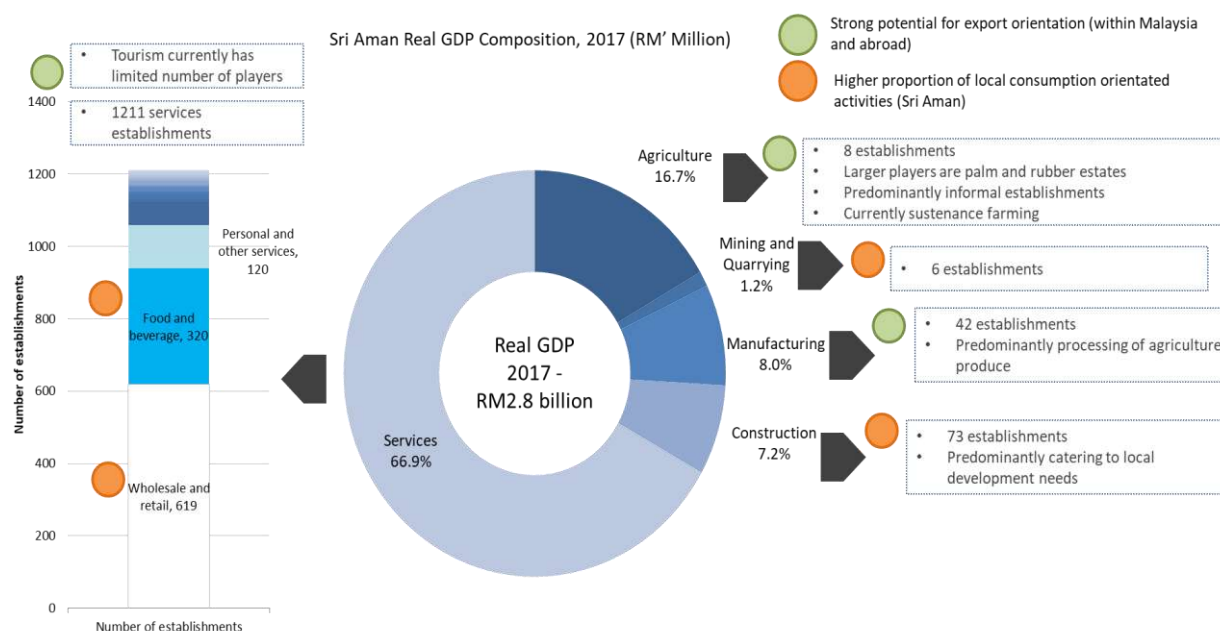


Figure 2-55: Economic Composition and Prospective Sectors

Note: Number of Establishment Statistics Based on 2015 Census Data

Source: Frost & Sullivan Analysis, State Planning Unit (Aug 2017)

2.7.1.1 Future Focus is on the Development of Economic Activities that Have Potential for Scalability

The primary focus area of the economic development model would build upon its strength in agriculture and tourism with the developmental focus in the next 10 years orientated towards enhancing the productivity, variety of offerings, and addressing fundamental infrastructure gaps critical to increasing the efficiency of logistics.

The subsequently, focus on development of three key areas of opportunities that include digital services, cross-industry activities, and increasing exports.

- Digital services - The establishment of digital services such as e-Commerce platforms will facilitate greater market access for the core productive sectors of the Sri Aman Division. Additionally, digital services may be developed as a standalone productive sector for instance in the provision of shared services/Global Business Services to clients in the regional and global markets.
- Cross industry activities – Potential has been identified in cross productive sector type of activities for instance a hybrid of an agriculture farm and tourism attraction.
- Export orientation – The development of exports to the rest of Malaysia and abroad is one of the key strategies in increasing the economic contributions of the division. The development of export requires strong production volumes and is best achieved through collaborative initiatives that consolidate production volumes not only within Sri Aman Division but also from the surrounding divisions such as Samarahan and Betong. An effective approach towards development exports would be through a collaborative initiative with business associations that has access to investors and customers throughout Sarawak and overseas.

2.7.1.2 Prospects Driven by Interconnectivity

Development of the Pan Borneo highway has largely been viewed positively by the local business community and is expected to improve interconnectivity across divisions in Sarawak and to major seaports. The travelling time between Kuching and Betong - the division neighbouring Sri Aman - is expected to be reduced to 1.6 hours from 2.6 hours (close to similar reductions of travelling time is expected for Sri Aman (Simanggang) (Sarawak Government, 2020). The improved road interconnectivity is expected to enhance the prospects of the Sri Aman Division in terms of its potential to be developed as a consolidation hub for agriculture and food processing related produce.

Surrounded by Divisions that have agriculture as among their key economic focus, namely Betong and Samarahan, the Sri Aman Division has good potential to establish agriculture value-added activities. For Sri Aman to become the focal point of agriculture processing activities, meaningful production volumes need to be achieved within the division. Figure 2-56 illustrates the key economic focus of divisions across Sarawak and the agriculture focus of divisions surrounding Sri Aman.

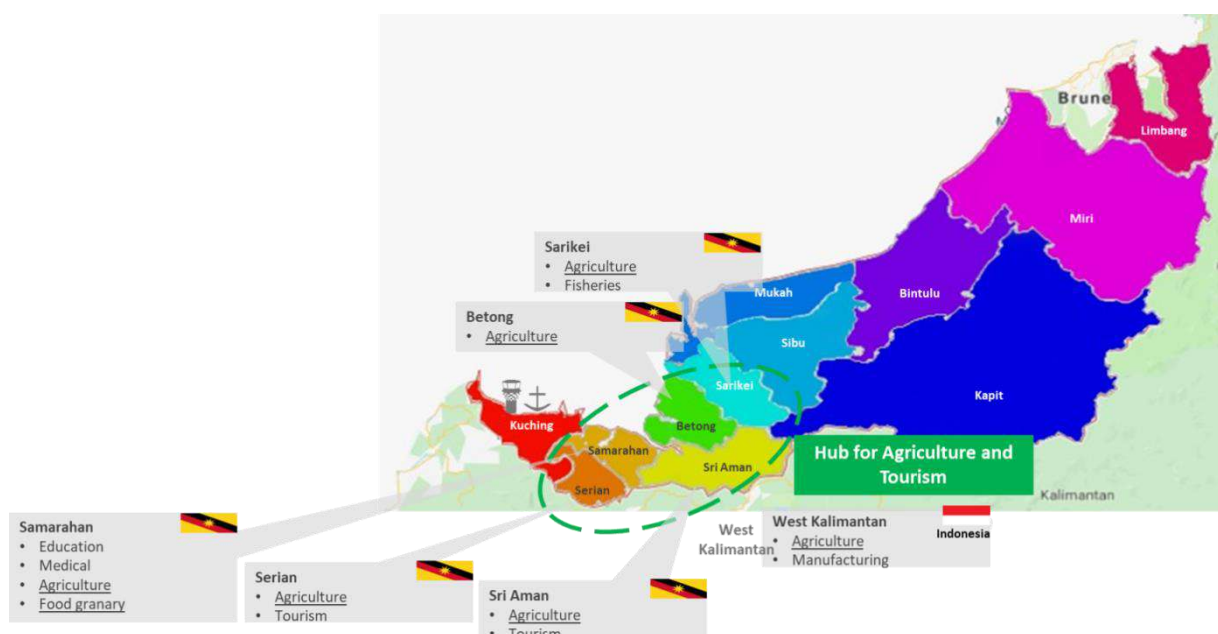


Figure 2-56: Key Economic Activities of Major Divisions in Sarawak

Source: Frost & Sullivan, Sarawak State Planning Unit Data

2.7.1.2.1 Case Study on Agro-Food Parks – Value Added Services

Innova Agri Park in Malur, Karnataka India (Value Added Farming Activities):

Overview

This section will take a look at a case study of an Agri park development in India which may serve as an example of a potential industry to support both the current and future development of the agricultural industry in Sri Aman Division. The development of the agricultural industry can be one of the main thrusts for the long-term prosperity of Sri Aman Division and making the district a market leader in producing local agricultural products in the region. This case study takes the example of Innova Agri Park in Malur, Karnataka India, an Agri park that provides shared facilities for farmers and producers that was developed to transform Indian traditional farming into a more dynamic form of entrepreneurship while supporting the overall mission of strengthening food safety and security in India.

This study covers four areas:

- Existing agricultural conditions and technological advances
- Human capital challenges
- Agriculture park initiative - creating a win-win industry and environment for farmers, processors, marketers and future consumers
- Collaborative development with institutions based at home or abroad

Existing agricultural conditions and technological advances

India is a global agricultural powerhouse. It is the world's largest producer of milk, pulses, spices, and has the world's largest cattle herd (buffaloes), as well as has the largest area for wheat, rice, and cotton. India is also the second-largest producer of rice, wheat, cotton, sugarcane, farmed fish, goat meat, fruit, vegetables, and tea (World Bank, 2010).

For decades, the level of the agricultural industry in India was focusing on the basic forms of agriculture activities. Perishable foods such as fruits and vegetables make up nearly 50 percent of the total foods required of a typical daily diet, and in the absence of reliable preservation techniques or modern processing facilities within farm areas, a large proportion of the perishable foods are spoiled before they could reach the consumer.

Inadequate agricultural facilities have been identified as a contributing factor to high food losses, especially in the post-harvest production process. The situation is largely inhibited by various reasons but much of it is linked to poor management, limited investment, and lack of competitiveness on the farmer/trader/processor part. The limited technical skills of farm workers have also further contributed to the contaminated or poor quality goods being offered to the market (Rao, 2006).

In recent times, there has been a trend of increasing income and urbanization that is changing the food demand pattern. Most industrialized countries are switching to animal protein and grain-based foods as well as developed a preference for imported foods that are rarely found in the market. This situation increases both the demand for normal consumable food and alternative foods in the international market.

Though the international and domestic demand for fresh and processed foods from countries like India exists and appears to be quite substantial, on the world-scale, the proportion of international trade coming from developing countries are only 1-2 percent, as most of this is raw materials trading and value addition taking place in the importing countries. This is because increased export trade was inhibited and linked to inadequate management on the part of the farmer/trader/processor.

Human capital challenges

Apart from the challenges of increasing yields and diversifying of products to cater to the ever-growing populations in both international and domestic markets, one of India's key challenges in agriculture has always been to conserve sufficient quantities of post-harvest raw materials to channel for food security and production. As facilities were inadequate, this has resulted in high food losses – especially during the post-harvest cycle. The use of inadequate or outdated technologies, poorly maintained plants and a labour force with limited technical skills have all resulted in contaminated or substandard goods being offered to the market. Rejection ensued, coupled with high levels of wastage and loss of confidence in local suppliers.

The post-harvest practices determine the efficiency of how foods/ materials are collected, handled, and transported to a store or factory. Distribution and logistics mechanisms play a role to reduce the level of losses that occur to much of the produce. Poor infrastructure, limited roads, non-specialized transport, limited care when handling, inadequate packaging, and other fresh produce all deteriorate the produce further due to factors such as the distance, time, and handling involved.

The post-harvest problems can be resolved by having a facility to process the raw materials to help maintain or reverse deterioration and provide for better market opportunities and encourage increased food production in local communities. Some of the advantages of raw materials processing include better quality materials are prepared for the market, lower/ bad quality materials are filtered out, wastages remain at the point of production and handling, storing and transporting to be more efficient and cost-effective.

The establishment of viable agro-processing enterprises in rural areas is important to increase the level of volume and quality of raw materials, but more than that it also creates employment and income opportunities as well as increases the demand and capacity for farm produce. Agro-enterprise employment can start to offer off-farm activities such as handling, packaging, processing, transporting, and small enterprises of food and agricultural produce.

And with a proper plan implemented, it serves as a catalyst for creating economic growth as a result of commercial agrifood systems which are efficiently run and responsive to evolving market demands.

Agriculture park initiative: Creating a win-win industry and environment for farmers, processors, marketers and future consumers

The high cost of modern technologies, equipment, and infrastructure makes it difficult for most small-scale manufacturers in small countries to keep pace with the changing needs. Hence this is where the idea of shared facilities is meant to overcome the challenges and to provide both local farmers and producers a sustainable way that will enable the small-scale farms to compete. An 'agro-industrial park' is a platform for small farms to focus on the processing of the requirement of good quality 'agricultural products'.

The Innova Agri Bio Park Limited located in Malur, India is a perfect example of shared facilities. It is a Public-Private Partnership enterprise established in 2005 with support of the Ministry of Food Processing Industries (MoFPI), Government of India, and Food Karnataka Limited (FKL) and is a Special Purpose Vehicle under the Government of Karnataka with the mission to address the post-harvest management requirements of horticultural produce (Innova Food Park, 2020).

The objectives of the park are to strengthen India's food security and safety while creating a win-win environment for farmers, processors, marketers, and consumers. The park also aims to meet the growing needs of consumers for safe and hygienic foods, while adding value to farmers' produce along with reducing waste and inefficiency along the supply chain. In the long run, Innova Agri Bio Park Limited aspired to be a working model for the entire country.

Innova Agri Bio Park ensures that local produce such as fruits and vegetables, spices, coffee, tea, cocoa, rubber, and cotton are now processed on the farm to boost quality and to prepare them for processing in the factory.

Innova Agri Bio Park facilities:

1. **Fruit and Vegetable Facility:** The park housed India's only integrated Gamma Irradiation facility that is adjacent to the packhouse for exports to USA & Australia. The Pack House can process 1,000 MT of incoming raw material & packed produce. Activities include:
 - a. Specialising in handling mangoes and pomegranates exports to worldwide
 - b. Sorting, grading, sizing, washing, weighing, ripening, precooling and packing process.
 - c. Hot water treatment for Mangoes to USA, Australia and EU countries (Dip & Conveyor System)
 - d. Fully automatic ripening chamber process for Mangoes, Bananas and other fruits, using ethylene
 - e. Quarantine labs at packhouse and Gamma irradiation facility for inspection and certification of fruits and vegetables & other Agriculture commodities
2. **Gamma Irradiation Agro Processing Facility (GRAPF):** The Park owns and operates India's first and only private low-dose Gamma Irradiation Facility that was set up under technical collaboration with Board of Radiation & Isotope Technology (BRIT), Department of Atomic Energy (DAE), Government of India. Activities here include:
 - a. Decontaminate food
 - b. Inhibit of sprouting in onions, potatoes, ginger & garlic
 - c. Delay ripening in fruits
 - d. Quarantine treatment for import/export food
 - e. Insect disinfestations in cereals, fruits & vegetables
 - f. Elimination of microbial contamination in spices & herbs
 - g. Extension of shelf life and prevent foodborne infection by destroying spoilage due to microbes, pathogens & parasites and sterilization of medical & allied products.
3. **Cold Storage Facility:** There are a total six chambers in the park with a total capacity of 3,000 Megatonne that allows different temperature and humidity levels required for storing various raw materials or finished products.
 - a. Three cold rooms of dimensions: 13.3m (L) x 10.5m (B) x 9.0m (H)
 - b. Three cold rooms of dimensions: 16.8m (L) x 10.6m (B) x 9.0m (H)

The rooms are supported by two compressors which are designed to maintain the Cold Room temperature between 2 to 8 degrees Celsius and a diesel generator to ensure 24 hours power back-up to maintain temperature and humidity in the cold rooms, as well as power supply to other facilities of Innova Agri Bio Park.

4. **Cereal & Pulse: Cleaning and Packing Facility:** The facility is equipped with state-of-the-art machinery for cleaning, de-stoning, sorting and grading of all pulses and cereals. Machinery includes:
 - a. Pre-cleaner and grader
 - b. Gravity separator
 - c. De-stoner
 - d. Bosch Terra 25 Automatic Packing machine (capable of packing cereals, pulses, seeds, powdered spices, etc in 1000 gm and 500 gm packs at the rate of 30 to 40 packs per minute.)
5. **Food Safety:** Innova Agri Bio Park has the expertise to process all fruits and vegetables at the facility for safer consumption & avoid food contamination such as
 - a. Physical contamination (hair, glass or metal, pests, dirt)
 - b. Chemical contamination (pesticides, herbicides, veterinary drugs, contamination from water, air or soil pollution, cross-contamination during food processing, presence of natural toxins)
 - c. Biological contamination (Pseudomonas, E. Coli, Staphylococcus, Bacillus, Aspergillus, Candida, and Mycelia)

Collaborative development with institutions based at home or abroad

Innova Agri Bio Park is located right at the heart of the vegetable belt and the idea of having the park was specifically conceived to address the post-harvest management requirements of horticultural produce. The Park, at Malur, Karnataka, is also logistically attractive due to its proximity to Bangalore that provides access to domestic and export markets (Kumar, 2020).

The government played an important role in providing facilities such as an agri park such as The Innova Agri Bio Park whose main mission is to maximize food potential and farmers' benefits. Combining the processing services with the licenses allows for a fertile ground for farmers to amplify their export capabilities (Innova Food Park, 2020).

Among the license that held by The Innova Agri Bio Park are:

1. U.S Food and Drug Administration (USFDA)
2. Food Safety and Standard Authority of India (FSSAI)
3. Atomic Agency Regulatory Authority (AERB)
4. Department of Atomic Energy (DAE)
5. ISO 9001
6. ISO 14001
7. ISO 22000
8. Certificate of approval of Pack House for export of vegetables and Fruits to European Countries.

Key Takeaways:

1. An Agro Park is suitable for an area with access to viable rural farms, where a range of agro horticultural and enterprises may exist.
2. Value-added industry: is a step after traditional farming where it involves more efficient use of resources. Processing raises the standards of quality of food, contributes to food security and safety.
3. Shared facilities are meant to overcome the challenges of traditional farming, where it provides local farmers and producers, the catalyst that enables the small-scale farms to compete. A shared facility in an 'agro-industrial park' focuses on processing the requirement of good quality 'agricultural products'.
4. Market Expansion and Exports Potential To remain competitive, agro-industries must understand the consumer needs and wants, employ skilled workforce and technologies to gain efficiencies, deliver quality goods in the quantities as per market demand, and consistently and work with reliable and mutually supportive partners throughout up and downstream of the supply chain.
5. Agropark Employment provides employment and training to locals in shared facilities activities
6. Government plays an important role behind the idea of Agri Park as the park's requirements may include (but are not limited):
 - The provision of land,
 - Subsidies for the provision of the infrastructure needed (e.g. roads, buildings, power-lines, etc.)
 - Exemptions for park management and / or park tenants from selected taxation - at least during a period of start-up.
 - Government is also obliged to consider the wider implications of international business arrangements at this time.
 - The domestic farmer/ producer should not face undue financial difficulties when seeking access to equipment or supplies, or additional hikes in purchasing price as the result of duties and levies when buying from foreign suppliers.
 - Support from planner, administrator (public, private or ngo), engineers (in structures, water, power, etc.) and, importantly, the entrepreneur and those within the local finance industries that support them.
7. Agroparks can be a pioneer to advanced and innovative food or agri industry by combining academia, research, etc.
8. Services such as management, information, transport, storage, and packaging can be shared across a range of different crop and livestock products. There may be opportunities for recycling wastes and/or using rejected products from the one processing stream as the raw material for the next.
9. Agro-industrial parks provide networks of contacts between producers, markets, and processors

2.7.2 Cross Border Trade Opportunities

Kalimantan, which is made up of Indonesian provinces, shares a significant land border with Sarawak and has a considerably larger population and geographical area. The population of Kalimantan is estimated to be 16.4 million in 2020 while the population of Sarawak was estimated to be 2.81 million in 2019. Kalimantan covers 544,150 square kilometres of land area (approximately 28% of Indonesia's total land area) close to five times larger than Sarawak which spans 124,450 square kilometres.

From an economic development perspective, these facts indicate good potential in cross-border trade opportunities for the state of Sarawak both as access to raw materials and supply to the vast population base of Kalimantan. Depending on the maturity of economic activities and comparative advantage of both locations, integration of value chains across the border may be established leading to greater cross-border trade activities. This is examined in further detail in the following sub-sections.

In addition to the vast population and resource base of Kalimantan, the planned movement of Indonesia's capital to Kalimantan is viewed as one of the key impetus to increased economic activities. The construction of the new capital where the first phase was expected to complete by 2024 and the full completion of the project in 2045 has been delayed until further notice at the time of writing of this report due to the COVID-19 pandemic. The movement of the capital of Indonesia to Kalimantan is expected to increase the population base by another six to seven million inhabitants. The increase in population base is expected to have spillover effects to the rest of Kalimantan in the provision of resources that support the physical development of the capital and that of the consumption of its inhabitants.

2.7.2.1 *Sri Aman Division positioning relative the overall development of Kalimantan*

Sarawak shares four main border crossings with Kalimantan Indonesia where Lubok Antu is the border crossing located within the Sri Aman Division and is one of the nearest access points to the internal regions of Kalimantan. The strategic geographical location enables the Sri Aman Division to tap the potential cross-border trade opportunities particularly with the internal regions of Kalimantan. Before the temporary closure of the Lubok Antu border crossing in 2020 due to the COVID-19 pandemic, imports of crude palm oil into Malaysia amounted to RM400.6 million in 2019. The palm oil imports are primarily for further processing in Malaysia.

The Sri Aman Division and the neighbouring geographical areas of the Kapuas Hulu Regency due to the landlocked nature of the location, are better suited for economic activities that are natural resource-based including the processing of local natural resources-based goods. Processing activities that interact with the global value chains are better suited for geographical areas typically coastal with seaport and airport access such as Kuching, Tanjung Manis, and Pontianak. The likely trade interactions are exports of natural resource-based goods from the internal landlocked regions and imports of consumption goods for local populations, capital goods, and production inputs for the internal landlocked regions.

Opportunities exist to harness the cross-border economic synergies with Kapuas Hulu regency in areas of agriculture logistics, food processing, and establishing the collective area as an eco-tourism region.

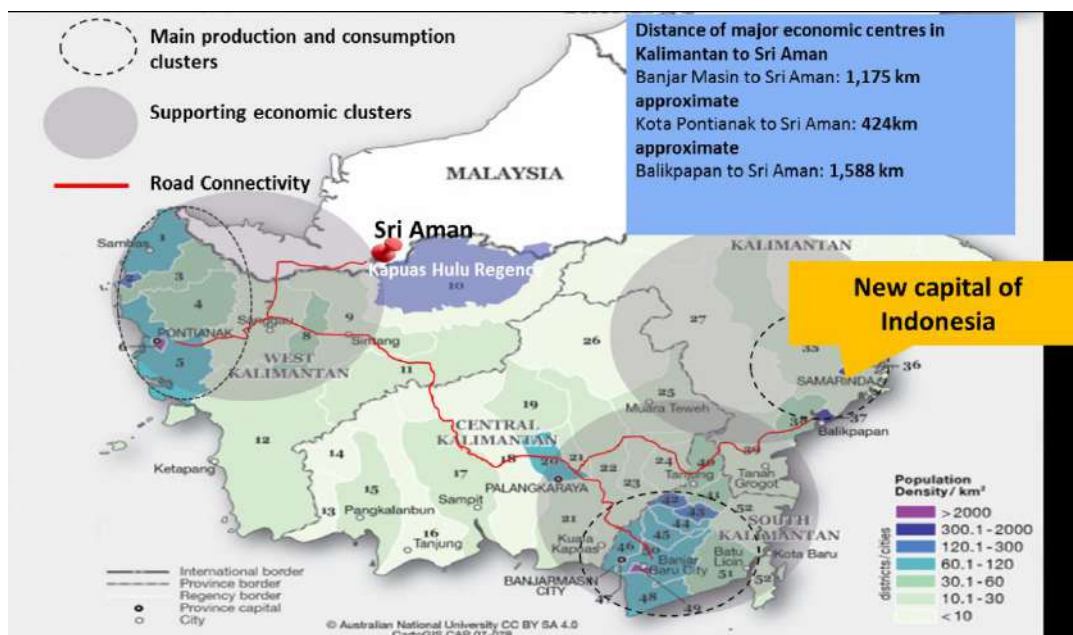


Figure 2-57: Potential economic activities of Sri Aman Division and Kapuas Hulu Regency

Source: Frost & Sullivan

Note: Base map sourced from Australian National University maps database -> <http://asiapacific.anu.edu.au/maponline/base-maps/kalimantan-districts>



Figure 2-58: Logistical Advantage of Sri Aman/Sarawak for Port Access of the Kapuas Hulu Region

Source: Frost & Sullivan

Note: Base map sourced from UNIMAS

The Kapuas Hulu region can access the port in Kuching through its connection to Sri Aman. This will position Sri Aman as a strategic location that connects Kapuas Hulu through shorter roads to Kuching port compared to the distance between Kapuas Hulu and Pontianak. The distance from Kapuas Hulu to Sri Aman is estimated to be 264 kilometers which is equal to 4 hours and 37 minutes of driving and from Sri Aman to Kuching port is 191 kilometers, which is equal to 3 hours 16 minutes of driving. The total distance and driving time from Kapuas Hulu to Kuching post is 455 kilometers and 7 hours and 53 minutes respectively. On the other hand, the distance from Kapuas Hulu to Pontianak port is 585 kilometers which is equal to 12 hours of driving. This will reduce travelling time by more than 4 hours

of driving for transiting products from Kapuas Hulu to Kuching port compared to the distance from Kapuas Hulu to the port located in Pontianak. This discussion is illustrated in Figure 2-58.

2.7.2.2 Cross Border Lachau Sintang Regency

At present, the cross-border movement that occurs at Lachau area is predominantly in the vicinity of Gua, Lachau and Rapak. These areas have been used as entry points by the Indonesians who live in settlements near the Sarawak-Kalimantan border to gain access to Lachau area for decades. The cross border movement by the locals to the Indonesian side is mostly for social visits, due to the kinship ties that exist between the people in the area. This does not bring about any trade potential. However, the cross-border movements by the Indonesians to Sarawak are mostly for the purpose of buying supplies and selling their agricultural products at Lachau Bazaar, and /or its surrounding areas. Such activities occur because it is nearer for them to cross to Lachau area, compared to going to Sintang, the nearest Indonesian town. However, their trading activities at Lachau are very small scale and very much household-oriented. For instance, a family comes across the border to sell their products such as seasonal fruits, rubber or pepper and, in return, they buy groceries and supplies to bring back.

Other than that, the cross border movement from the Indonesian side into Lachau area is for employment purposes. This has been ongoing for decades but, according to the locals in the area, this trend has declined very rapidly in recent years due to stringent measures being put in place.

Although the location of Lachau-Sintang Regency is nearer than that of the Hulu Kapuas Regency, the potential for trading at present is minimal and one-sided. Thus, the establishment of an ICQ at Lachau is not considered as a priority at the moment. The security aspect arising from the present cross-border movement, however, should be taken seriously and for that reason, the security measures should be enhanced and prioritized. This can be done by providing a better on-site facility to monitor the cross-border movement in the area.

In the future, with the planned expansion of the role of Lachau-Pantu as outlined in SAMP 2020-2030, this point may need to be revisited, to take into account expected higher volume of movement of both people and goods across the border.

2.7.3 Market Demand Analysis

The market demand analysis aims to identify products that represent the top volume of imports by neighbouring countries, major trading partners in the Asia-Pacific region, and that of Malaysia.

- Neighbouring country imports identifies industries with large potential for Malaysian exports closest to home
- Key trade partner imports identify industries with large potential for Malaysian exports
- Malaysia imports - analysis of current exports identifies the product focus and largely represents the domestic demand and current ecosystem

For this analysis, we have identified Malaysia's neighbouring country as those of ASEAN countries i.e. Singapore, Thailand, Indonesia, Philippines, Vietnam, Cambodia, Myanmar, and Laos, as well as key trade partners in the Asia-Pacific region to be China, Japan, South Korea, Hong Kong, and Taiwan.

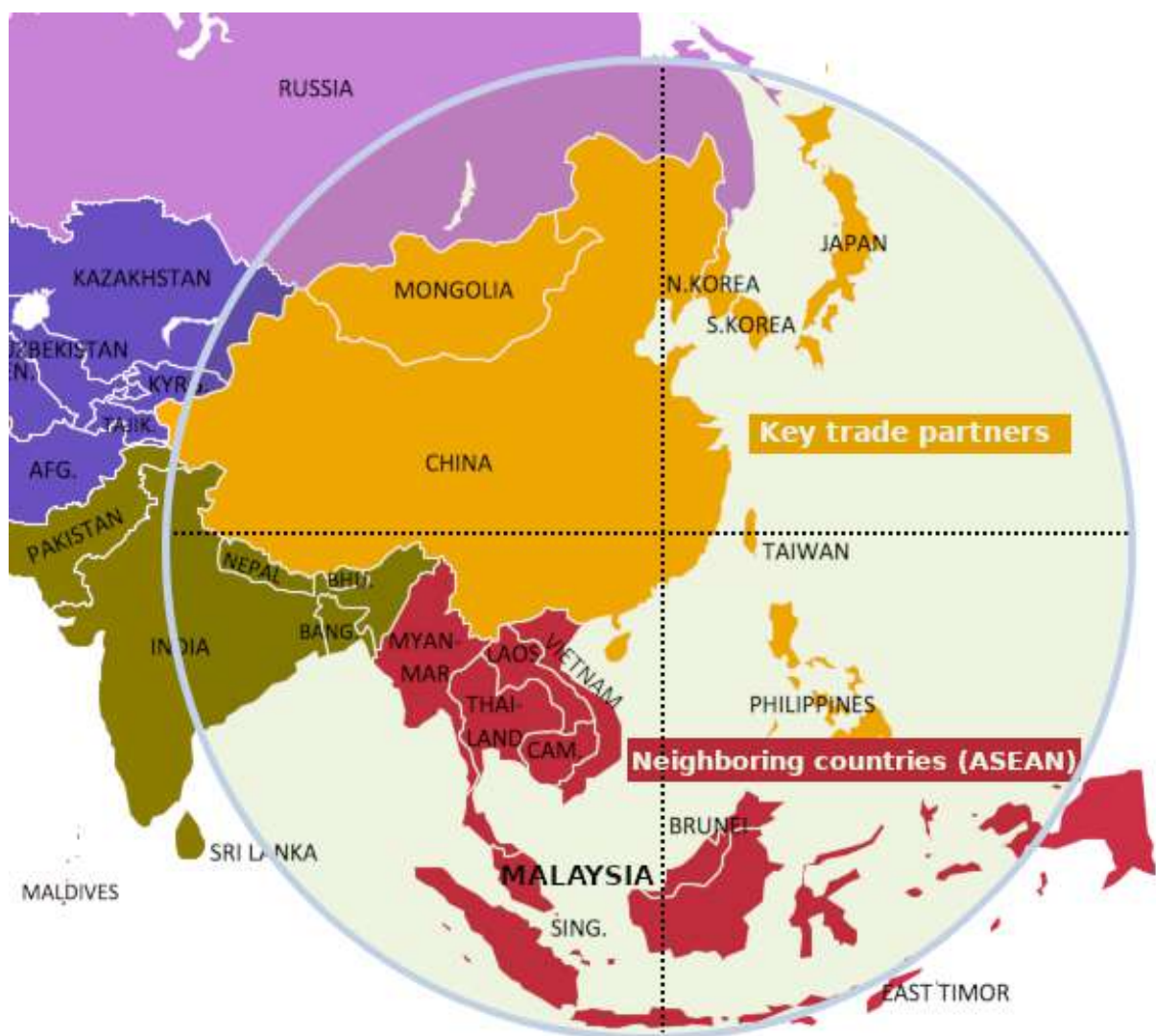


Figure 2-59: Neighboring Countries and Key Trade Partner, Malaysia

Source: ITC Trademap (2020) and Frost & Sullivan, 2020

2.7.3.1 Product categories imported by Malaysia's neighbouring countries (ASEAN) from Malaysia

As Sri Aman's key economic activity and core capabilities are agriculture and livestock, the following are the top 10 product categories related to agriculture and livestock which are imported by ASEAN countries for Sri Aman's consideration:

Table 2-103: ASEAN Imports by Product Categories from Malaysia (2017-2019)

Country	Import by Product Category from Malaysia
Singapore	- Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . (Trade Map, 2020) - Miscellaneous edible preparations - Edible vegetables and certain roots and tubers - Live animals³ - Fish and crustaceans, molluscs and other aquatic invertebrates - Cocoa and cocoa preparations - Edible fruit and nuts; peel of citrus fruit or melons - Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates - Preparations of vegetables, fruit, nuts or other parts of plants - Coffee, tea, maté and spices - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . .

Country	Import by Product Category from Malaysia
Thailand	• Rubber and articles thereof • Miscellaneous edible preparations • Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Fish and crustaceans, molluscs and other aquatic invertebrates • Cocoa and cocoa preparations • Coffee, tea, maté and spices • Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage • Preparations of vegetables, fruit, nuts or other parts of plant • Residues and waste from the food industries; prepared animal fodder⁶ • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Edible fruit and nuts; peel of citrus fruit or melons
Indonesia	• Miscellaneous edible preparations • Cocoa and cocoa preparations • Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Fish and crustaceans, molluscs and other aquatic invertebrates • Preparations of vegetables, fruit, nuts or other parts of plants • Coffee, tea, maté and spices • Residues and waste from the food industries; prepared animal fodder • Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . . • Edible fruit and nuts; peel of citrus fruit or melons
Philippines	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Miscellaneous edible preparations • Cocoa and cocoa preparations • Coffee, tea, maté and spices • Residues and waste from the food industries; prepared animal fodder • Fish and crustaceans, molluscs and other aquatic invertebrates • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Preparations of vegetables, fruit, nuts or other parts of plants • Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . . • Edible fruit and nuts; peel of citrus fruit or melons
Vietnam	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Rubber and articles thereof • Miscellaneous edible preparations • Residues and waste from the food industries; prepared animal fodder • Cocoa and cocoa preparations • Fish and crustaceans, molluscs and other aquatic invertebrates • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Preparations of vegetables, fruit, nuts or other parts of plants • Coffee, tea, maté and spices • Edible fruit and nuts; peel of citrus fruit or melons
Myanmar	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Miscellaneous edible preparations • Residues and waste from the food industries; prepared animal fodder • Cocoa and cocoa preparations • Preparations of vegetables, fruit, nuts or other parts of plants • Coffee, tea, maté and spices • Live animals • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . . • Fish and crustaceans, molluscs and other aquatic invertebrates
Cambodia	• Rubber and articles thereof • Miscellaneous edible preparations • Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates

Country	Import by Product Category from Malaysia
	• Meat and edible meat offal • Preparations of vegetables, fruit, nuts or other parts of plants • Coffee, tea, maté and spices • Residues and waste from the food industries; prepared animal fodder • Cocoa and cocoa preparations • Edible fruit and nuts; peel of citrus fruit or melons

Note:

1 Palm oil and its fractions, whether or not refined (excluding chemically modified); Margarine, other edible mixtures or preparations of animal or vegetable fats or oils and edible . . . ; Coconut "copra", palm kernel or babassu oil and fractions thereof, whether or not refined, . . .

2 Food preparations, Extracts, essences and concentrates, of coffee, tea or maté and preparations with a basis of . . . , Sauce and preparations therefore; mixed condiments and mixed seasonings; mustard flour and meal, . . .

3 Live poultry, fowls of the species *Gallus domesticus*, ducks, geese, turkeys and guinea fowls; Live horses, asses, mules and hinnies

4 Locust beans, seaweeds and other algae, sugar beet and sugar cane, fresh, chilled, frozen or . . .

5 Live plants incl. their roots, cuttings and slips; mushroom spawn (excluding bulbs, tubers, . . .)

6 Flours, meals and pellets, of meat or meat offal, of fish or of crustaceans, molluscs or other . . . ; Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting . . .

From the table above, it can be concluded that product categories which are common across Malaysia's neighboring countries i.e. ASEAN countries include (Frost & Sullivan, 2020):

- 1) Animal or vegetable fats and oils and their cleavage products, prepared edible fats, animal
- 2) Miscellaneous edible preparations
- 3) Fish and crustaceans, molluscs and other aquatic invertebrates
- 4) Cocoa and cocoa preparations
- 5) Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
- 6) Coffee, tea, maté and spices

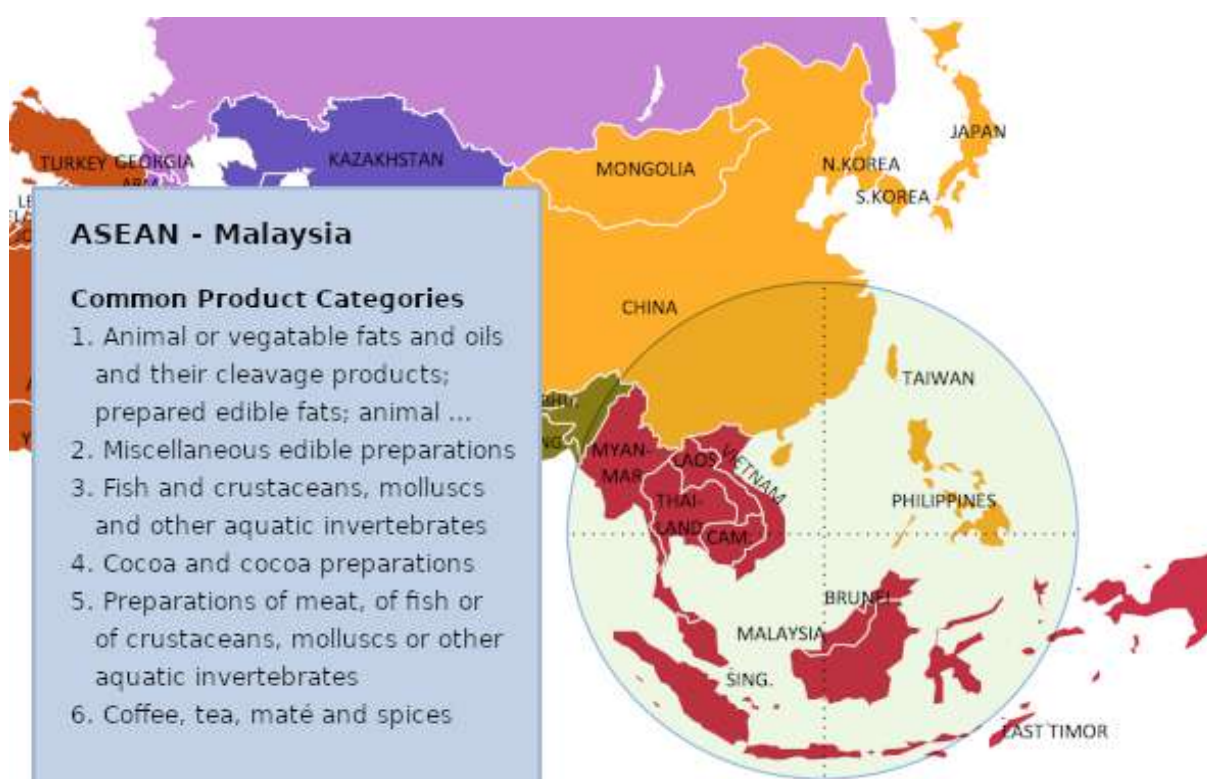


Figure 2-60: Common imported agriculture product categories from Malaysia by ASEAN countries (2017-2019)

Source: ITC Trademap (2020) and Frost & Sullivan, 2020

Singapore, Philippines and Vietnam are the top 3 importers of the common product categories as stated above, with import value of USD 0.82 billion, USD 0.58 billion and USD 0.48 billion respectively. Animal or vegetable fats and oils and their cleavage products, prepared edible fats, animal category is the top product to be imported by ASEAN countries, followed by miscellaneous edible preparations, and cocoa and cocoa preparations category (Frost & Sullivan, 2020). Figure 2-61 outlines the import values of the common products by ASEAN countries in 2019 (Frost & Sullivan, 2020).

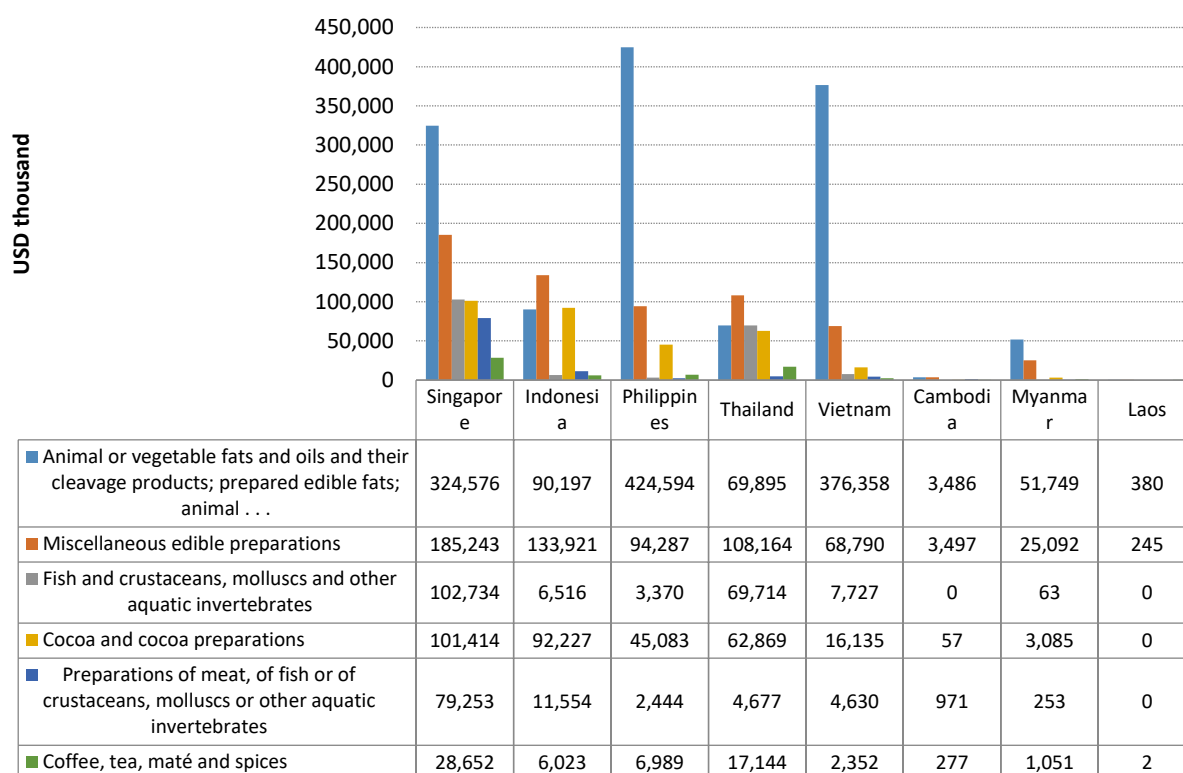


Figure 2-61: Value of ASEAN Imports by Product Categories from Malaysia (2019)

Source: ITC Trademap, 2020

2.7.3.2 Product categories imported within ASEAN countries

The following are the top 10 product categories related to agriculture and livestock imported within ASEAN itself for Sri Aman's consideration (Trade Map, 2020):

Table 2-104: ASEAN Imports by Product Categories from ASEAN (2017-2019)

Country	Import by Product Category from ASEAN
ASEAN	- Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal - Miscellaneous edible preparations - Fish and crustaceans, molluscs and other aquatic invertebrates - Edible fruit and nuts; peel of citrus fruit or melons - Residues and waste from the food industries; prepared animal fodder - Edible vegetables and certain roots and tubers - Cocoa and cocoa preparations - Coffee, tea, maté and spices - Live animals - Raw hides and skins (other than furskins) and leather

Source: ITC Trademap, 2020 and Frost & Sullivan, 2020

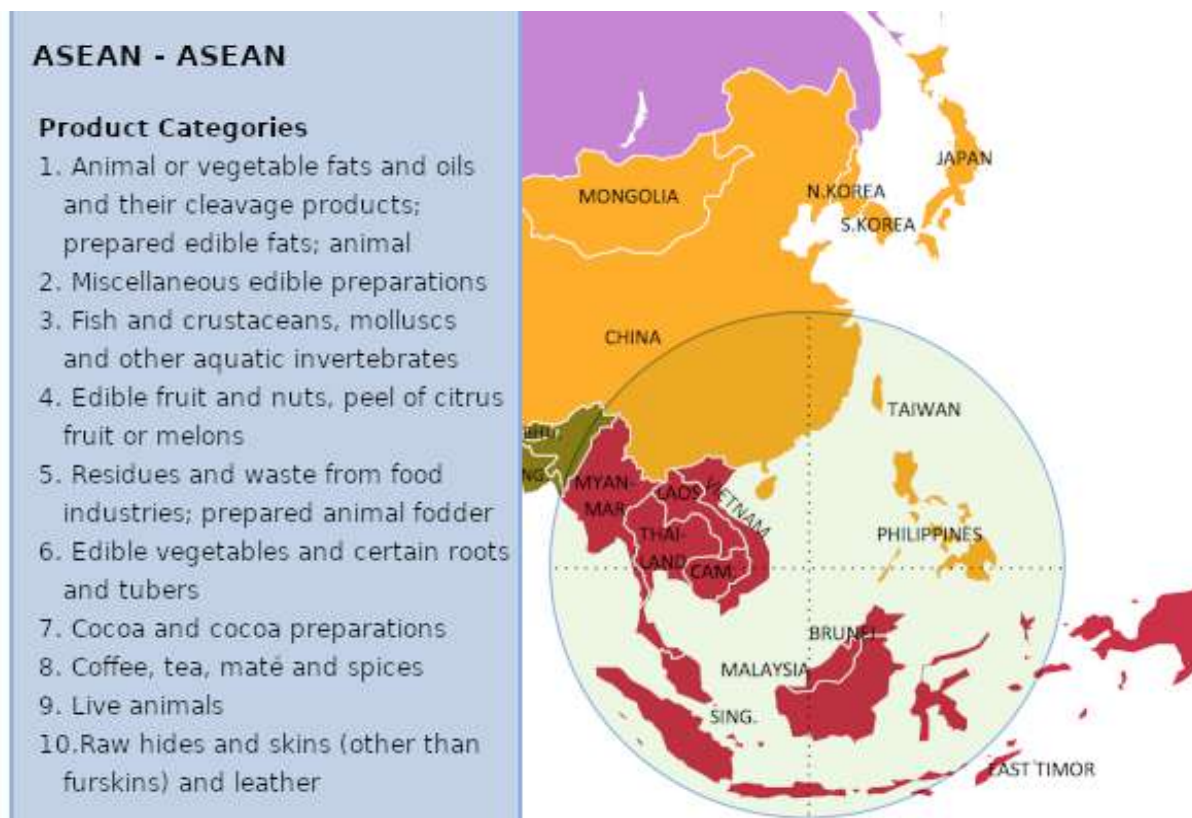


Figure 2-62: Top import of agriculture product categories within ASEAN countries (2017-2019)

Source: ITC Trademap, 2020 and Frost & Sullivan, 2020

Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal category has the highest import value in 2019 (USD 3.75 billion), followed by miscellaneous edible preparations category (USD 3.47 billion), and fish and crustaceans, molluscs and other aquatic invertebrates category (USD 1.76 billion).

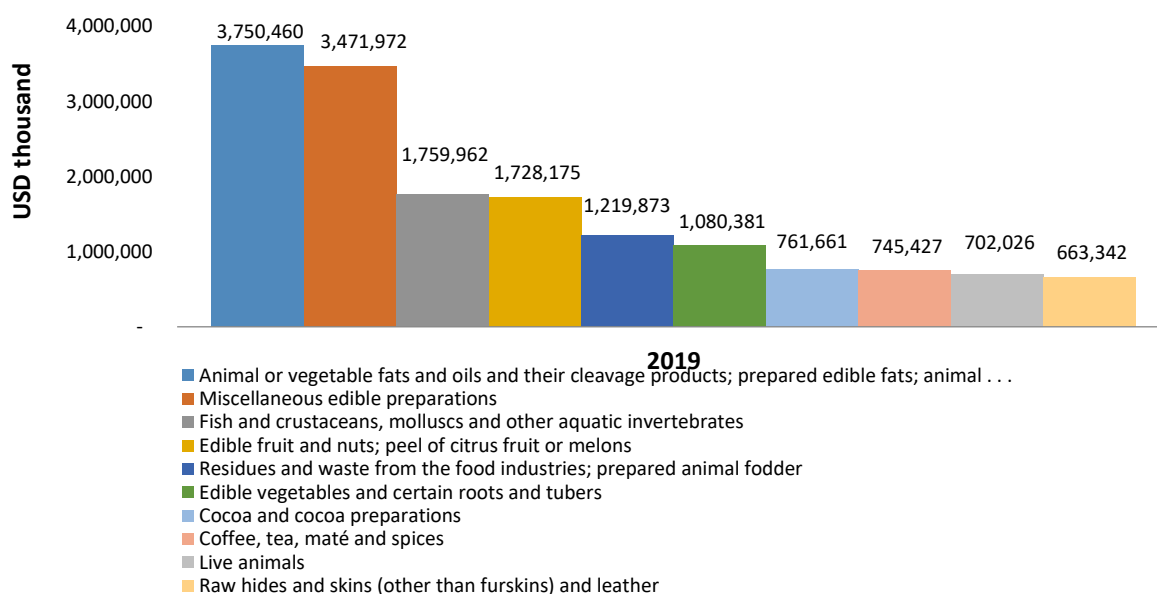


Figure 2-63: Value of Imports by Product Categories within ASEAN countries (2019)

Source: ITC Trademap, 2020

2.7.3.3 Product categories imported by Malaysia's key trade partners from Malaysia

The following are the top 10 product categories related to agriculture and livestock which are imported by key trade partners for Sri Aman's consideration (Trademap, 2020):

Table 2-105: Malaysia's Key Trade Partners Imports by Product Categories from Malaysia (2017-2019)

Country	Import by Product Category from Malaysia
China	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Rubber and articles thereof • Fish and crustaceans, molluscs and other aquatic invertebrates • Miscellaneous edible preparations • Cocoa and cocoa preparations • Edible fruit and nuts; peel of citrus fruit or melons • Coffee, tea, maté and spices • Vegetable plaiting materials; vegetable products not elsewhere specified or included • Preparations of vegetables, fruit, nuts or other parts of plants • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
Japan	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Cocoa and cocoa preparations • Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage • Residues and waste from the food industries; prepared animal fodder • Fish and crustaceans, molluscs and other aquatic invertebrates • Vegetable plaiting materials; vegetable products not elsewhere specified or included • Coffee, tea, maté and spices • Preparations of vegetables, fruit, nuts or other parts of plants • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . .
South Korea	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Residues and waste from the food industries; prepared animal fodder • Fish and crustaceans, molluscs and other aquatic invertebrates • Cocoa and cocoa preparations • Miscellaneous edible preparations • Coffee, tea, maté and spices • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates • Preparations of vegetables, fruit, nuts or other parts of plants • Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . . • Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
Hong Kong	• Miscellaneous edible preparations • Fish and crustaceans, molluscs and other aquatic invertebrates • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrate • Edible fruit and nuts; peel of citrus fruit or melons • Products of animal origin, not elsewhere specified or included¹ • Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Preparations of vegetables, fruit, nuts or other parts of plants • Cocoa and cocoa preparations • Coffee, tea, maté and spices • Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . .
Taiwan	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Fish and crustaceans, molluscs and other aquatic invertebrates • Coffee, tea, maté and spices

Country	Import by Product Category from Malaysia
	• Residues and waste from the food industries; prepared animal fodder • Cocoa and cocoa preparations • Products of animal origin, not elsewhere specified or included • Edible fruit and nuts; peel of citrus fruit or melons • Vegetable plaiting materials; vegetable products not elsewhere specified or included • Preparations of vegetables, fruit, nuts or other parts of plants • Edible vegetables and certain roots and tubers

Source: ITC Trademap (2020)

Note:

¹ Guts, bladders and stomachs of animals (other than fish), whole and pieces thereof, fresh, . . . ; Coral and similar materials, shells of molluscs, crustaceans or echinoderms, cuttle-bone, powder . . .

From the table above, it can be concluded that product categories which are common across Malaysia's key trade partners i.e. China, Japan, South Korea, Hong Kong, and Taiwan include: ²

- 1) Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal ...
- 2) Fish and crustaceans, molluscs and other aquatic invertebrates
- 3) Cocoa and cocoa preparations
- 4) Coffee, tea, maté and spices
- 5) Preparations of vegetables, fruit, nuts or other parts of plants

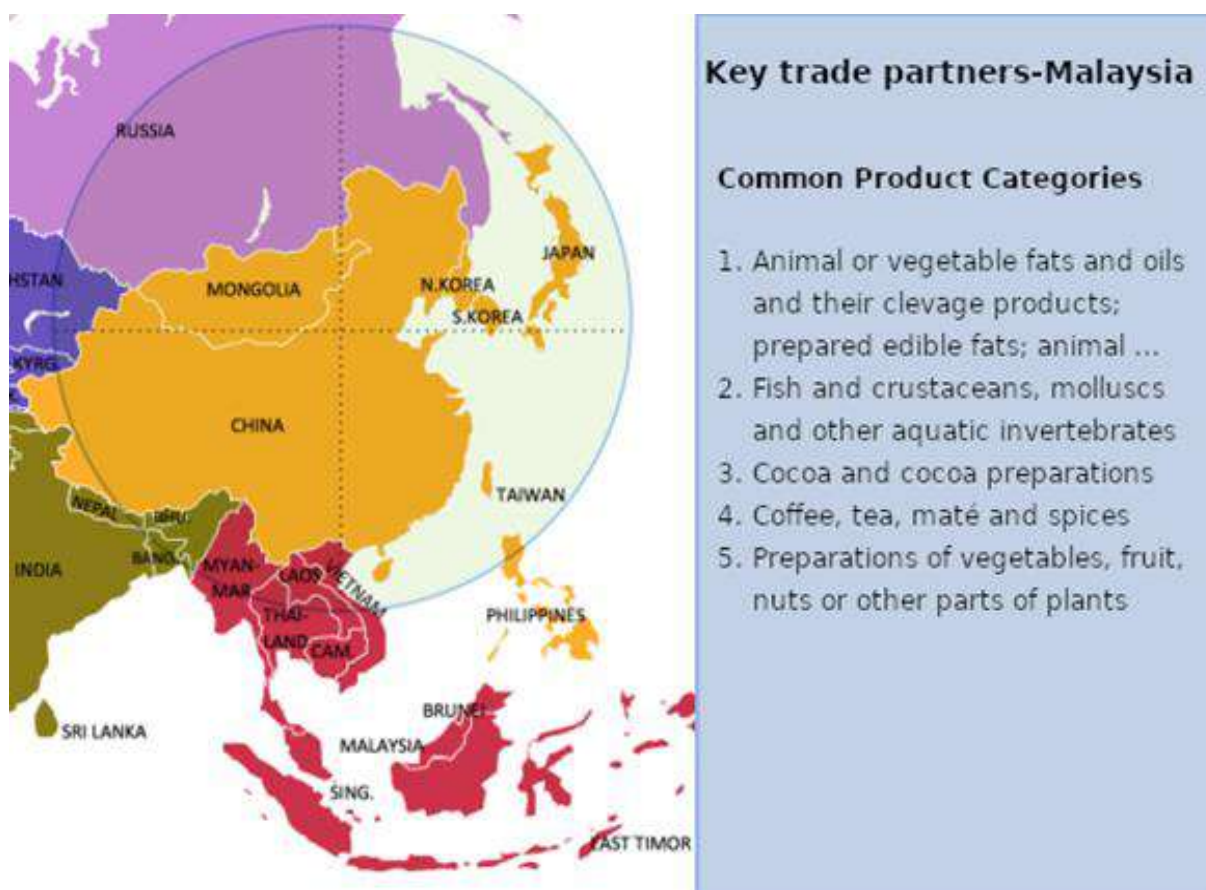


Figure 2-64: Common imported agriculture product categories from Malaysia by key trade partners (2017-2019)

Source: Frost & Sullivan, 2020

² Frost & Sullivan Analysis (2020)

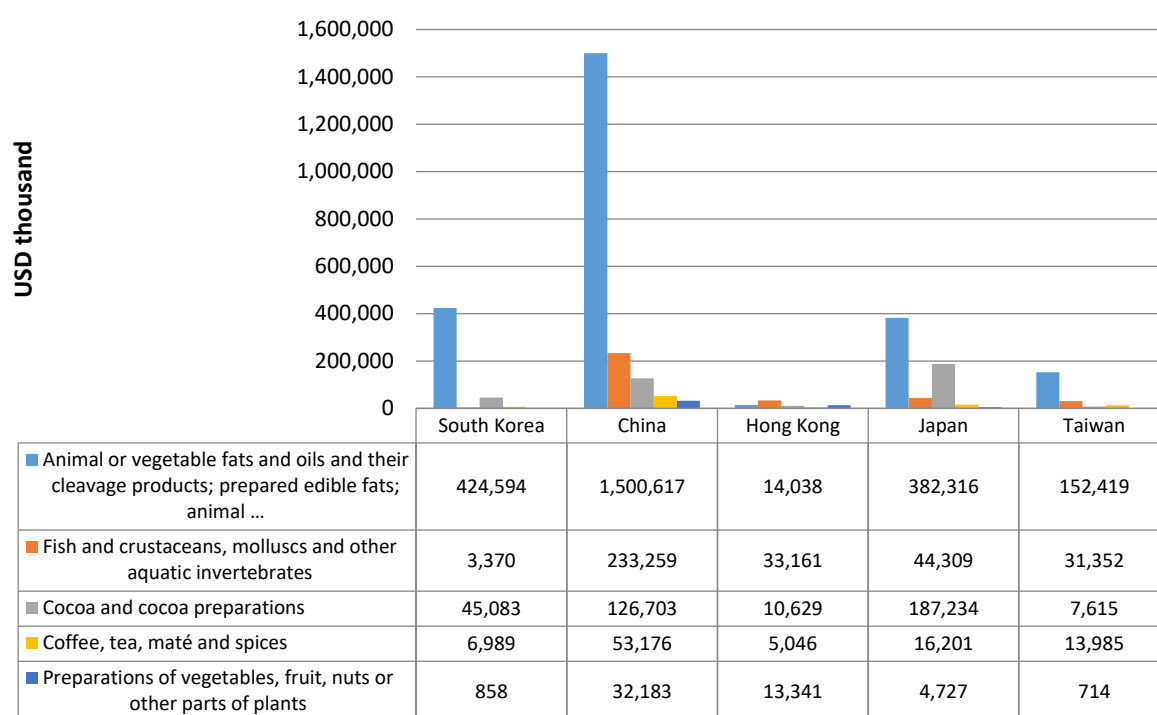


Figure 2-65: Value of Key Trade Partners' Import by Product Categories from Malaysia (2019)

Source: ITC Trademap, 2020

Animal or vegetable fats and oils and their cleavage products, prepared edible fats, animal category has the highest import value in 2019 by the key trade partners with a total of USD 2.47 billion, followed by cocoa and cocoa preparations category (USD 0.38 billion), and fish and crustaceans, molluscs and other aquatic invertebrates category (USD 0.35 billion). China is the highest importer of all the common product categories, except for fish and crustaceans, molluscs and other aquatic invertebrates category, and cocoa and cocoa preparations category, where Hong Kong and Japan are the top importers respectively (Frost & Sullivan Analysis, 2020). Figure 2-65 outlines the import values of the common products by China, Japan, Korea, Hong Kong, and Taiwan in 2019.

2.7.3.4 Product Categories Imported by Malaysia's Key Trade Partners from ASEAN

The following are the top 10 product categories related to agriculture and livestock which are imported by key trade partners from ASEAN for Sri Aman's consideration (Trademap, 2020):

Table 2-106: Malaysia's Key Trade Partners Imports by Product Categories from ASEAN (2017-2019)

Country	Import by Product Category from ASEAN
China	• Palm oil and its fractions, whether or not refined (excluding chemically modified) • Fresh strawberries, raspberries, blackberries, back, white or red currants, gooseberries and . . . • Crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine, . . . • Dates, figs, pineapples, avocados, guavas, mangoes and mangosteens, fresh or dried • Coconut "copra", palm kernel or babassu oil and fractions thereof, whether or not refined, . . . • Fish fillets and other fish meat, whether or not minced, fresh, chilled or frozen

Country	Import by Product Category from ASEAN
	- Coconuts, Brazil nuts and cashew nuts, fresh or dried, whether or not shelled or peeled - Food preparations, n.e.s. - Margarine, other edible mixtures or preparations of animal or vegetable fats or oils and edible . . . - Frozen fish (excluding fish fillets and other fish meat of heading)
Japan	- Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates - Rubber and articles thereof - Fish and crustaceans, molluscs and other aquatic invertebrates - Edible fruit and nuts; peel of citrus fruit or melons - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . - Cocoa and cocoa preparations - Miscellaneous edible preparations - Meat and edible meat offal - Preparations of vegetables, fruit, nuts or other parts of plants - Coffee, tea, maté and spices
South Korea	- Rubber and articles thereof - Fish and crustaceans, molluscs and other aquatic invertebrates - Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates - Edible fruit and nuts; peel of citrus fruit or melons - Residues and waste from the food industries; prepared animal fodder - Preparations of vegetables, fruit, nuts or other parts of plants - Coffee, tea, maté and spices - Cocoa and cocoa preparations - Edible vegetables and certain roots and tubers
Hong Kong	- Edible fruit and nuts; peel of citrus fruit or melons - Fish and crustaceans, molluscs and other aquatic invertebrates - Miscellaneous edible preparations - Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates - Rubber and articles thereof - Meat and edible meat offal - Preparations of vegetables, fruit, nuts or other parts of plants - Cocoa and cocoa preparations - Coffee, tea, maté and spices - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . .
Taiwan	- Fish and crustaceans, molluscs and other aquatic invertebrates - Miscellaneous edible preparations - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . - Residues and waste from the food industries; prepared animal fodder - Coffee, tea, maté and spices - Preparations of vegetables, fruit, nuts or other parts of plants - Edible vegetables and certain roots and tubers - Edible fruit and nuts; peel of citrus fruit or melons - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal . . . - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere . . .

Source: ITC Trademap, 2020 and Frost & Sullivan, 2020

From the table above, it can be concluded that product categories which are common across Malaysia's key trade partners i.e. Japan, South Korea, Hong Kong, and Taiwan from ASEAN include (Frost & Sullivan Analysis, 2020):

- 1) Fish and crustaceans, molluscs and other aquatic invertebrates
- 2) Edible fruit and nuts; peel of citrus fruit or melons
- 3) Coffee, tea, maté and spices
- 4) Preparations of vegetables, fruit, nuts or other parts of plants

China has slightly different imported product categories than its neighbouring countries in the Northeast region where its top imports are other agriculture products such as palm oil; fruits such as fresh strawberries, raspberries, pineapples, avocados, guavas, mangoes and mangosteens; as well as coconuts, brazil nuts and cashew nuts, and fish related i.e. fish fillet and frozen fish. These imported products are of high values in 2019.



Figure 2-66: Common imported agriculture product categories by Malaysia's key trade partners from ASEAN (2017-2019)

Source: ITC Trademap, 2020

Fish and crustaceans, molluscs and other aquatic invertebrates category has the highest import value in 2019 by the 4 key trade partners (Japan, South Korea, Hong Kong and Taiwan) with USD 3.03 billion, followed by edible fruit and nuts; peel of citrus fruit or melons category (USD 2.26 billion), and preparations of vegetables, fruit, nuts or other parts of plants category (USD 0.731 billion) (Trademap, 2020).

Japan has the highest import of the common products above in 2019 with a total of USD 3.06 billion, followed by South Korea (USD 1.54 billion) and Hong Kong (USD 1.43 billion).

Figure 2-67 below outlines the import values of the common products by Japan, Korea, Hong Kong, and Taiwan in 2019 (Frost & Sullivan, 2020).

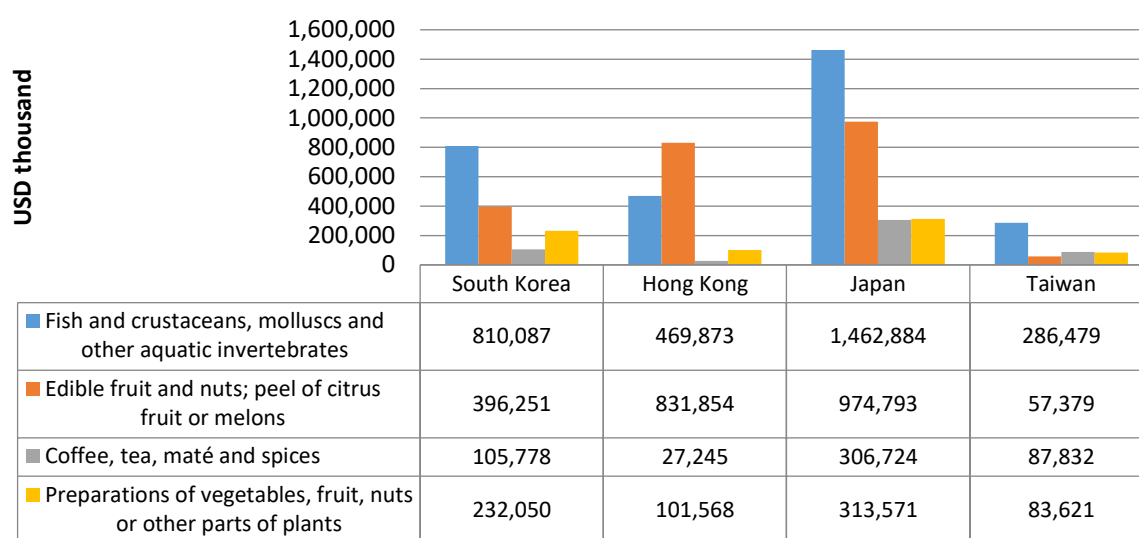


Figure 2-67: Value of Malaysia's Key Trade Partners' Import by Product Categories from ASEAN (2019)

Source: ITC Trademap, 2020

As for China, its top import is palm oil and its fractions, whether or not refined (excluding chemically modified) category with a total import of USD 11 billion, followed by fresh strawberries, raspberries, blackberries, back, white or red currants, gooseberries category (USD 5.75 billion) and crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine category (USD 1 billion).

Figure 2-68 below outlines the import values of the common products by China in 2019 (Frost & Sullivan, 2020).

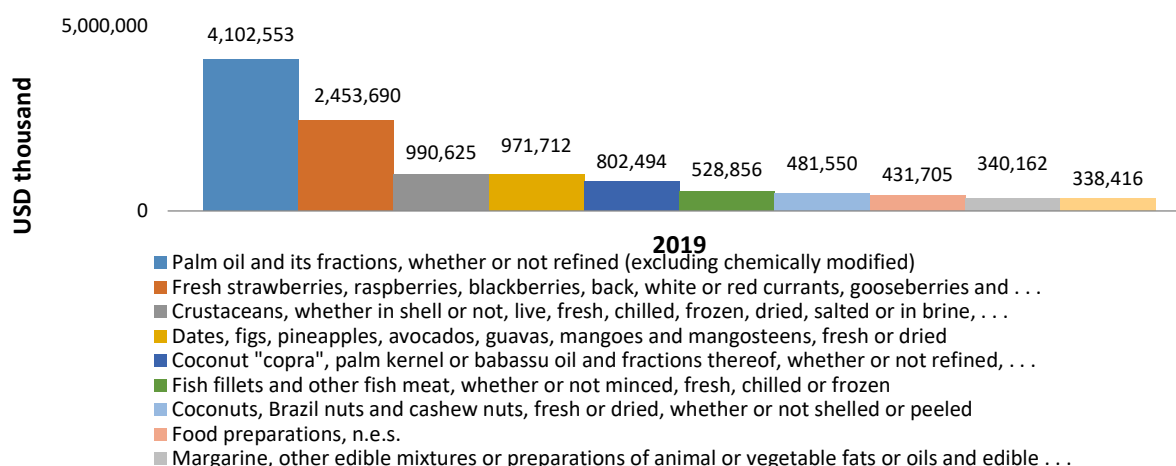


Figure 2-68: Value of China's Import by Product Categories from ASEAN (2019)

Source: ITC Trademap, 2020

2.7.3.5 Product categories imported by Malaysia

The following are the top 10 product categories related to agriculture and livestock imported by Malaysia itself for Sri Aman's consideration (Trademap, 2020):

Table 2-107: Domestic Imports by Product Categories, Malaysia (2017-2019)

Country	Import by Product Category from Malaysia
Malaysia	• Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal . . . • Coffee, tea, maté and spices • Residues and waste from the food industries; prepared animal fodder • Cocoa and cocoa preparations • Edible vegetables and certain roots and tubers • Products of animal origin, not elsewhere specified or included • Miscellaneous edible preparations • Preparations of vegetables, fruit, nuts or other parts of plants • Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates

Source: ITC Trademap, 2020 and Frost & Sullivan, 2020

Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal category has the highest import value in 2019 (USD 3.82 million), followed by coffee, tea, maté and spices category (USD 0.26 million), residues and waste from the food industries, prepared animal fodder category (USD 0.11 million), and cocoa and cocoa preparations category (USD 23,000).



Figure 2-69: Top domestic import of agriculture product categories, Malaysia (2017-2019)

Source: ITC Trademap, 2020

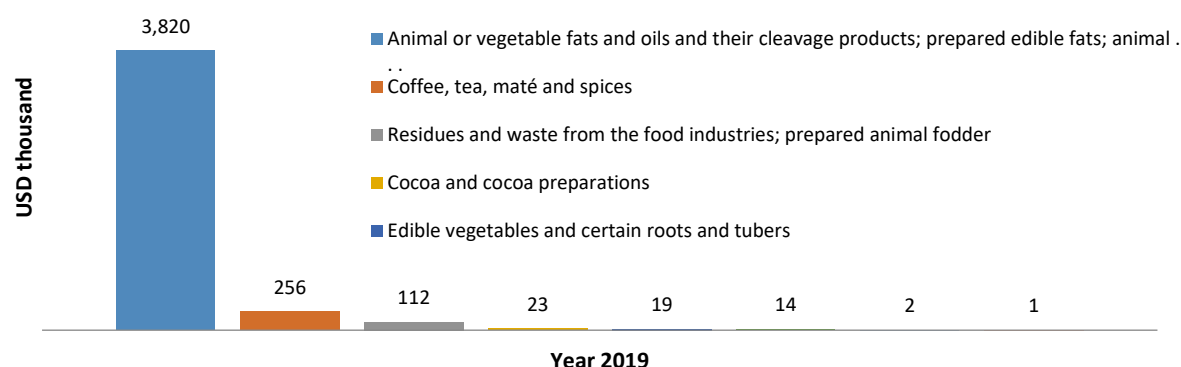


Figure 2-70: Value of Domestic Imports by Product Categories, Malaysia (2019)

Source: ITC Trademap, 2020

2.7.3.6 Trade prospects for Sri Aman

From the analysis above, the following agriculture product categories are common in the top 10 list of trade value in Malaysia as well as outside of Malaysia i.e. ASEAN and Northeast Asia region (Malaysia's key trade partners) and has high import values are selected for Sri Aman:

- 1) Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal (USD 3.82 billion)
- 2) Fish and crustaceans, molluscs and other aquatic invertebrates (USD 3.56 billion)
- 3) Cocoa and cocoa preparations (USD 0.7 billion)
- 4) Coffee, tea, maté and spices (USD 0.16 billion)
- 5) Edible fruit and nuts; peel of citrus fruit or melons (USD 2.26 billion)
- 6) Preparations of vegetables, fruit, nuts or other parts of plants (USD 0.78 billion)

Other agriculture products which have good market potentials are:

- 1) Rubber and articles thereof – high in demand in China (USD 1.36 billion), Thailand (USD 0.15 billion), Vietnam (USD 0.11 billion), and Cambodia (USD 4.56 million) in 2019
- 2) Miscellaneous edible preparations – high in demand in China (USD 0.14 billion), Thailand (USD 0.11 billion), Philippines (USD 94.29 million), Vietnam (USD 68.79 million), and Myanmar (USD 25.09 million) in 2019
- 3) Palm oil and its fractions, whether or not refined (excluding chemically modified) – high demand in China alone (USD 11 billion)

The above nine product categories are within Sri Aman's strength which could be the focus of product development for its agriculture industry in the future.

2.7.4 Inland Port

There have been suggestions that an inland port associated with the Lubok Antu border crossing may stimulate trade and development for Sri Aman Division. This section investigates this option.

2.7.4.1 The Tebedu experience

2.7.4.1.1 History

An inland port was first established at Tebedu Border crossing in Serian Division. Container operations commenced in May 2011 with the first users of the warehouse facilities. Initially there were issues with tariffs, processing delays, and resistance by truck operators to switch from informal trade routes to the Tebedu Inland Port route.

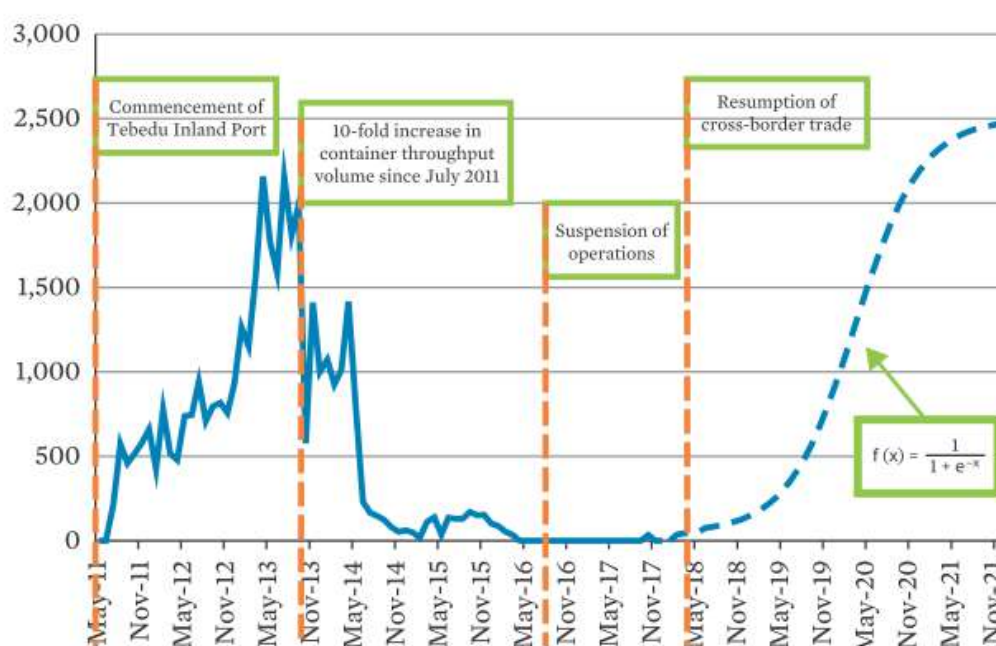


Figure 2-71: Tebedu Inland Port Container Throughput (2011-2018)

Source: Tebedu Customs Data and UNIMAS Holdings Analysis

As a result, affordable duties were applied to small traders, and customs officials began diverting cargo trucks weighing over 5 metric tons (MT) to the inland port. Furthermore, duties on transshipments were eliminated and special passes with special tariff rates were issued to small traders. Also, to reduce processing delays, a one-stop service center was created within the port area. By August 2011, the port was fully operational (Figure 2-71).

During the initial years of operation, the port authorities supported the establishment of an Entikong Dry Port on the West Kalimantan side of the border, to complement the Tebedu Inland Port. It was intended to help improve living standards in the border area through increased economic activity, especially that associated with the establishment of local industries, and the development of a market place for tourists to buy local goods along a green lane linking Entikong with Tebedu that would form part of a free trade zone.



Figure 2-72: Tebedu Inland Port

The port's container throughput volume experienced a 10-fold increase between July 2011 and July 2013 and included breakbulk, liquid bulk, dry bulk, containerized cargo, transit cargo, and transshipments.

In early 2014 the Road Transportation Department of Malaysia (Jabatan Pengangkutan Jalan Malaysia, or JPJ Malaysia) ruled that Indonesian lorries could not go beyond the Tebedu Inland Port. The intent of this ruling was to support domestic transport and logistics companies.

In early 2014, the Indonesian police and customs authorities tightened their enforcement on cargo being transported across the border. Then, in mid-May of the same year, the Indonesian government halted internationally traded goods. The government classified Entikong Customs as a C-status facility capable of only handling border trade. It limited trade to RM600 worth of cargo per person per month and those goods were to be used exclusively for local consumption by people living in the border area. The types of goods permitted were mainly agricultural products from the Indonesian side of the border and, on the Malaysian side, tools and equipment used for daily activities by the local population.

Border trade restrictions severely affected local businesses and household income and employment.

On 22 November 2017 The Malaysian and Indonesian Governments agreed to reopen trade at the Tebedu–Entikong border area. That decision implied the revival of activities by the Tebedu Inland Port. After signing the 1970 BTA and Border Cross Agreement between the two countries, the Malaysian Prime Minister said that, taking into consideration the potential of the Teledu–Entikong border area, the federal government planned to create a commercial zone at the area, which would benefit residents of both countries.

2.7.4.2 Assessment

Tebedu has shown that the Inland Port concept can be successful if the application of tariffs and processing regulations can be streamlined and set at levels to encourage trade.

At Tebedu the Inland Port handles mostly containerized traffic. It is reasonable to assume that this cargo is carried from sea ports, probably at Pontianak and Sinkawang, but perhaps further afield. The containers will be used for a wide range of goods originating in these coastal towns. Shipping through Tebedu allows good trade access to major population centres of Kuching and Serian.

From a transport perspective there is little incentive to carry containers through to Lubok Antu rather than Tebedu, as the distance is much greater (Figure 2-75). This may be a feasible approach if the ultimate market is Sibu or Bintulu.



Figure 2-73: Relative location of Tebedu and Lubok Antu border crossings

Source: UNIMAS Holdings

From Table 2-108 we see, however, that the value of cross-border trade at Lubok Antu is actually relatively high when compared with Tebedu.

Table 2-108: Sarawak–West Kalimantan Cross-Border Trade, 2012–2017 (\$)

	Entikong (WK)– Tebedu (SW) Trade		Nanga Badau (WK)– Lubok Antu (SW)		West Kalimantan– Total Border Trade	
	WK Exports	SW Exports	WK Exports	SW Exports	WK Exports	SW Exports
2012	1,557,450	532,928	8,580,928	–	10,138,378	532,928
2013	2,252,843	464,040	8,073,529	–	10,326,372	464,040
2014	31,409,329	3,299,170	11,195,595	–	42,604,924	3,299,170
2015	10,337,816	242,265	48,268,389	59,226	58,606,206	301,491
2016	12,844,025	311,135	46,761,103	146,250	59,605,128	457,385
2017	7,677,827	354,391	55,658,789	2,036,546	63,336,617	2,390,937

SW = Sarawak, WK = West Kalimantan.

However, the type of goods involved in cross-border trade is fairly limited at present. It is mostly CPO being brought into Sarawak and building materials and equipment carried into Indonesia (Table 2-109 and Table 2-110).

Table 2-109: Sarawak Imports at Lubok Antu (tonnes)

Commodity	2016	2017	2018	2019
Crude Palm Oil (CPO)	56,249	66,761	129,094	194,717
Frozen Fish	26.5	6	12.2	1.1
Machinery & Equipment	1 Unit	16 Units		

Source: Lubok Antu Customs Data

Table 2-110: Sarawak Exports at Lubok Antu (tonnes)

Commodity	2016	2017	2018	2019
Sugar	3849	275		
Portland Cement	20			
Building materials	610 Units	385 Units	717 Units	2,323 Units

Source: Lubok Antu Customs Data

2.7.4.3 Recommendation on Inland Port prospects

The range of goods being traded would need to expand somewhat to justify the establishment of an Inland Port at Lubok Antu. There is not much advantage off-loading CPO at the border for reloading and transporting to refineries in Sarawak, or to shipping terminals in Bintulu. This would simply be a double-handling exercise that would incur additional cost for little benefit.

2.7.5 Outsourcing industry and e-Commerce Opportunities

2.7.5.1 Current State of Digital Services in Sarawak

Digital services present in Sarawak mainly revolves around digital marketing in big cities like Kuching and Kota Samarahan. Examples of existing digital services companies in Sarawak are Karuna (Sarawak) Enterprise Sdn Bhd (provides digital marketing services via website/online) (Karuna Sarawak, 2020), Ericanfly SEO (helps increase the search engine rank and site traffic to companies) (Company Info, 2020), Uwdieyn Network Digital Centre (provides services such as online business, digital technology training, online marketing, telemarketing) etc (Uwdieyn Network Digital Business, 2020).

Currently, digital services are changing and expanding as Sarawak is embarking on developing a digital economy to drive the state forward into becoming an advanced high-income state by 2030. The digital transformation journey has been active since 2017 with the mission to accelerate Sarawak's economic growth, reduce poverty in the rural areas and improve youth employment opportunities (Chief Minister's Department, 2017).

The Sarawak Digital Economy Strategy 2018-2022 was put in place to spearhead the digital economy transformation in Sarawak. As an early initiative to implement Sarawak's digital economy, the Sarawak Digital Economy Strategy 2018-2022 has four clusters and covers 17 sub-subject areas, as outlined in the table below, to drive Sarawak into the digital world involving its society in a more organized way while cost-effectively applying knowledge and technologies (Chief Minister's Department, 2017).

Table 2-111: The Sarawak Digital Economy Strategy (2018-2022) Clusters and Sub-subject Areas

Cluster	Sub-subject Areas
● Governance and Infrastructure ● Economic Sectors ● Smart City ● Talent and Research and Development	● Legislation and Governance ● Digital Infrastructure ● Digital and Data ● Cyber-security ● Digital Government ● Agriculture ● Tourism ● Manufacturing ● e-Commerce ● Health ● Physical Infrastructure and Utilities ● Housing and Urban Development ● Transport, Logistics and Supply Chain ● Talent Management ● Digital Village ● Centre of Excellence ● Digital Inclusivity

Source: Chief Minister's Department, 2017

In 2017, the Sarawak Multimedia Authority (SMA) was established to ensure the proper development of the Sarawak Digital Economy, including developing and reforming state policies and laws relating to communications and multimedia. SMA will be the one-stop agency that provides policies and guidelines to facilitate the Digital Economy programs and projects. Under SMA, the anchor sectors are:

- 1) Agriculture
- 2) Manufacturing – Industry 4.0
- 3) Tourism
- 4) Smart City
- 5) Digital Health
- 6) e-Commerce
- 7) Digital Government

Under the Sarawak Digital Economy Strategy 2018-2022 and SMA's anchor sectors, e-Commerce was selected to be one of the anchor sectors as it is regarded as important in the marketing and sales sector to help promote Sarawak products effectively and efficiently to both local and global markets.

Agriculture is also one of the selected sectors. This is in line with the state government's aim to develop the agriculture sector and Sarawak the major exporter of agriculture products by 2030. In 2019, a total of RM797 million was allocated by the Sarawak government to develop the agriculture sector by 2020 (New Sarawak Tribune, 2019).

Additionally, tourism is also regarded as an important sector to be developed under the digital economy plan. This can enhance the state government's initiative to empower youth in the hospitality and tourism industry. In addition, the Federal government has allocated a total of RM48.3 million to fund tourism infrastructure development for the proposed 18 tourism and cultural development projects in Sarawak (The Malay Mail, 2020).

Strategic plans have also been outlined to drive the agriculture, tourism, and e-commerce sectors under the Sarawak Digital Economy Strategy 2018-2022, which can be applied by Sri Aman Division, as detailed in the table below:

Table 2-112: Strategic Actions for Agriculture, Tourism, and e-Commerce Sectors in Sarawak and Sri Aman

Sector	Strategic Action
Agriculture	Adopt ICT and digital technologies to drive innovation and improve productivity in agriculture sector
	Establish efficient distribution system for agriculture inputs and products
	Expand existing markets and develop new markets for agriculture products
Tourism	Promote Sarawak through Digital Media
	Digital platform for tourism product and service providers to enhance their business
	Enhance tourist experience online
e-Commerce	Improve e-Commerce and services ecosystem
	Increase awareness of Sarawak products and services through digital platform
	Increase e-Commerce adoption
	Create a FinTech platform that provides technological and business tools to secure a competitive advantage in current and future markets

Source: Chief Minister's Department, 2017

2.7.5.2 Potential for e-commerce platforms/channels for local businesses in Sri Aman

Agriculture and tourism are important sectors driving the economy of Sri Aman. Based on the Sarawak Digital Economy Strategy 2018-2022 and SMA's anchor sectors as described above, Sri Aman could leverage its strength and tap into the digital economy strategy to upgrade its agriculture and tourism sectors to better support local businesses. Telecommunications and digital technologies could be adopted to innovate the production and marketing strategies of the agriculture and tourism sectors, hence promoting e-Commerce in Sri Aman (Frost & Sullivan, 2020).

e-Commerce sector

Currently, there are no known e-Commerce companies or entrepreneurs in Sri Aman. However, there are some e-Commerce companies in Kuching which provide digital services such as digital marketing (Frost & Sullivan, 2020).

e-Commerce has also become more important in Sarawak recently due to the outbreak of Covid-19 pandemic. The e-Commerce at this juncture refers to online transactions and online shopping (Sri Aman, 2020). Given that Sri Aman's major economic activities to be the services sector driven by wholesale and retail trade industry, e-Commerce will be an important feature to businesses moving forward (Frost & Sullivan, 2020).

e-Commerce opportunities for Agriculture

Sri Aman has immense potential within the agriculture sector. According to the Sri Aman Divisional Agriculture Office, agricultural planning and development in the Sri Aman Division are broken down into 3 agricultural districts i.e. Sri Aman, Lubok Antu dan Pantu. Currently, there are a total of 611 villages and 13,339 families who run farms in the Sri Aman Division, with Pantu having the highest density of agriculture activities (Department of Agriculture Sri Aman, 2020).

Major activities carried out by the farming population in Sri Aman Division include rubber, pepper, oil palm, paddy, and also livestock farming. Sri Aman Division is also being focused on by major entrepreneurs for commercial oil palm plantations (Department of Agriculture Sri Aman, 2020). The agricultural land areas are also grown with other potential food crops such as durian, banana, pineapple, coconut, and rambutan which have the potential to be marketed overseas and generate income for the rural population (New Sarawak Tribune, 2019).



Figure 2-74: Agriculture districts of Sri Aman

Source: Department of Agriculture Sri Aman, 2020

The implementation of agriculture e-Commerce in Sri Aman will be important to help local farmers improve productivity and efficiency in their farming activities. Agriculture e-Commerce involves the trading of agriculture products and goods via electronic communications and computer technology which are linked together over internetwork protocols and standards. Agriculture e-Commerce will enable online transactions of goods and products - with this facility, goods, and products can be sold over a longer distance seamlessly. Physical stores would be largely replaced by virtual stores where information of products and goods, including pricing, would be easily accessible online without having to travel far to obtain the products (Frost & Sullivan, 2020). Essentially, agriculture e-Commerce covers “agricultural information flow, the business flow of agricultural products, cash flow of business transactions and physical flow of agricultural products” (Dan & Qihong, 2014). In other words, the business flow will now involve taking orders and payment over the phone or via online forms to place orders with payment by card or cash at the time of pickup or delivery.

The agriculture e-commerce models which can be considered are as follows (Folorunso et. al, 2006):

1. Farm to Farm (F2F) - farmers collaborate and sell agriculture products and services to each other as complementary or supplementary basis
2. Farm to Business (F2B) – farmers sells their products and services to suppliers or retailers
3. Farm to Customer (F2C) - farmers sell agriculture products and services direct to customer online with agents being responsible for setting price comparison
4. Customer to Customer (C2C) – the agriculture products and services are sold from one individual to another i.e. suppliers to buyers who are individuals

Some of the benefits of agriculture e-Commerce include (Frost & Sullivan, 2020):

1. Reduce administrative cost and cycle time
2. Improve inventory management - product inventory numbers will be updated daily to synchronize between the physical location and online store, hence ensuring fresh and quality agriculture products
3. Re-organizing farm processes e.g. farmers can sell directly to customers online bypassing intermediaries, leading to improved income for the farmers, reduced wastage and fresher products for customers
4. Ability to provide personalized services to individuals who visit the website, e.g. providing customized packaging items with good quality and low prices, hence improve branding and customer loyalty
5. Expand business and customers over larger geographical areas
6. Increase communications and business opportunities with customers, suppliers and other farms

7. Creation of new job opportunities e.g. data entry, data analyst, customer service specialist, inventory management analyst/advisor

Basic requirements to implement agriculture e-Commerce, other than an online store and internet connection, will be mobile tools such as smartphones and tablets. A third-party hosted e-commerce solution would also be needed to better manage concerns related to technical maintenance and support. Other issues such as online transaction security and online customer service are also important which could use some help from third-party vendors (Vegetable Grower News, 2020).

Currently, there is already a digital platform from where farmers in Sri Aman Division could benefit. In June 2020, AirAsia has initiated and launched Ourfarm, an e-commerce platform to help connect farmers directly with businesses, thus eliminating middlemen which will then boost the farmers' earning power. The initiative is also a strategic partnership with the Ministry of Agriculture and Food Industries which supports over 1,000 government contract farmers as well as owners of private farms, including small businesses (The Star, 2020).

e-Commerce opportunities for Tourism sector

Sri Aman Division's tourism sector has the potential to be developed. There are numerous tourism products and services in Sri Aman Division that could be considered such as the Batang Ai dam and the orangutans in Batang Ai National Park, Fort Alice, and Simanggang Town.



Figure 2-75: Key Potential Tourist Attractions in Sri Aman

Source: Sarawak Tourism Board (2020)

(clockwise from top left: Batang Ai dam and the orangutans in Batang Ai National Park, Maludam National Park and its wildlife (middle), Panorama Benak Park on the banks of Batang Lupar, Fort Alice and Sri Aman Town)

These tourist attractions could be promoted via digital platforms such as mobile applications and social media websites such as Facebook, Instagram, and personal blogs. Digital platforms will greatly impact the way destinations facilitate tourism, develop a product, gather data, access markets, and attract visitors. Common business models for tourism e-Commerce (e-Tourism) include (Kabir et. al, 2012):

1. Business to Customer (B2C) - Tourist service providers sell their products directly to tourists or customers and have direct communication with tourists or customers

2. Business to Business (B2B) – Tourist services business like airlines and hotels promote and sell their products to other businesses like tour operators e.g. expedia.com.
3. Customer to Customer (C2C) – Tourist-to-tourist interactions via blogs, forums and other social media to share and exchange views and ideas on various tourism and travel related topics e.g. hotel booking, flight ticket prices, local attraction sites etc.
4. Government to Business (G2B) - Government plays a role in interacting, collaborating, facilitating tourism promotion with the tourist service providers/agents

Benefits of e-Tourism will include (Frost & Sullivan, 2020):

1. Reduce operational costs
2. Increase variety of tourism products and experiences via innovative technologies e.g. augmented reality, geotagging
3. Personalize products/services to meet the needs of the customers
4. Easily accessible information online
5. Increase sales and marketing in both local and global markets
6. Creation of new job opportunities e.g. global tour coordinator, web designer, data analyst, customer service specialist
7. Improve livelihoods especially for women and rural entrepreneurs

Similar to agriculture e-Commerce, the e-Tourism industry would require basic requirements such as internet connections, online platforms, technical maintenance and support, and online customer service. All these functions could be well-managed by a third-party vendor (Frost & Sullivan, 2020).

2.7.5.2.1 Case Study on Rural Business Services Delivery

1. Alibaba (Taobao) Rural Digital Market Access (CEIBS, 2018)

In September 2014, Group President Jianhang Jin indicated that agricultural e-commerce, big data, and cross-border e-commerce would be the three areas of focus in Alibaba Group's future strategic development. As far as agricultural e-commerce was concerned, there were about 800 million rural residents in China, a huge potential market. However, the rural market had its unique traits as compared to the urban cities, which meant Alibaba had to face a lot of challenges while engaged in e-commerce with farmers. Hongbing Gao, Director of AliResearch, pointed out that when it came to consumption, the rural market had a weak business foundation, and it was hard to meet farmers' demands.



Source: Make a Better Rural China - Rural Taobao, Alibaba Group Investment Day 2016

There was a fair amount of progress in the production process, but there was still room for improvement as farmers had to bear the costs incurred because of low efficiency and delayed market information. Similarly, on the supply side, the distribution channels for high value-added agricultural products were still not open. Hence, Hongbing Gao emphasized a need for **both the involvement of big e-commerce platforms** – which could provide resources such as technology, expertise, and a commercial ecosystem – **and the governments' efforts** in infrastructural and environmental development to solve these problems.

Seeing the great value of e-commerce for rural development, in October 2014 Alibaba Group unveiled its Rural Strategy, and clearly articulated its goal of “serving farmers, innovating agriculture, making the countryside better”. In the same month, Alibaba Group announced the initiation of its 1,000 Counties & 100,000 Village Plan, which involves an investment of RMB10 billion within 3-5 years to build 1,000 county-level operational centres and 100,000 village-level service stations. That means Alibaba will work towards having its e-commerce network cover more than 1/3 of the counties and 1/6 of the rural areas in China in the next few years.

Rural Taobao has two visions:

(1) To leverage the internet to promote urban-rural-integration. This means putting in place the infrastructure needed to open up logistics and information channels to villages so that rural residents can enjoy the same convenience as urban citizens at no extra cost. For example, they can buy daily necessities and farming supplies at low prices without travelling outside their villages. One point of special importance is that, through the internet, farmers can purchase the means of production directly from manufacturers and they can find purchasers for their agricultural products all over the country – all this from within their rural communities.

(2) To create more rural entrepreneurship and employment opportunities. The aim is to achieve this by making full use of the local media and various publicity channels to create a strong atmosphere of entrepreneurship in these communities. This would be coupled with efforts to encourage more and more young people to return to their hometowns and become a part of these local communities. Of profound social significance, this second vision would solve issues that result from left-behind children and empty-nest elderly.

Alibaba's Rural Taobao project is beneficial to man; and it based on a four-pronged strategy:

(1) Emphasize purchasing, and focuses on internet + infrastructure. It allows Rural Taobao Service Stations to make purchases on villagers' behalf through the two channels of logistics and information flow, as well as the closed-loop formed by secure trade.

(2) Empowering talents, and focuses on internet + farmers. This is where local partners are recruited for Rural Taobao Service Stations, creating a group of leaders who promote the establishment of Taobao Villages or other forms of a flexible economy.

(3) Strengthening sales, and focuses on internet + agricultural products. This includes the promotion of agricultural products, setting up websites where they can sell their products, and completing the Online-to-Offline (O2O) experience in the countryside.

(4) Enabling an ecosystem, and is linked to internet + farmers. It involves the establishment of ecological service centres. This would see the extension of Rural Taobao Service Stations, completing the one-stop experience (where customers can access everything they need: clothes, food, accommodation, traffic, travel, entertainment, and shopping) thus transforming rural residents' lifestyles, sources of entertainment, and shopping habits.

2. Business Process Outsourcing (BPO) center in small villages in India (rural services delivery for business services) (Wharton University of Pennsylvania, 2010)

Overview

This section will look at the set-up of a BPO (business process outsourcing) center in small villages around India which could form the basis of a shared service centre in Sri Aman in the future.

As Malaysia is now poised as an outsourcing hub due to its strategic location and good infrastructure, the BPO market or services has started to grow and become an important segment of shared services for business clients who required a resilient, multilingual customer support solution. Long-term planning and buy-in from the relevant stakeholders will help to establish Sri Aman's capability in shared services, not only to the local market but also in the ASEAN and APAC regions.

This case study will cover the important ingredients to make rural BPO centres a success, i.e.:

1. Demand
2. Business model
3. Human capital
4. Infrastructure

Demand

Village-level BPO or rural BPO began operation in small villages around India as early as 2007. There are demands for BPO centres operating in villages where most of these centres have been around for about 13 years now. About 60% - 70% of recruitments for BPO centres have shifted to smaller towns and villages. According to the National Association of Software and Services Companies (Nasscom), more than 100 rural BPOs are operating in the following Indian states:

1. Rajasthan state (northern region)
2. Andhra Pradesh state (south-eastern coastal region)
3. Kerala state (southwestern coastal region)
4. Karnataka state (south-western region)

Reasons for the huge potential and demand for village-level BPOs are:

1. Low operating cost, especially on human resource and land

Villagers are paid about USD 100 a month for an eight-hour shift five days a week, which is half of the pay in a BPO centre located in the cities. In addition, land prices in rural areas in India are only a small fraction compared to prices in cities like Mumbai and Bangalore. Clients can save 40%-50% of their current costs when they outsource part of their services to rural BPO centres.



Rural BPO centre in India

2. Availability of skilled employees

Villagers are proficient in English and computer and upon training, they can deliver and perform in their jobs. Villagers, both men and women, are trained in the BPO centres to work with computers and handle work related to domestic voice (i.e. call centres), non-voice businesses, and international non-voice businesses.

The ability to create job opportunities for the rural communities has also increased disposable income among lower-income groups and prevented people to migrate to urban areas for jobs, particularly the youths. Youths who remained in the villages and are unemployed would now be able to find employment in non-agricultural jobs and contribute to the economy. As women also started to play an important part in the rural BPO centres, parents are encouraged to support their daughters' educations up to upper secondary school levels at least.

Business model

Rural BPO centre's model is to focus on villages and tier-2 cities and subsequently to set up rural centres at various locations in India with more than a thousand employees. The strategy is also to set up centres where the originating companies can have a significant presence.

Most companies setting up BPO operations in rural India operate either as third-party service providers to multiple clients or as captive back-office centres for big companies. These rural BPO centres can have a total number of 200 employees and up to 550 employees working an eight-hour shift involved in non-core operations, such as data capturing, data entry, data conversion, and indexing of customer details.

BPO centres in rural areas in India are also set up to support low-end jobs. Originating companies in the cities would shift low-margin and low-skill jobs or projects to rural BPO centers, while the headquarters will act as the interface between the client and the rural centres. This model enables the BPO companies in the cities to evolve into knowledge-process outsourcing units, focusing on specialized and high-end jobs.

Most clients will be looking for an outsourcing partner who can offer them additional services over the years such as data analysis, report preparation, and graphics and layout services. In this case, rural BPO centres could either consider expanding their services and built extra in-house capabilities in the long run or partnering with urban centres that can offer such services. For example, the services offered by 'Source for Change' in the Rajasthan state have evolved from web research projects, transcription and translation work to job web site and Hindi-based voice work.

Human Capital

As a country with a huge population, it is not difficult for companies who seek to set up BPO centres in rural areas to find human resources. Some of the companies, for example, Tata Group, headquartered in Mumbai, aimed to hire as much as 5,000 people for rural BPO operations in the future, an ambitious plan, and following close is DesiCrew Solutions Pvt Ltd, a data processing and data mining services headquartered in Chennai, with plans to expand its rural BPO centre workforce to 1,000 employees to establish a pan-India presence.

Getting the right people to work is crucial for the success of the BPO centres. To be considered for employment at the centres set up by the big companies from urban areas, minimum requirements of 12th pass (upper secondary school qualification) and basic knowledge on computers as well as some proficiency in English are needed. As the job progresses, additional knowledge or skills would be needed depending on the projects. In the event of the absence of formal qualifications, testing for logic and abstract thinking may occur before hiring the applicant.

Training is provided by the large companies to the people in the rural areas where there are training programs outlined and training are given regularly and conducted mostly on the job. Training started with computer operations, basic office management, HR practices, data entry, and Internet usage. For DesiCrew, continuous learning is also provided for language skills, internet and email usage, and other soft skills. Training will typically take 1-3 months for a rural employee to be fully prepared to handle and deliver tasks as required, while some may take 2-4 months. The rural employees are also given an opportunity to progress in their career paths, e.g. from an entry-level operator to a higher level of operations to middle management roles.

One of the human capital challenges in India is high attrition. BPO centres in the villages tend to hire more women working in the centres than men and having more women in the rural BPO centres in India is an advantage as women are revealed to be less likely to move to urban areas, thus lowering the attrition rates.

The BPO centre in the village in Rajasthan state is an all-women BPO centre, while more than half of the employees in the BPO centres in the other states as stated above are women, ranging from 19 to 35 years old. In 2019, the total workforce of DesiCrew's rural BPO centres consists of about 70% women. These women were proven to be equally proficient in handling IT-related tasks as men, in addition to being more loyal employees.

The rural BPO centres have greatly impacted the lives of the people in the rural areas, especially women. The BPO centres have empowered women in the villages as they now have the means to contribute and assist in supporting their families. In addition, men have been more accepting of the fact that women can handle computers and accomplish tasks with it. The BPO centre in the village in Rajasthan state has been remodeled to 'Source for Change' which combined headquarters and training center, and men have been dropping in the centre occasionally hoping to find employment for the women in their families. Rural employees are also able to save more i.e. about 90% of their salaries as opposed to 10% in the city.

Infrastructure

The top challenge for rural BPO centres operating in the villages is infrastructure. First and foremost is the power supply issue which ranges from erratic to nonexistent, and with the entire villages still awaiting electrification. To overcome the problem, most rural BPO centres run on heavy-duty diesel generators.

Some BPO centers do not have a proper building and are operating from non-air-conditioned buildings that double as schools and marriage halls. Employees in these centres also sit on plastic and stackable chairs. On the flip side, there are other BPO centres in the rural areas which operate from modern offices where biometric IDs are required for entry and are filled with highly educated team leaders who hold post-graduate degrees. This suggests that rural BPO centres can run on a basic set-up in a building, depending on the situation.

Internet is very important to BPO centres, something which the villages usually lack. Some big companies who are investing in rural BPO centres helped to bring broadband connections to villages where they operate. However, depending on the role of the BPO centres, non-voice BPO tasks have lower requirement for broadband, hence real-time connectivity is not much of an issue.

Other Challenges

Although the demand is there for rural BPO centres, many urban people in India are still skeptical about the concept of operating in rural areas. To make rural BPO centres a success, it is important to change the perception of people in urban India that work could be done in villages with the same quality and efficiency.

The negative mindset could affect business in the centres if no one is willing to invest in the rural areas. It is a challenge to get business to rural BPO centres in India that are offering low-skilled and basic digitization services such as data entry and data conversion. Hence, connection with NGOs can help rural BPO centres to tap into extensive networks of companies willing to contract work to these centres as part of their corporate social responsibility initiatives. For example, DesiCrew is an incubatee of IIT-Chennai's Rural Technology Business Incubator program (RTBI), and with that, the company was provided seed initial funding as well as in-kind support such as office space and basic infrastructure. Additionally, the Lemelson Foundation's Recognition and Mentorship program (L-RAMP) has provided a long-term soft loan and development support to DesiCrew to help make the BPO centres in the rural areas a success (NextBigWhat, 2020).

Key Takeaways:

1. There are high demand and potential to set up BPO centres in the rural areas due to low operating cost, especially on human resource and land, and the availability of skilled employees
2. Benefits of BPO centres in the rural areas include the creation of non-agriculture job opportunities to people in the rural areas thus preventing rural folks to migrate to urban areas for jobs, particularly the youths; increase disposable income among lower-income groups; and improve the

livelihood of women as they can now play a more significant role in the economy of the rural areas and the states.

3. The business model of the rural BPO centres in India is to provide third-party services to multiple clients or as captive back-office centers for big companies. Responsibilities for these centres involved low-margin and low-skill jobs or projects such as data capturing, data entry, data conversion, and indexing of customer details, while the headquarters will act as the interface between the client and the rural centres.
4. Rural BPO centres are also expected to build up more capabilities and expand their service offerings in the long run as most clients will start to look for an outsourcing partner who can offer them additional services such as data analysis, report preparation, and graphics and layout services.
5. Skilled human capital is important to the success of rural BPO centres, hence intensive training for up to 4 months is provided for the villagers in various areas such as computer operations, basic office management, HR practices, data entry, and Internet usage, language, and other soft skills. Upper secondary school qualifications and basic computer knowledge are also a prerequisite to work in the centres in India.
6. Basic infrastructure requirements for a rural BPO centre are power supply, broadband connection, and basic office equipment such as tables and chairs as well as proper ventilation in the building.
7. It is important to change the negative perception of urban people on the rural BPO centres concept to encourage more companies to invest in the rural areas. The centres could also partner with NGOs to network with companies who are willing to contract work to the rural BPO centers as part of their corporate social responsibility initiatives.

Potential for Shared Services to be located in Sri Aman Division

As evident from the discussion above, e-Commerce can be developed in the Sri Aman Division focusing on the agriculture and tourism sectors. The Sri Aman Division can leverage e-Commerce to increase productivity and efficiency in the agriculture and tourism sectors while improving the livelihood of its residents in the rural area (Frost & Sullivan, 2020).

With the establishment of e-Commerce, there will undoubtedly be strong opportunities to develop new business such as shared services in the Sri Aman Division. According to the Shared Services & Outsourcing Network (SSON), the definition of shared services is (SSON Network, 2020):

.... the delivery of defined business functions or processes that can be delivered to the corporation from a 'shared' delivery model which involves dedicated unit of people, processes, and technologies - this 'sharing' not only leverages the delivery of services across business units but also represents a 'sharing' of accountabilities and responsibilities between the shared services organization and its customers.

The shared services model is very similar to outsourcing and the two are not necessarily mutually exclusive. Outsourcing is the act of contracting a third party to perform certain services such as facilities management (janitorial services, security, cafeterias) and administrative support functions such as Information Technology (IT), Finance and Accounting and Human Resources (HR). These functions are supported by IT and IT services for multiple business units within the corporation (Furlong, 2012).

Potential type of shared services in Sri Aman (Frost & Sullivan, 2020)

The types of shared services to be implemented are determined by the customers and demands from the surrounding environments. There are three types of shared services that have the potential to be implemented and located in Sri Aman:

1. Shared services to support local e-Commerce industry
2. Shared services outsourcing to support certain business functions such as IT, HR and administrative

3. Shared services for disaster recovery centre (data centre)

Shared services to support e-Commerce are discussed above where the agriculture and tourism e-Commerce sectors would need a centre to help with managing technical maintenance and support, and online customer service, standardizing the multiple processes. In addition, shared services would be able to create new job opportunities such as local/global tour coordinator, web designer/programmer, online marketing, data entry, etc. to the populations in Sri Aman Division, particularly the youths.

Shared services may come from several different physical locations, and involve numerous business functions and IT processes, giving the opportunity for shared services outsourcing. At this point, Sri Aman Division could act as the centre to perform and support certain business functions for larger companies in town areas like Kuching at lower costs.

Given that Sarawak is embarking on its digital economy journey, companies will experience changes in the existing operational environment and future requirements which might affect potential future costs due to the need to invest massively in new tools and technologies. In this case, outsourcing to shared services centre such as Sri Aman, if implemented, could be well-positioned to transition to the new environment.

Since the services sector which is primarily driven by wholesale and retail trade industry is the main economic activities in Sri Aman (SPU, 2017), a shared service centre could be leveraged for a standard set of services such as call centre and customer service, which could help to expand trade outward from Sri Aman to other locations.

In addition, as Sarawak has been moving well towards e-Commerce and digitalization in the near future, a disaster recovery centre (data centre) would be fitting to provide computer backup and ensure reliable, efficient maintenance of data for business operations. Sri Aman could be well-positioned as a disaster recovery centre supporting businesses in Sri Aman itself and for big cities such as Kuching due to the following reasons (Upstack, 2020):

1. Located far away from the customer production systems, hence unaffected by malfunctions and damage that arises at the primary data location
2. Generally free from natural disaster – however, there are plans to improve drainage to mitigate flood in Sri Aman (SADA Lab 1, 2020)
3. Greenfield area which makes set-up of infrastructure such as internet cable easier
4. Ample of undeveloped land area for capacity expansion of the center should the need for more backup server space arise later

The key benefits of the shared services mentioned above are an increase in efficiency, technology and skills leverage, and standardization of processes, as well as improved effectiveness in terms of sharing of information and resources across businesses and allowing management to focus more on core business.

Key Enablers for Shared Services Sector in Sri Aman

Shared services model has a huge potential to be implemented and located in Sri Aman. The following key enablers are good considerations which will make shared services a success in Sri Aman:

1) Support from government

First and foremost, initiatives and guidelines from the government are very important. The e-Commerce initiative is enabled by the state government and its policy, i.e. the Sarawak Digital Economy Strategy

(2018-2022), as mentioned earlier above. Support to improve telecommunications in the rural areas via SMA and empower youth with digital skills and knowledge are also outlined (Frost & Sullivan, 2020).

To facilitate the digital changes in Sarawak, SMA has begun to implement as many as 600 Sarawak Multimedia Rural Telecommunication (SMART) projects in stages in rural and regional areas. SMA is also working together with the Malaysian Communications and Multimedia Commission (MCMC) to improve the broadband services in rural and regional areas in Sarawak (Angkatan Zaman Mansang Sarawak, 2020).

In 2017, the state government has also launched the E-Com Y30 as part of its e-Commerce transformation plan. The main agenda of the E-Com Y30 is to empower the youth to drive Sarawak's digital transformation. Youths in the rural and urban areas would be equipped with technical skills and knowledge via education and supported with infrastructure and policies from 2017 up until 2030. This will, in return, increase youth employment in the digital sector in Sarawak (Borneo Post Online, 2017).

Other forms of support include (OpenGovAsia, 2019):

- Fund allocation of RM1 billion by the state government and RM500 million by the federal government for ICT infrastructure in Sarawak (The Edge Markets, 2018)
- 50Mbps internet connectivity speed for rural areas and between 100Mbps and 150Mbps for urban areas (The Edge Markets, 2018)
- Collaboration between SMA and international partners such as Huawei relating to Sarawak Digital Economy
- Collaboration between SACOFA, the leading telecommunication infrastructure provider in Sarawak, and Datastream Technology Sdn Bhd (DST) of Brunei Darussalam, relating to providing high-speed retail internet services in Sarawak
- Collaboration between SACOFA and XPERANTI on partnership for the provision of IoT solutions in Sarawak
- Digital awareness and training to rural communities via various programs such as Digital Empowerment Inclusivity Workshop, and upgrading of network system to 5G in the state (Angkatan Zaman Mansang Malaysia, 2020).

2) Population in Sri Aman

According to the United Nations, the 'youth' is defined as people between the ages of 15 and 24 (United Nations, 2020). The youth population of the Sri Aman Division is relatively small, making up only between 17%-21%. However, the working population (25-60 years old) is relatively large, making up 50% of the Sri Aman Division. The young adults (30-39 years old), which consist of 16% of the population in the Sri Aman Division, and the youths could be leveraged for digital works as these groups are considered to be the most receptive towards digitalization, in addition to being more agile and flexible than their older counterparts. This will make adequate resources to perform on tasks related to digitalization.

3) Level of Education of Population in Sri Aman

The population in the Sri Aman Division is mostly literate. In Engkilili alone, 34% of its population has received secondary education while 3.2% has received Diploma education and another 3.2% received Degree education. Being literate will make it easier for them to be further upskilled via training and other forms of educations.

4) Sarawak Second Highway network

The new highway would be connecting the Sebuyau, Lingga, and Roban districts in the Sri Aman Division (The Malay Mail, 2020). The new highway could open up Sri Aman Division as the agriculture and tourism hub in Sarawak, hence could facilitate the need for shared service centres for business process control and standardization.

2.7.5.3 *Potential Business Development Model for Digital Services in Rural Areas in Sri Aman*

Global Business Services (GBS) is a developed model for digital services and the evolution of Shared Services and Business Process Outsourcing (BPO). According to i2M Ventures (i2M Ventures, 2020), GBS “encompasses business processes, shared services and outsourcing (BPO and SSO), as well as offsite information technology and technical support services in the financial services, oil and gas, technology, logistics, and electrical and electronics industries” (GBS Iskandar, 2020).

The GBS concept is not new in Malaysia. A market report by SSON in 2019 on the state of the shared services in Malaysia revealed that about 18% of the shared services organization in Malaysia has been in existence for 10 years and above while 24% between 4 years and 10 years. Interestingly, 50% of the shared services have been around for 0-3 years and about 10% in the planning stage indicating that the shared services model is becoming more prevalent and important to leverage for business performance improvement (SSON, 2019).

To date, there are over 200 Shared Services & Outsourcing (SSO) companies consisting of major local and multinationals within the Multimedia Super Corridor (MSC) Malaysia and Malaysia is already home to many shared services divisions of banking, financial services, and insurance (BFSI), energy and transport & logistics companies” (i2M, 2020).

2.7.5.3.1 *Case Studies*

GBS is an important industry to support digitalization initiatives in Malaysia. Currently, a few states in Malaysia are adopting the GBS model to lead in the digitization era i.e. Kuala Lumpur, Johor (Iskandar Puteri), Penang, Ipoh, and Sabah:

Kuala Lumpur

Most of the shared services division of banking, financial services and insurance (BFSI), energy and transport & logistics companies are located in Kuala Lumpur (KL) and is one of the largest shared services cluster in the country.

KL has the advantage of setting up a GBS/SSO attributed by the following characteristics (i2M, 2015):

1. Ranking 6th Ease of Doing Business in the World (World Bank, 2014)
2. Ranking 3rd Global Services Index List in the World (AT Kearney, 2013)
3. Ranking 8th Network Readiness Index in Asia Pacific (World Economic Forum, 2013)
4. Ranking 5th Human Capital Index in Asia Pacific (World Economic Forum, 2013)
5. Ranking 5th Safest Country in Asia Pacific (Green peace Index, 2013)

Johor (Iskandar Puteri)

An initiative of i2M Ventures, Iskandar Puteri is an example of a successful implementation of a global business service (GBS) centre. Since 2016, i2M Ventures has been working towards promoting Iskandar Puteri as the Business Process Outsourcing (BPO) and SSO hub of the south due to its advantage as a

lower cost centre supported by the favourable exchange rate and more competitive rental and labour costs. According to i2M Ventures, average annual salaries for graduates with a bachelor's degree in Johor Bahru start at USD 7,500 (RM 30,536), while office rents start at USD 1.50 per square feet (PSF) (RM 6.10 PSF) (GBS Iskandar, 2020).

Today, Iskandar Malaysia in Johor Bahru is known as a regional gateway for GBS. Due to its proximity to Singapore, which is just a 40-45 minutes' drive away, many local and foreign companies that are looking to penetrate Singapore or Asia-Pacific market, can take advantage of the lower costs of setting up operations and human resources in Iskandar. In 2015, i2M Ventures had attracted six companies to set up outsourcing centres or back offices in Iskandar Puteri and created 2,269 jobs with a total income of RM1.2 billion where about 90% of these employees were from Johor.

Iskandar has been able to attract many multinational companies (MNC) over the years. Many companies set up in Iskandar serve clients from around the world in United States (US), Europe, and Asia-Pacific. Examples of companies that have invested in Iskandar are Aegis, Deluxe Games (gaming developer), Vistra, OK Blockchain.

In 2017, Iskandar Puteri has also been selected as the core data center of TM One, the business solutions arm of Telekom Malaysia Berhad (TM) Group. The TM ONE Iskandar Puteri Data Centre (IPDC), located in Nusajaya Techpark, is positioned to capture a slice of the regional market by offering high-value managed services including cloud computing, virtualization, workspace, and collaboration services TM One, 2020).

To attract investors into Iskandar Puteri, several incentives have been outlined and offered to investors, such as:

1. 10-year tax exemption under the Iskandar Regional Development Authority (IRDA)
2. 15% Tax Rate Scheme for Knowledge Workers in Iskandar Malaysia
3. MSC Malaysia status*

*Note: MSC Malaysia status is a recognition awarded to ICT and ICT-facilitated businesses that develop or use multimedia technologies to produce and enhance their products and services. The recognition is awarded by the Government of Malaysia through the Multimedia Development Corporation (MDeC). Under the MSC status, companies can enjoy various benefits such as tax exemptions, R&D grants, unrestricted employment of foreign knowledge workers, IP protection etc.

Penang (Buletin Mutiara, 2019)

GBS One Mahsuri is a new GBS facility with a size of 80,000 sq ft located in Bayan Baru, Penang. The role of the facility is to provide investors with a conducive enterprise workspace and environment while supporting talents worldwide and offering job opportunities to locals. As Penang is known as the Silicon Valley of the East and has attracted many multinationals to operate in the state, the GBS facility will particularly be complementing the electrical and electronics-related manufacturing sector.

Currently, there are more than 60 companies with GBS operations in Penang, with some having no physical manufacturing presence but has opted to establish their shared services operations in the state. Examples of companies that have established their GBS in Penang are B. Braun, Cypress, Intel, Jabil, Motorola, Osram, and Seagate (with physical manufacturing presence), Celestica, First Solar, Swarovski, and UST Global (with no physical manufacturing presence).

Ipoh (NCER Malaysia, 2020)

GBS@IPOH is a new initiative that was implemented in Perak in 2019 by the state government in collaboration with the Northern Corridor Implementation Authority (NCIA) to support North Corridor Economic Region (NCER) promoted economic clusters i.e. Manufacturing, Agribusiness, Tourism, and Logistics. The initiative will spur Ipoh town as the next hub for GBS@NCER investment growth centre, providing a cost-effective location, an abundance of multilingual workforce, and easy access to the rest of the established GBS ecosystem in Klang Valley and Penang.

The GBS@IPOH is expected to create more than 1,500 job opportunities with high-income knowledge workers from various sectors ranging from finance, human resource, robotics and automation, enterprise resource planning (ERP), and IT including big data analytics, software development, cloud computing.

The NCIA has introduced attractive incentive programs to attract investors to be located in GBS@IPOH such as:

1. NCER Tax Incentives Package
2. NCER Talent Enhancement Program (NTEP)
3. Dana Mudahcara Bumiputera@NCER for financial assistance to potential investors

Examples of companies which have invested in GBS@IPOH are:

1. Volgo Sdn Bhd - software development, ERP
2. TecCSA Sdn Bhd – programming, ERP, finance and accounting, payroll
3. Revoluteq Sdn Bhd. – application management, development and maintenance; data analytics, robotics process automation etc.
4. Puncak Tegap Sdn Bhd – blockchain, R&D on application development for eLand systems for International Market
5. DigitalQ Solutions Sdn Bhd - Internet of Things (IoT), Industrial Internet of Things (IIOT), Cloud Computing application development, data analytics

Sabah

In 2016, Sabah was picked as the fourth SSO hub after Klang Valley, Penang, and Iskandar by MDEC with the recognition award of Multimedia Super Corridor (MSC) Malaysia status to NXG Global Sdn Bhd, a subsidiary of Hong Kong-based Nexgen Biopharma Group (Digital News Asia, 2020).

NXG Global Sdn Bhd is the first Sabah-based company to receive MSC status in East Malaysia. Having two locations in Kota Kinabalu, its shared services focus on wellness, beauty, and health (WBH) industry and offers multi-functional Business Process Outsourcing (BPO) services, covering areas in Financial, Accounting, Sales, Marketing, Customer Contact Management, IT, Warehousing, and Design and Creative. NXG Global supports customers from Malaysia as well as overseas from Hong Kong, China, Germany, and Switzerland. Sabah is also strategically located to facilitate business with countries in the Northeast Asia region i.e. China and Hong Kong (NXG Global Website, 2020).

Other than the WBH industry, NXG Global is also looking to expand into the tourism industry which is one of Sabah's economic strengths (Digital News Asia, 2020).

In addition to NXG Global, Sabah has launched its first Shared Services and Outsourcing (SSO) Business Platform which provides integrated food supply chain services. The main agenda of the SSO is to help SMEs and entrepreneurs increase business productivity as well as to expand the business to wider locations in and outside of Sabah (The Borneo Post Sabah, 2016).

From the case studies above, it is noted that the following attributes are important to make it feasible to establish a GBS hub in a location:

1. Government initiatives to accelerate economic development in the state and region e.g. NCER and Iskandar
2. Strategic location to access local and international markets including cross-border business
3. Conducive and viable environment e.g. ease of doing business, safety, skilled workers etc.
4. Local industries and businesses
5. Number and types of companies established in the location creating demands to complement existing businesses
6. Location attractiveness e.g. lower costs, availability of incentives and infrastructure

Potential of GBS model in Kuching and Sri Aman

To accelerate economic growth, most appropriate GBS model that could be established in Sarawak is the hub-and-spoke model, where Kuching will act as the center of business services serving clients both locally and globally, and several supporting nodes based in areas outside of Kuching such as Kota Samarahan, Sri Aman, Bintulu, Miri, etc. for processing-related tasks as well as supporting unique local demands and requirements as mentioned earlier above.

The GBS hub/organization would not deliver all functions, but rather it is the umbrella for several functions placed in scope and has multiple service delivery models in place in various locations or geographies. The hub in Kuching can house transactional activities and back-office processing such as benefits administration, workplace policies, buying and selling of products, accounts, invoices, etc., while local centers like Sri Aman can house standard non-transactional activities that require local understanding and skills such as integrated data warehouse, call center, customer service, development of site-specific policies, etc.

This concept is developed in our proposals in Volume B of this Report.

2.7.5.4 Opportunities

As highlighted above, the GBS hub-and-spoke model is the most suitable for Kuching and Sri Aman as it can help to maintain Kuching's position as the premier business and commercial centre in Borneo owing to its population size and strategic location to access local and international markets including cross-border business, as well as help to accelerate economic development in Sri Aman Division. GBS or SSO is now trending as there has been a burst of demand for shared services due to Covid-19. Potential activities for the proposed shared services in Kuching would be services for the bank, insurance, staffing and workforce, training and development, and data management centre, while in the Sri Aman Division would be customer support activities, call center, data center disaster recovery centre, tourism centre, and domestic staffing and talent related to support the hub in Kuching as well as to support district industrial and commercial activities.

However, Sarawak would need to address a few issues to establish itself as a GBS hub with spoke locations. First and foremost, there are not many shared services in Sarawak simply because not many MNCs are located in Sarawak due to lack of ease of doing business and proper infrastructure needed to make GBS a success, i.e.:

1. T1 private network lines
2. Redundant power supply
3. Grade A building spaces
4. Data centers and disaster recovery center

Some ways to improve the ease of doing business includes increasing the visibility and awareness of Sarawak and the Sri Aman Division in particular, as well as to take into account what is available there and subsequently promote those. On top of that, Sarawak needs to increase awareness on the importance of digital services to businesses in urban and rural areas so that the population in the Sri Aman Division would be more receptive to change in time to come.

The cost involved such as electricity, labor (human resource/talent), and setting up the office/facility should also be considered. Generally, there is a huge talent pool in Sarawak but they need upskilling to participate in the digital services industry. Hence, incentives to support the development of shared services facilities in Sarawak and Sri Aman would be indeed helpful.

Finally, to sustain the GBS or shared services infrastructure and facility, it is important to do market development that involves domestic companies. This can then help to rejuvenate domestic economic activities and create more white-collar job opportunities to retain the local population in Sri Aman Division, particularly the youths, hence reducing unemployment to mitigate the social impact.

2.7.6 Business, Commerce & Services

The agricultural sector is the largest non-service contributor to the division's economy. The main agricultural activities in Sri Aman Division include oil palm, paddy, pepper, rubber, and livestock. There are more than 13,000 farming families identified spread out in the three main agricultural areas in the Sri Aman Division, namely Sri Aman, Lubok Antu, and Pantu (Sri Aman Agriculture District, 2020).

The local economy of the Sri Aman Division is largely composed of wholesale and retail trade activities. Simanggang Town is a lively center especially for their morning market where locals sell a variety of agricultural produce, jungle products, indigenous handicrafts, local delicacies, fresh-water fish, prawns, and a range of seafood (sarawak2discover, 2019). Many of the local population are believed to be participating in the informal sector particularly in small format retail stores, or in local markets. They principally trade in dry and wet food, daily necessities, and other essential items.

2.7.6.1 Commerce in Sarawak and Sri Aman

The services sector consists of industries such as wholesale and retail, food & beverage, tourism industry among others. The wholesale and retail industry is also known to be under commerce and trade hence the terms "commerce" and "wholesale and retail" were used/ will be used interchangeably to describe trading activities throughout this report.

Commerce and trade generally mean business activities within an industry that involves the distribution of large-scale goods and services, that includes sales, transfer, or exchange of goods and services produced by the industry. On the other hand, wholesale and retail trade is concerned with procuring products of goods and services at a large scale from the manufacturer, storing goods in a warehouse, and selling them to business and final consumers (Montalvo et. al, 2011).

The services sector has played an instrumental role in contributing to the Sarawak state GDP and growth for the past half a decade where it contributed more than one-third of Sarawak's GDP (Sri Aman Division Tourism Action Plan, 2017). The commerce industry makes up about one-fifth of the services sector, followed by the utilities, transport, storage, and communication industries, and contributed a total of 22.5% overall to the services sector in Sarawak State (New Sarawak Tribune, 2019). Utilities, transport,

storage, and communication sector has contributed almost one quarter for the State's services sector, followed by wholesale and retail trade.

Referring to Table 2-113, the services sector contributed 33.4% of the Sarawak state GDP with about 180,300 persons employed in the Sarawak state within the wholesale and retail trade industry in 2017. The same trend was observed in the Sri Aman Division GDP breakdown by economic activity whereby, the services sector contributed 67% of the Sri Aman Division's GDP in 2017.

With a CAGR of 6.2% from 2015 to 2019, the services sector has been consistently growing since 2015 and contributed up to 35.8% to the overall Sarawak State GDP in 2019.

**Table 2-113: Sarawak State GDP Breakdown by Economic Activities
(in RM Million and (% contribution), 2015-2019)**

Kind of Economic Activity	2015	2016	2017	2018	2019	CAGR
Agriculture	16,987.9 (14.0%)	16,631.9 (13.4%)	16,728.0 (12.9%)	16,556.3 (12.5%)	16,518.4 (12.1%)	-0.7%
Mining and quarrying	29,852.4 (24.6%)	29,252.9 (23.5%)	30,213.5 (23.2%)	29,688.8 (22.3%)	29,601.6 (21.7%)	-0.2%
Manufacturing	32,128.3 (26.4%)	33,566.6 (27.0%)	34,811.0 (26.7%)	35,579.1 (26.8%)	36,615.2 (26.9%)	3.3%
Construction	3,842.6 (3.2%)	3,633.4 (2.9%)	4,354.6 (3.3%)	4,400.402 (3.3%)	4,462.65 (3.3%)	3.8%
Services	38,369.7 (31.6%)	40,982.0 (32.9%)	43,541.2 (33.4%)	46,285.9 (34.8%)	48,767.3 (35.8%)	6.2%
Import Duty	404.3 (0.3%)	446.3 (0.4%)	520.2 (0.4%)	470.2 (0.4%)	313.5 (0.2%)	
Total	121,585.3	124,512.9	130,168.6	132,980.7	136,278.6	2.9%
Y-o-Y growth		2.4%	4.5%	2.2%	2.5%	

Source: Department of Statistics Malaysia, Frost & Sullivan Analysis

It was estimated that the services sector contributed RM1.86 billion (66.9%) to Sri Aman division's GDP in 2017, followed by agriculture which contributed to 16.7%.

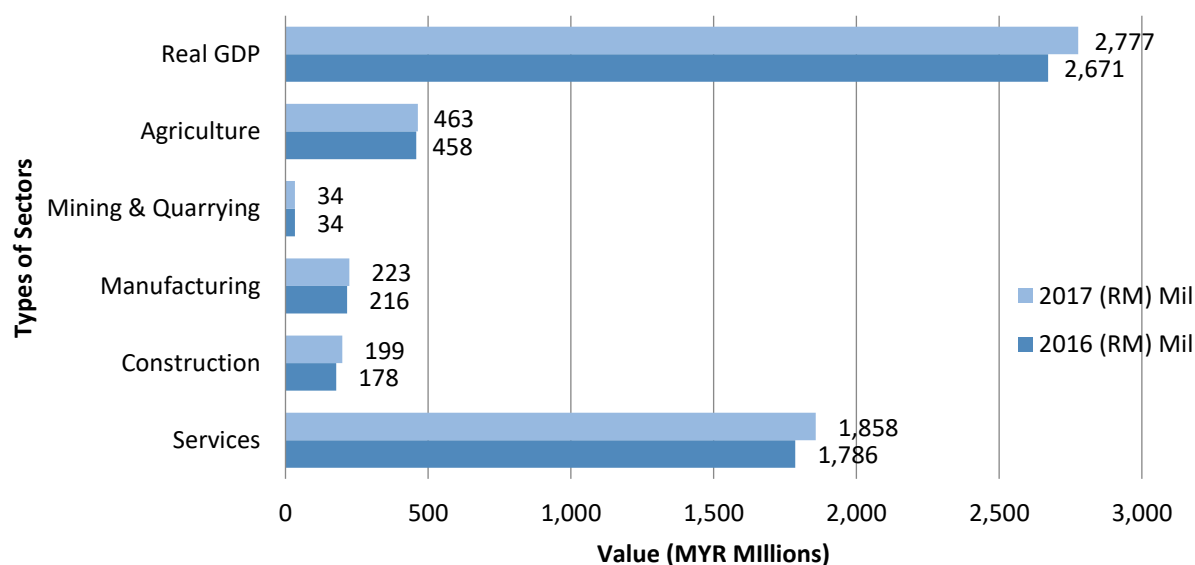


Figure 2-76: Sri Aman Division GDP Breakdown by Economic Activities, 2016-2017

Source: State Planning Unit (Aug 2017)

While there are major agricultural activities taking place in Sri Aman, it is undeniable that the services sector too has been contributing a large portion to the Division's GDP and it is primarily driven by the wholesale and retail trade industry. The trend can be further observed in terms of the number of establishments for the wholesale and retail industry in Sri Aman Division. The economic composition of the Sri Aman Division can be seen in the following:

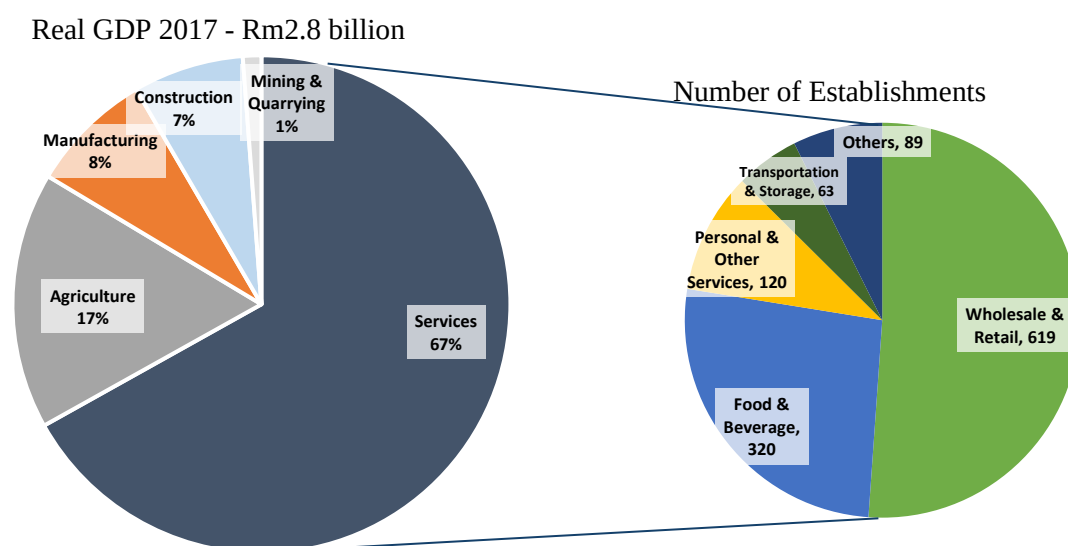


Figure 2-77: Sri Aman Division Economic Composition, 2017

Source: State Planning Unit (Aug 2017)

Note: Number of establishments statistics based on 2015 census data.

From the above figure, it is observed that the Sri Aman Division has a total of 1,211 services establishments, with 619 establishments from the wholesale and retail industry, contributing about 50% of total establishments in the services sector.

Growth trends

In 2019, a census was conducted on the 'Wholesale and Retail Trade' where statistics were provided to the level of the Sri Aman division. Findings of the 2014 census, with the reference year 2013, showed there were a total of 26,948 wholesale and retail trade establishments operating in Sarawak with the value of gross output generated of RM11.1bil, while the value-added output was RM7bil. Within just a short 5-years span, the 2019 census, with the reference year 2018, showed that the total number of wholesale and retail trade establishments operating in Sarawak has increased to 33,860, with a 4.7% annual growth rate, where the value of gross output generated has also increased to RM17.2bil with an annual growth rate of 9.2%, and the value-added has reached RM11.0bil in 2018 with an annual growth rate of 9.5% (Penerbitan Banci Perdagangan Borong & Runcit, 2019).

From Figure 2-78, the growth trend is seen as mainly centred in the larger urban centres, and is not reflected in Sri Aman.

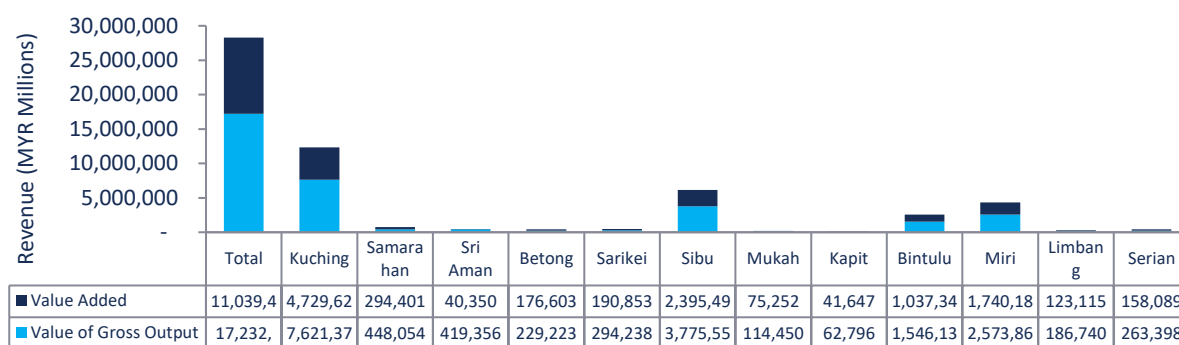


Figure 2-78: Value of Gross Output and Value Added for Wholesale and Retail Trade Industry, by Division, Sarawak, 2018

Source: Wholesale & Retail Trade Census 2019

2.7.6.1.1 Digital Economy

One of the challenges that local wholesalers and retailers in Sarawak are currently facing is the disruption of digitalisation and the advent of global e-commerce that causes traditional brick and mortar stores or retailers to rethink their existence and business sustainability in the long run due to digital commerce platforms ability to offer more competitive pricing (The Malaysian Reserve, 2020). Based on this reason, there is an urgency to develop better telecommunications, internet facilities, and infrastructure nationwide, and particularly in rural areas, so that the opportunities for market access through the digital commerce platforms are accessible to all, both wholesalers, retailers, and consumers, regardless of location. In the long run, these infrastructure developments would also help in retaining and growing domestic population size, and create more job opportunities within the Division, and as the economy grows, the value of gross output and value-added from Sri Aman Division would also be able to see significant growth.

In his speech in 2017, Chief Minister of Sarawak State, Abang Johari Tun Openg stated that the State Government has allocated RM2bil to lay down fibre optic cable, facilitate cloud computing, and provide satellite connection to cover the whole of Sarawak. This initiative has intended to boost internet connectivity throughout the state and also with a keen eye to develop digital village and data centers, promote e-learning among younger generations, encourage more young entrepreneurs, and connecting and integrating with rural villages to the rest of the world by bringing in telemedicine, e-learning, and e-commerce to their everyday life (The Borneo Post, 2019).

CM Abang Johari also reiterated that the State transition into digital commerce and the digital economy was necessary as the State has an overreliance on natural resources, which may have a risk of echoing China's economic consolidation that has led to a fall in commodity prices. While the Sarawak government spearheads the development of the digital economy in the State, digital commerce can be leveraged for new growth of both the Sarawak State and Sri Aman Division (Sarawak, 2019).

2.7.6.2 Summary

Overall, the wholesale and retail trade industry has seen commendable annual growth rates of 9.2% and 9.5% respectively from 2014 to 2019 for its value of gross output and value-add in Sarawak. While in the Sri Aman Division, the wholesale and retail trade industry are still observing steady growth, it is additionally poised to play an important role in contributing to Sri Aman Division's GDP in the future.

Based on current trends, the wholesale and retail trade industry can prove to serve as a potential catalyst assisting in achieving Sarawak's vision of becoming a developed state by 2030.

With the state of the retail industry in Sri Aman Division still being very inward-looking with minimal trade among surrounding divisions and across borders to the rest of Malaysia, the growth and future of the wholesale and retail trade industry in the Division is seen as very much driven and supported by domestic population and income growth that is dependent on productive sectors.

The wholesale and retail trade involve the distribution and selling of agricultural products, processed food, livestock, and other local value-added products from the Sri Aman Division to the rest of Sarawak and Malaysia, will be one of the key enablers of development and growth in the Division. Currently, the existing agriculture and livestock industries are limited by market access. With a mature wholesale and retail trade industry in Sri Aman Division, other industries like manufacturing and construction, are also able to tap into the industry and allow further expansion of the local market and increase the visibility and demand for Sri Aman's local products and services. Additionally, this could also be a good opportunity for local business owners and entrepreneurs to enhance their entrepreneurship capabilities.

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PART 3 **PRODUCTIVE SECTORS**

SECTION 3.1 AGRICULTURE & LIVESTOCK

The objective of this Study is to formulate a development Master Plan for the Sri Aman Division from 2021 up to 2030 with strategies to ensure a high and sustainable economic growth for the Division. The plan's aims are to identify specific strategic economic drivers and development enablers to guide the Division's economic, social, physical and environmental development.

In terms of agriculture development, emphasis will be given to the increasing the rural farm income to RM5,000 per month, thereby reducing disparity between the urban and rural sector, as well as contributing to Sarawak's food self-sufficiency targets and food security, and to be an exporter of some food products by 2030.

To achieve these objectives, the focus will be on the commercialisation of agriculture, technological innovations, and development approaches & business models that can accelerate agriculture growth and achieve a quantum leap in agricultural production and trade.

3.1.1 The Wider Picture – Agriculture in Sarawak

3.1.1.1 Agriculture Contribution to the State Economy

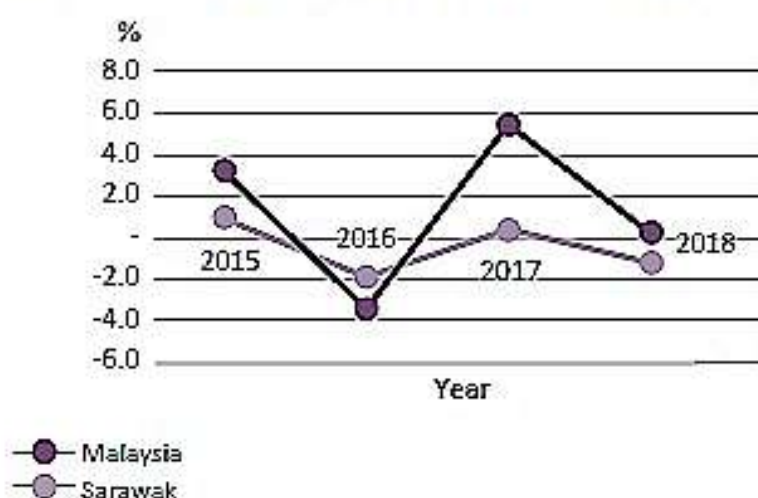
The Agricultural sector in Sarawak has been viewed as of the most important sectors to the state's economy. The agriculture growth rate has shown a positive trend as shown in Table 3-1 and Figure 3-1. The agriculture sector grew at an average of 2.60 percent over the last 7 years (2011 – 2018).

Table 3-1: Annual GDP growth of the Agriculture Sector in Sarawak 2011-2018 (Constant 2010 prices)

Components	2011	2012	2013	2014	2015	2016	2017	2018	Average Growth Rate (%)
Agriculture GDP in 2010 prices	12,915	13,388	13,733	14,859	15,183	14,778	14,992	15,267	
Annual Growth Rate of the Agriculture Sector (%)	8.8	3.7	2.6	8.2	4.6	-2.66	1.45	1.80	2.60

Source: DOA Agriculture Statistic of Sarawak 2015 & 2019

Figure B.11: Annual growth rate of the Agriculture Sector



Source: Department of Statistics Malaysia, 2018

Figure 3-1: Annual Growth Rate of the Agriculture Sector in Sarawak

In 2018, the state agricultural and forestry sector contributed about 12.80 percent to the gross domestic product (GDP) (Table 3-2).

Table 3-2: Contribution of Agriculture & Forestry Sector to the Sarawak State Economy In 2018 (at 2010 prices)

Agriculture GDP (RM million)	% of Total GDP	Agriculture Employment	% of Total Employment
15,267	12.80	259,200	20.3

Source: DOA Agriculture Statistic of Sarawak 2019

The agriculture GDP is very much dominated by the crop & livestock subsector contributing about 79.90 percent of the agriculture GDP in the state in 2018. This is followed by the forestry & logging subsector at 15.16 percent, and fisheries subsector contributing about 4.94 percent (Table 3-3).

Table 3-3: Agriculture GDP by Type of Commodities in 2018 for Sarawak

Sub-Sector	Value-Added (RM million)	%
1 Crops & Livestock	12,199	79.90
2 Fisheries	755	4.94
3 Forestry & Logging	2,314	15.16
Total	15,267	100

Source: DOA Agriculture Statistic of Sarawak 2019

In term of employment, the agriculture labour force has shown a decreasing trend from 26.9% (at 331,500) in 2014 to 20.3% in 2018 (at 259,200), decreasing at 1.65% per annum. (Table 3-4).

Table 3-4: Contribution of Agriculture & Forestry Sector to the Sarawak Labour Force 2014- 2018

	2014	2015	2016	2017	2018	Average Growth Rate
Agriculture & Forestry	26.9	25.1	24.7	23.9	20.3	-1.65

Source: DOSM

The commodities sector in Sarawak which covers palm oil, rubber, timber, cocoa and pepper is one of the main contributors to the country's export earnings, with the state's commodities sector export value amounting to RM13.30 billion in 2018.

Table 3-5: Trade Deficit in Food 2014-2018

	2014	2015	2016	2017	2018
Imports	4,100.0	4,216.2	4,438.7	4,612.4	4,762.3
Export	1,050.0	1,160.1	1,169.2	1,017.3	901.5
Trade Deficit	3,050.0	3,056.1	3,269.5	3,595.1	3,860.8

Source: DOA 2019

However, the food import bill for Sarawak reached RM4.77 billion in 2018. Its outshined exports at RM 1.10 billion, leaving a deficit of over RM3.67 billion (Table 3-5 and Figure 3-2).

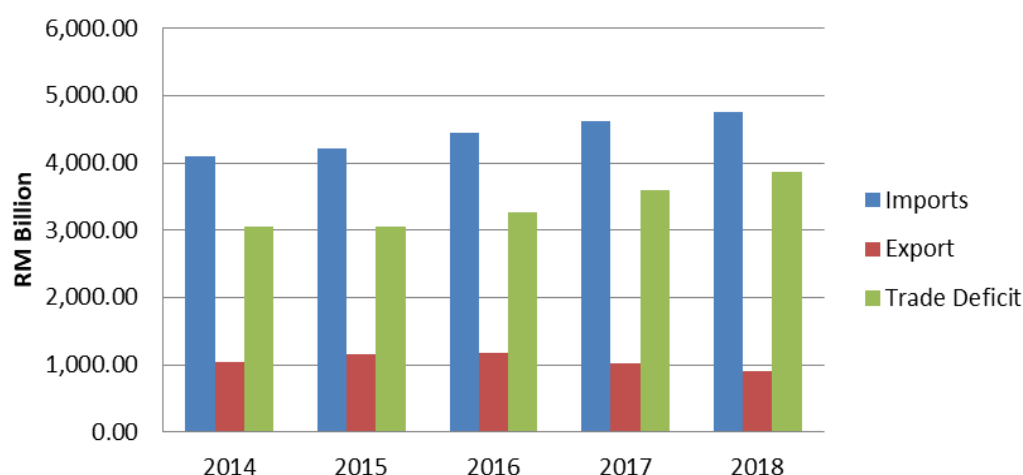


Figure 3-2: Food Trade in Sarawak 2014-2018

Source: DOSM

Table 3-6 shows the major food items imported during the period 2015-2018. Some of the major food items imported were cereals, vegetable & fruits, feed stuff & meat.

Table 3-6: Major Food Imports of Sarawak 2015-2018

Principal Food Imports	Value of Imports (RM million)			
	2015	2016	2017	2018
Meat & Meat Preparation	269.5	253.0	330.2	338.0
Dairy Products & Birds Eggs	185.2	164.1	289.8	241.9
Cereal & Cereal Preparations	1,021.2	986.3	1,052.8	1,156.9
Vegetable & Fruits	518.7	574.5	546.0	533.4
Sugars & Honey	266.3	304.8	275.5	243.2
Feed Stuff for Animals	366.3	365.2	430.6	462.8
Beverages	514.8	534.7	533.7	589.7

Source: DOSM

Although the contribution of the agricultural sector to the state economy is expected to decline gradually in line with the trends of the national economy, the sector is still expected to play a major role in the state economy and rural development. Agriculture is not only a source of employment and income for the rural people but also a source of raw materials for expanding food and non-food processing industry in the state.

The continued growth of the agricultural sector in Sarawak, however, is contingent to the state addressing the challenges of efficient and optimal utilization of existing resources in order to improve further its competitiveness. Resource constraints and rapid changes to the global trading & investment environment necessitate the development of a resilient agriculture sector in Sarawak.

The high costs of labour and land have also made the state less competitive in agricultural products compared to neighbouring countries like Indonesia. Despite these constraints, the agricultural sector remains important and can be enhanced to contribute still further to the state economy. Agricultural activities will continue to be dominant in income generation and employment in the state.

3.1.1.2 Sarawak Land Use

The physical land area of Sarawak, as of 2018, is about 12,402,600 hectares, of which, 2,036,300 hectares are used for agriculture i.e. about 16.4 percent of the total area (Table 3-7, Figure 3-3). Forest and swamp land occupy about 10,081,300 hectares or about 81.3 percent of the physical area of Sarawak.

Table 3-7: Land Use of Sarawak 2018

No.	Land Use Category	Hectares	%
1	Primary & Secondary Forest	8,372,200	67.5
2	Sparse Forest / Swamp	1,709,100	13.8
3	Grassland	45,600	0.4
4	Cleared Land	160,700	1.3
5	Industrial Plantations	1,895,300	15.3
6	General Agriculture	141,000	1.1
7	Aquaculture	800	0.01
8	Urban	77,900	0.6
	Total	12,402,600	100.0

Source: Govt of Sarawak, Facts & Figures 2017

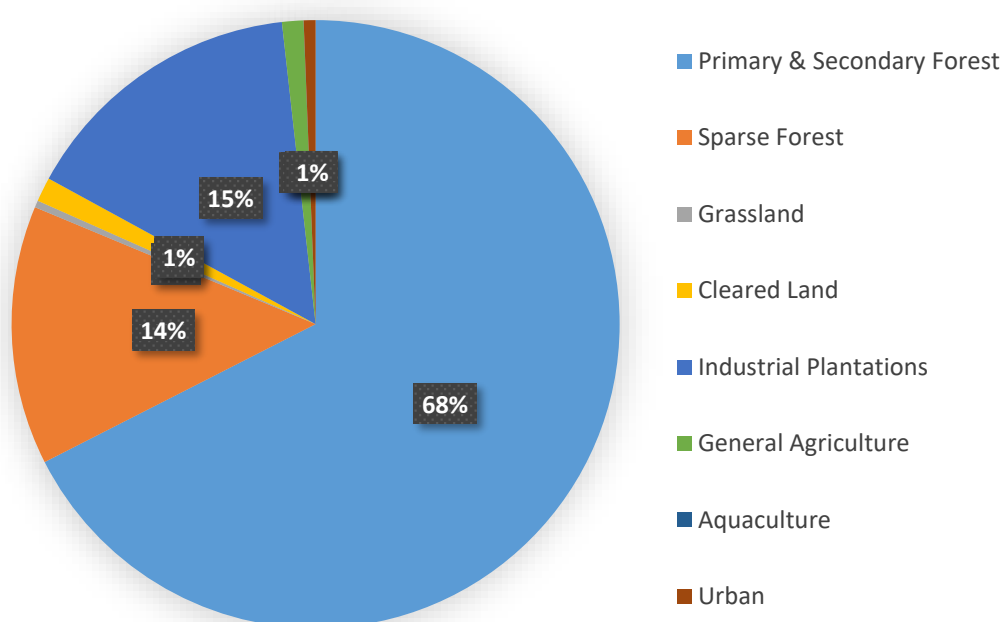


Figure 3-3: Existing Land Use of Sarawak 2018

Source: Govt of Sarawak, Facts & Figures 2017

3.1.1.3 Crop Development

The distribution of the crop subsector in the state in 2018 is shown in Table 3-8. In terms of land use, the crop sector is dominated by oil palm and rubber which covers about 86.9 percent of the planted area.

Table 3-8: Distribution of Crop Sector in Sarawak 2018

	Crop	Hectare	%
1	Rubber	166,636	8.4
2	Pepper	16,798	0.8
3	Paddy	135,426	6.8
4	Sago	40,641	2.0
5	Coconut	13,260	0.7
6	Oil Palm	1,555,828	78.5
7	Cocoa	6,862	0.3
8	Fruits	37,467	1.9
9	Vegetables	5,078	0.3
10	Spices	535	0.0
11	Others	4,014	0.2
	Total	1,982,545	100

Source: DOA Agriculture Statistics of Sarawak 2019

The area for food production is only about 2.7% of the total agricultural land use. There is now a policy to allocate more land for food production to ensure food security and to reduce the trade deficit in food products.

Sarawak is now embarking on vigorous measures in strengthening the state's food security and reduction in food trade deficit that stood at about RM3.8 billion in 2018. Sarawak's abundant resources such as arable land and water offer competitive advantage in the production of food crop with the depleting agricultural land areas. Combined with the modern farming technologies, the food sub-sector has the potential to dominant the agriculture sub-sector in the future.

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3.1.1.4 Livestock Development

The non-ruminant sector of the state's livestock industry, made up of poultry and pig, forms the biggest sector in terms of production value. The 2018 ex-farm production value is estimated to be around RM382 million for chicken eggs, and RM700 million for poultry meat. The pig industry contributed to about RM400 million (Table 3-9).

The ruminant sector, comprising mainly of cattle and goat, is lagging behind in terms of production. The estimated ex-farm production value of beef in the state is RM22.87 million, with RM3.36 million estimated for mutton.

In term of numbers, the state 2018 inventory of livestock were 14,520 head of cattle, 6,334 buffalo, 15,178 goats, 2,766 sheep, 29,521,448 chicken, and 453,415 swine.

Table 3-9: 2018 Annual Livestock Production, Values & Self Sufficiency Level

Livestock product	Quantity (metric tonnes)	Production Value (RM mill)	Self-Sufficiency Levels (%)
Beef	389	22.87	12
Mutton	134	3.36	5
Poultry	80,000	700	130
Eggs	75,000	382	110
Pork	30,000	400	150
Total	186,306	1,501	

Source: Department of Veterinary Services Sarawak (DVSS)

Over the last 5 years, there has not been any significant increase in the population of cattle and goat. The estimated CAGR (compound annual growth rate) for cattle and goat over the five period 2014-2018 is 3.72 % and 1.08% respectively. During the same period, however, sheep, pig and chicken experienced declines in population with negative CAGR of 1.35, 7.81 and 1.95 respectively (Table 3-10).

Table 3-10: Livestock Population and CAGR Sarawak 2014-2018

Livestock	2014	2015	2016	2017	2018	CAGR 5 years (%)
Cattle	12,096	10,840	9,734	14,381	14,520	3.72
Buffalo	6,002	5,396	5,531	6,042	6,334	1.08
Goats	15,021	14,363	12,747	12,694	15,178	0.20
Sheep	2,961	2,811	1,932	2,517	2,766	-1.35
Swine	681,068	795,596	209,559	203,718	453,415	-7.81
Chicken	32,579,155	32,367,038	10,377,114	34,313,884	29,521,448	-1.95

CAGR = compound annual growth rate

Source: Department of Agriculture Sarawak 2006 - 2014, Department of Veterinary Services Sarawak 2016**

The breakdown of livestock numbers by division in 2019 is shown in Table 3-11. Buffalo is mainly found in the Limbang division, while cattle are largely found in the Kuching, Samarahan and Serian divisions. There is also large concentration of goats in these south-western divisions of the state, although sizeable numbers (38% of total population) are farmed in the central divisions of Betong (2,766 goats) and Mukah (1,066 goats). While about one third of the total commercial pig population in the state are found in farms located in Serian division, the same proportion of the state population of native pig are reared in the Sarikei Division (29%).

Table 3-11: Livestock Numbers by Division in 2019

Division	Swine	Rabbit	Chicken	Ducks	Puyuh
Kuching	39,600	255	21,896,242	44,585	0
Sri Aman	13,597	0	133,209	2,680	0
Sibu	21,022	2,190	6,838,673	7,350	0
Miri	58,773	0	4,325,700	21,390	0
Limbang	7,598	0	49,623	5,380	0
Sarikei	26,732	1,362	1,809,474	34,620	400
Kapit	5,273	0	72,260	0	0
Samarahan	257,898	0	12,883,200	45,310	36,300
Bintulu	1,505	220	1,157,400	8,630	350
Mukah	2,073	317	44,891	3,784	950
Betong	9,299	0	27,550	5,358	0
Serian	10,045	0	10,993,000	20,000	890
Total	453,415	4,344	60,171,222	199,087	38,890

Source: DVS Sarawak 2019

The administrative divisions of Serian, Kuching, and Sibu have the greatest number of commercial chicken breeds farmed in the state for the year 2016 with standing population figures of 4,117,970 heads, 2,617,304 and 1,906,945 respectively. Ducks are mainly farmed in the Sarikei and Miri divisions while quails are almost entirely farmed in the Samarahan division.

Sarawak is also an exporter of chicken eggs, pork, birds' nest and day-old chicks. The major markets are Singapore, Indonesia, Hong Kong, West Malaysia, Brunei (Table 3-12).

Table 3-12: Export of Livestock Products 2019

Commodity	Quantity	Units	Country	Value (Rm)
Chicken egg	50,215,680	PCS	Hong Kong, Maldives, Indonesia & Brunei	14,060,390
Live porker	56,050	HDS	Singapore	56,276,402
Frozen pork	219,724	KG	Singapore	17,001,408
Bird nest	9,534	KG	Hong Kong, China & Taiwan	68,166,341
Chicken	257,500	KG	West Malaysia & Indonesia	1,854,000
Day old chicks	2,751,860	HDS	Brunei	7,705,208

Source: DVS Sarawak 2019

3.1.1.4.1 State Veterinary Health Status

The state of Sarawak has been privileged in that it has been able to maintain a disease-free status from most major livestock diseases such as Rinderpest, Blue tongue, Bovine spongiform encephalopathy, Aujeszky's disease, swine fever, and avian influenza (e.g. HPAI H5N8). Haemorrhagic septicaemia (HS) that affects the highland buffaloes are under control with annual HS vaccinations by DVSS. Ranikhet disease is present but is a preventable disease through vaccinations.

Since 2004, Sarawak has been recognised as an OIE FMD free zone without vaccination according to the provisions of Chapter 8.8 of the Terrestrial Code

The states classical swine fever and FMD free status plays a very important role in allowing the export of animal products into foreign markets as seen in the case of the acceptance of Sarawak produced pork into Singapore.

Certification of food safety and quality for food of animal origin under Malaysian Good Agriculture Practice (My GAP) certification scheme certifies animal farms: cattle, buffalo, deer, sheep, goat, poultry, and edible-nest swiftlet ranching premises. This is also important criteria to be met if livestock products for export are to be considered for importing countries.

3.1.1.4.2 Livestock Development Strategies

The DVSS under the state Ministry of Modernisation of Agriculture and Regional Development (MANRED) has the following development strategies for the state livestock industry.

1. Private Sector Participation in livestock farming area (LFA) development, cattle fattening, dairy clusters and new pig farming area.
2. Government intervention in cattle integration under oil palm.
3. Livestock entrepreneurship development in rural areas as in swiftlet rearing, buffalo and goats, free range chicken and local pigs.

In general, the department's overall objectives are to increase local production of livestock and thereby increase the SSL and reduce imports for beef, mutton and dairy produce in line with the National Agrofood Policy 2011-2020.

In particular, the department is taking ruminant development as the way forward in its livestock development plan. Along this line, cattle integration management is to be strengthened through intensified training and promotion. Further, the development of its livestock production stations at Temudok, Layar, Karabungan, Maragang, Batu Danau is to be further developed.

Table 3-13: Livestock industry Target Production Value & Self Sufficiency Level (SSL) 2015 – 2030

Parameters/Year	2015	2020	2025	2030
Production value (RM)	1.5 billion	2.0 billion	2.75 billion	4.0 billion
Export value (RM)	100 million	250 million	600 million	1,000 million
SSL Poultry	90%	110%	120%	130%
SSL Beef	10%	20%	30%	50%
SSL mutton	15%	25%	35%	50%
SSL Milk	0.7%	25%	75%	110%
SSL Eggs	102%	107%	115%	120%
SSL Pork	100%	110%	125%	150%

Source: DVS Sarawak

3.1.1.5 Modernization of the Agriculture & Rural Sector in Sarawak

Sarawak stands to gain significantly from further agriculture development due to its huge amount of land which is rich in bio-resources that can be taken advantage of.

As one of the states that relies substantially on food imports, the cultivation of crops and agriculture produce in Sarawak is one of the solutions to help address the situation.

The development of agriculture produce will enable rural communities to earn more income through the marketing and exports of their crops and produce. Smallholders and commodities entrepreneurs in Sarawak are expected to play the role of modernising and commercialising the agriculture sector.

The State Government is committed to improve the agriculture and rural sector through various policy declarations. Various policy pronouncements have been made on the development of agriculture and the rural sector. These include:

- To increase the monthly household income of farmers from RM2, 750 to at least RM4,000 by 2020 (Source: The Borneo Posts 22 Aug 2017)
- To modernize & commercialize the agriculture and rural sector in Sarawak and application of digital technology
- Increase food production and increase self-sufficiency level (SSL) in food. Presently Sarawak SSL targets for food items are, for rice from 53 per cent to 60 per cent, fruits and vegetables from 60 per cent to 65 per cent, fisheries from 92 per cent to 100 per cent and beef from 10 per cent to 50 percent (Table 3-14).
- Sarawak to be a net exporter of high-quality farm products by 2030 through agricultural and rural transformation. (The Borneo Post, 2018)
- To attract greater private sector participation in agriculture and play the role of anchor companies in the development of the agriculture sector in the rural areas. Private sector is expected to bring in capital, modern management, latest technologies and market access (The Borneo Posts, 2018)
- To be competitive, to adopt the latest agricultural technology and take full advantage of the opportunities provided by advances in digital technology
- Strengthening the capacity and capability of its human capital to become highly knowledgeable, technically competent, business oriented and marketing savvy,

- Expanding its marketing access & network through trading hubs, strengthening transportation and logistics, and expanding and improving warehouses and collection, processing and packaging centres (CPPC) and equipping them with digital infrastructures
- Establishment of special purpose vehicle (SPV) to attract more private sector investment, promote trade to enable agriculture products to enter the global market. The state government is looking to establish a body for building and managing the export of Sarawak agriculture products to overseas markets. The body to be known as Sarawak Agriculture Products Export Corporation will be involved in advisory role as well as injection of capital for technology and projects.
- Strengthening the financing model for the agriculture sector not only through conventional banking but also through venture capital. For this purpose, the state government have approved an allocation of RM100 million. (The Borneo Post, 2019).
- To identify appropriate business models to integrate all players within the supply chain to enhance the development competitiveness of the agriculture sector.
- Setting up farming incubators and encouraging in-situ (on site) research and development (R&D) that utilizes digital technology to collect and analyse critical data to manage the farming variable, besides stressing that R&D activities will focus on areas that can generate high value-added agriculture products
- Develop and manage the full supply chain of our agriculture industry from farm to table and the value chain involving downstream agro-based industries.
- Strengthening the capacity and capability of human capital to become highly knowledgeable, technically competent, business oriented and marketing savvy, apart from expanding its marketing network through trading hubs, strengthening transportation and logistics, and expanding and improving warehouses and collection, processing and packaging centres (CPPC) and equipping them with digital infrastructures

Table 3-14: Sarawak Existing Self- Sufficiency Level in Food 2017 and Target 2030

Commodities	2017 % SSL	2030 %SSL
Rice	53	60
Fruit & Vegetables	60	65
Fish	92	100
Beef	12	50
Mutton	5	50
Poultry	90	130
Pork	100	150
Fresh Milk	5	100

Source: MANRED, Sarawak 2018

To assist the agriculture players in improving their productivity and income, the government offers various incentives and assistance such as the Palm Oil Smallholders Replanting Scheme, Cantas Discount Scheme, Farm-level Quality Improvement and Increment Scheme, as well as programs to enhance the revenue of the smallholders so as to achieve the target income of RM4,000 per month in 2030.

3.1.1.6 Challenges for the Agriculture Sector in Sarawak

For Sarawak, rural development is crucial because some 40 percent of the population still live in rural areas.

One of the major challenges Sarawak faces is meeting demands in raising productivity of subsistence farming and rural incomes. Thus, the government is gradually attempting to transform traditional farming into commercial farming to increase efficiency and productivity of the agriculture sector. Efforts

are being focused on commercialization of the rural sector through consolidation of small farms via group- farming concept, involvement of private sector/ entrepreneurs, moving up the value chain and efficient marketing of produce.

Smallholder and fishermen sector are faced with several constraints, which impinge in their level of efficiency, productivity and competitiveness. These include: -

- Uneconomic farm size and operations
- Limited access to technology and capital
- Ageing population
- Lack of labour force
- Low productivity and income
- Lack of entrepreneurship and management skills
- Involvement mainly at the lower level of the value chain
- Weak linkages to the market
- Involvement mainly in rubber, food crops, livestock, and inland and coastal fisheries

Labour shortage is one of the major constraints facing the agriculture sector in Sarawak. The labour shortage affects both the plantation sector as well as the smallholder sector. Estimates of worker shortfall in the palm oil plantation industry, for example, stand at 20-30%. Locals increasingly shun such work in favour of more desirable skilled jobs. Moreover, many of those who do work in the sector are employed only seasonally, contributing to unreliability and high turnover.

The agriculture sector in Sarawak, as in the rest of Malaysia, is very much dependent on foreign labour. In 2014 there are about 2.4 million documented legal foreign workers in the country of which 26 percent are employed in agriculture (MOA Report 2015). In Sarawak there were 69,666 migrant workers in the plantation sector in 2015 (<http://www.mtuc.org.my>).

In the smallholder sector, labour constraints are felt in labour intensive farming such as paddy farming and pepper farming. In the Kelabit highlands, for example, ten years ago, more than 200 hectares was planted with bario rice; today, due to labour shortage, only half that appears to be planted. Efforts are now in place to redevelop and modernise the bario rice areas with the involvement of entrepreneurs and private sector under the Economic Transformation Programme (ETP).

Mechanization is the way forward for dealing with the labour shortage currently being experienced by Sarawak's agriculture sector, and mechanising agricultural production is the only solution to furthering the commercialisation of the crop.

3.1.2 Covid-19 and Its Impact on the Agriculture Sector

3.1.2.1 Impact on the Agricultural Supply Chain

Getting food to where it is needed will require strong and flexible supply chains that can respond to shifts in consumer demand and adjust in response to supply constraints arising from measures implemented in response to COVID-19. While there are many uncertainties and the situation continue to evolve, experience with past crises (notably the food price crisis of 2007-8) provides insights into some actions that governments can take to mitigate the impacts of COVID-19 on the food system.

Preliminary analyses of the impact of the pandemic reveal disruptions to access to agricultural inputs (including foreign labour), extension and advisory services, and output markets for many farmers and fishermen

According to some reports, so far, there have been no incidence of food shortage since the start of the MCO. On the supply side, the MCO has resulted in somewhat limited access to markets and supplies for a relatively short-while, especially in regard to inputs such as seeds, fertilizers, chemicals etc. Perishables and fresh produce such as vegetables were more affected, resulting in increased levels of post-harvest losses and food waste

In response to the MCO, the Sarawak government has allocated RM2.3 million to buy back excess farm produce and fish from farmers and fishermen to ease their burden during the Covid-19 national shutdown; RM1.7 million has been set aside for farmers, and the balance for fishermen. The Ministry of Agriculture is working with several parties, including the area farmers' organisations (FO's) and the Federal Agriculture Marketing Authority (FAMA) to buy back excess farm produce from farmers who could not sell to the market.

In addition, the state government helped the farmers' organisations market their products online. Area fishermen's associations were acting as wholesalers to buy products from farmers and fishermen and market them online or sell from mobile Lorries under the "Fish on Wheels" concept.

3.1.2.2 *Development of E-Commerce*

This rapid growth of internet penetration has paved the way for development of e-commerce which enables businesses to expand supply channels online in facilitating business transactions including processing payment, marketing and order management of goods, and delivery tracking can be carried out on a digital platform accessible through computers and mobile devices from anywhere.

- Application of digital technology to assist farmers to market their products
- Linking farmers to buyers and logistic services to minimize the impact of the pandemic on the supply chain
- The state government has allocated RM 40 million to help SMEs in the agriculture sector to sell their produce on E-Commerce platform to reach a larger pool of consumers

E-commerce presents an opportunity to transform the agriculture industry by enabling farmers to access larger and new marketing channels in selling agricultural produce and products, giving more control over pricing of goods as well as creating additional income streams to alleviate poverty in rural areas. Collective initiative will also create positive disruptions to the traditional business practices which stimulates the birth of new streams of businesses, job opportunities and transformation. For instance, this transformation took place in China, whereby a village in the interior area produced 100 millionaires after they marketed their products via the Alibaba business platform which created value-add.

Sarawak is well-positioned to capitalize on the implementation of technology, given its sizeable land mass, and extensive agriculture efforts and variety of crops throughout the state. This would create further potential of agriculture efforts to grow beyond local consumption towards export-oriented industry.

3.1.2.3 *Impact on Access to Foreign Labour*

One of the post-covid impacts to agriculture is the access to the foreign labour market. The post-covid era will result in the difficulty for foreign labour to move in and out of Sri Aman to work as agriculture workers. The Sarawak agriculture sector, especially the plantation sector, is very much dependant on foreign labour since many locals shun working as labourers in plantations. Most of these labourers are transient in nature as Sri Aman Division is bordered by Indonesia in the South.

To overcome this problem a policy on foreign labour needs to be addressed to ensure better living standards and permanency of those working in the agriculture sector.

3.1.3 Sri Aman's Place Within Sarawak's Agriculture Sector

Sri Aman has the capability to play a major role as one of the food baskets of Sarawak. This role will require the followings:

3.1.3.1 *Modernization and Commercialization of the Agriculture Sector*

The Sri Aman Division has the capacity to increase food production that is able to meet domestic demand, achieve food security and to export its food produce to regional and international markets by the year 2030. This will be achieved through modern commercial farming and extensive application of digital technology in production and along the supply chain

3.1.3.2 *Increase Production of Crops in Unutilized NCR Land*

It is estimated, there are about 369,810.8 hectares of NCR land in Sri Aman Division. Of these, only 13% has been gazetted, and 17% surveyed. About 70% of the NCR has not been surveyed. There are about 200,000 hectares of undeveloped/uncommitted NCR land in Sri Aman which has not been surveyed (see Figure 3-4).

There is a need to expedite the survey of NCR land to enable these lands to be developed under the various proposed projects.

These initiatives will offer employment opportunities and increase in household income of the local communities.

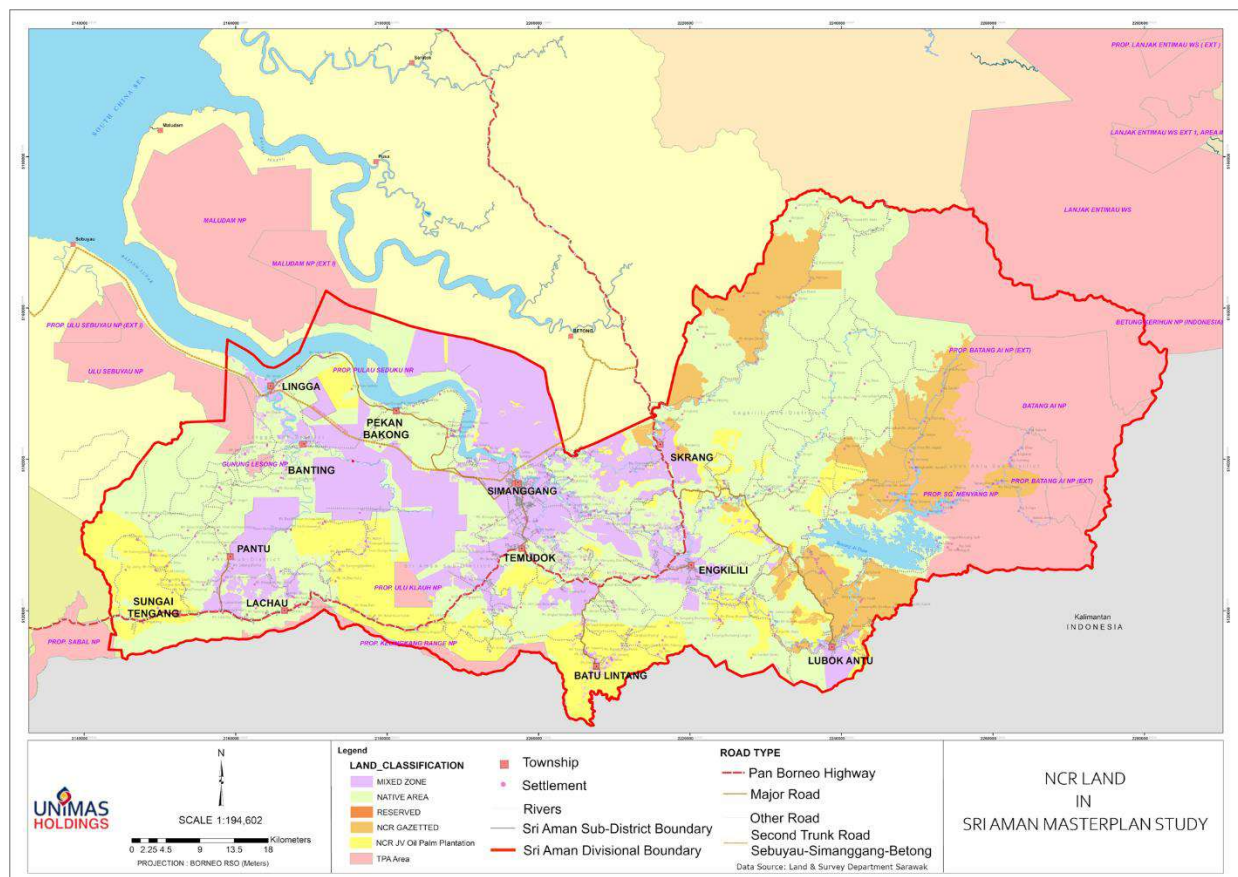


Figure 3-4: NCR Land in Sri Aman

Source: Land & Survey Dept. Sarawak

3.1.3.3 Increase the Income of smallholders and rural community through greater participation in modern commercial farming

Integrating small farmers, smallholders and farming communities as part of the modern commercial farming cluster or out growers and activities along the supply chain. The integration provides competitive advantages through better access to modern farming technologies, facilities and bigger market’.

3.1.3.4 Contribute to Livestock Production especially Cattle

Sri Aman has the potential to contribute significantly to the State’s SSL for ruminant by integrating ruminant farming in the oil palm plantations. Based on the stated livestock development strategies and targets described earlier, the one possible livestock development initiative identified in Sri Aman is the Integration of cattle rearing under oil palm especially by utilizing state-owned SALCRA plantations. The development of an integrated oil palm- cattle farming provides not only additional income to the rural community but also business and employment opportunities in Sri Aman

Integration of Cattle under oil palm has the following advantages.

- Conducive shady environment for the buffaloes as the animal cannot tolerate high temperatures.
- Favourable ambient temperature favours cattle reproductive performance
- Ready availability of vegetation and browser plants under oil palms as feed source for the buffalo including cut palm fronds.

- Natural method of weed control with minimal utilization of chemical weedicides.
- Diversify source of income in oil palm production.

3.1.4 Agriculture Resource Inventory of Sri Aman

This section will discuss the natural resource inventory of Sri Aman pertaining to agriculture development. These resources include:

- Land Use
- Soil Types & Soil Suitability Classification
- Environmentally Sensitive Areas (ESA)
- Rainfall and Weather Patterns
- Irrigation & Drainage Schemes
- Agriculture Employment
- Agriculture Institutions

3.1.5 Land Use

Generally, the existing land use pattern of Sri Aman Division closely follows the topography, which can be characterized under three broad areas, namely, the generally flat coastal plain, the undulating midland area and the steep highland areas along the Sarawak-Kalimantan border (see Table 3 15 & Figure 3 5).

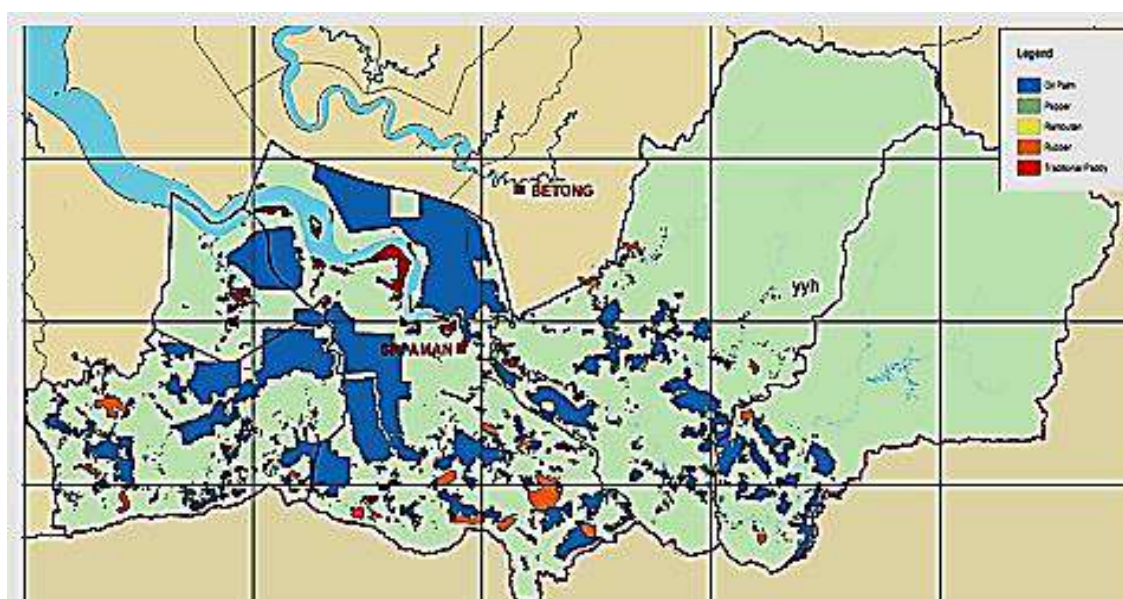


Figure 3-5: Sarawak Land Use 2018

Source: DOA Sarawak 2019

The primary economic activity of Sri Aman division is agriculture with some forestry and fishing activities. Sri Aman division has been transforming vast areas of land into palm oil estates and rubber mini estates.

The agricultural areas are mainly concentrated in the coastal as well as the midland areas covering an area of 118,492 hectares in 2018.

The forested areas comprising 67 percent of total areas, generally cover the interior midland and highland areas. They include gazetted forest reserves (permanent forest estates) and totally protected areas (National Parks and wildlife sanctuaries). There are also forest plantations (licensed planted forests LPF) in logged-over areas throughout the region.

Table 3-15: Existing Land Use (Hectares) in Sri Aman Division in 2018

	Land Use	Area (Ha)	%
1.	Settlement etc	1,883	0.72
2.	Horticulture land	991	0.38
3	Tree Crops (oil palm, rubber, Coconut etc)	67,281	25.66
4	Crop land (including wet & hill paddy)	4,554	1.74
5	Unused land	12,414	4.74
6	Swamp Forest	55,340	21.11
7	Dry Forest	119,804	45.69
8	Swamp land	16	0
	Total	262,238	100

Source: DOA Sarawak 2018

3.1.5.1 Agriculture Land use

The predominant crops are oil palm and rubber, and large plantations are continually being developed throughout the Division (Table 3-16). Other crops include paddy, pepper, fruits, cocoa, coconut and vegetables. Agricultural areas generally cover areas with slope of less than 25 degrees.

Table 3-16: Agriculture Land use in Sri Aman

Crop	2018 (Ha)	%
Rubber	19,042	16.07
Oil Palm	73,688	62.19
Pepper	1,571	1.33
Paddy	21,454	18.11
Sago	21	0.02
Coconut	55	0.05
Cocoa	1,013	0.85
Fruits	1,310	1.11
Vegetables	167	0.14
Spices	18	0.02
Others	153	0.13
Total	118,492	100

Source: DOA Sarawak 2018

A small area totalling less than 11,010 hectares has been cleared and planted with a variety of crops such as padi, rubber, pepper, fruits & cocoa. These cleared areas are along the river basin of the Batang Lupar and its tributaries, and consist mainly of flat topography and rolling hills.

It is estimated that a total of 60,390 hectares of agricultural land in the Sri Aman Division still remains undeveloped. In addition, challenges faced in utilising idle land include difficulty in identifying land owners as well as scattered and uneconomic land size holdings. Add to this problem is the lack of farm labour to work on the land. Most of the young population are working in the other parts of Sarawak such as Bintulu and Kuching and elsewhere such as Labuan, Sabah and Brunei.

A major portion of the eastern region of Sri Aman Division is made up of organic soils (mostly deep peat areas). A good part of these peat areas are environmentally sensitive areas which should be preserved under forest.

3.1.5.2 Soil Types & Soil Suitability Classification

3.1.5.2.1 Soil Types

There are basically 10 soil types in the Sri Aman Division (refer Table 3-17 and Table 3-18).

Table 3-17: Soil Types of Sri Aman

Soil Group		Area (Ha)		%
1	Alluvial	16,489		3.07
2	Arenaceous	289		0.05
3	Gley	28,113		5.24
3	Gley White Podzolic	20,569		3.83
4	Organic (deep peat)	115,535		21.52
5	Oxisols	23,132		4.31
6	Podzols	4,150		0.77
7	Red-Yellow Podzolic	134,845		25.12
8	Shallow Organic	2,405		0.45
9	Skeletal	191,097		35.60
	Total	536,624		100

Source: DOA Sarawak

The features of these soil types are described in Table 3-18.

Table 3-18: Soil Descriptions

Soil Types		Description
1	Alluvial	These are mineral soils which have developed in alluvia at sites where the drainage regime is good, for example, the river levees. As a result, these soils are imperfectly to well drained. The commonly occurring Alluvial Soils are classified under the Bemang and Seduau Families, which are characterized by loamy and clayey particle-size classes respectively. The soils are deep, but some of them, particularly the Bemang soils found at the upper reaches of the rivers may be stony and layers of river pebbles may be present in the subsoils.
2	Arenaceous	Chalky, crumbly, sand-like soil.
3	Gley	These are mineral soils which have developed in alluvia at sites where the drainage is poor to very poor, for example on the back-slopes of the river levees where the ground surfaces dip downwards. A groundwater table is common at or near the surface. The soils are non-sulphidic, non-saline, and are usually non-calcareous and greyish in colour. The soils are largely classified under the Bijat Family, which embraces Gley Soils that have a clayey particle-size class. The loamy members are placed under the Pakan Family.
4	Gley White Podzolic	A variant of podzolic mineral soils
5	Organic (Deep Peat)	Organic soils in Sarawak are comprised primarily of peat swamp forests, where thick layers of waterlogged organic material have accumulated near low-lying coastal areas. Soils classified as organic are deep peat soils (more than 150 cm), which occupy approximately 89% of the total land area of the peat swamps.
6	Oxisols	Oxisol soils are characterized by weathered, stable, tropical mineral soils with oxidized subsurface horizons.
7	Podzols	This soil type is typical of coniferous or boreal type forests and heathland. Podzols are mineral soils typically contain an ash-like lower layer.
8	Red Yellow Podzolic	These are mineral soils characterized by brownish yellow to red colours and have weak podzolic features. The soils have developed in situ from the weathering of mainly shale and sandstone. The dominant soils are classified under the Merit Family.

		Closely associated with these soils are soils of Nyalau and Bekenu Families which have developed from sandstone and mixed shale/sandstone parent materials respectively. The Merit soils have a clayey particle-size class; the Bekenu soils are fine loamy while the Nyalau are coarse loamy. Soils of all these families have a friable to firm consistence, and weak to moderately developed structure. The soils are well-drained to moderately well-drained. The effective soil depths are greater than 50 cm. However, on slopes of less than 25 degrees, they are usually deeper than 75 cm.
9	Shallow Organic	Under the Sarawak's soil classification system, the peat soils are mainly differentiated by the thickness of the peat layer. Shallow peat soils (50-150 cm) occur in the periphery of deep peat areas, and according to the reconnaissance soil surveys
10	Skeletal Soils	On these very steep slopes, Skeletal Soils such as those of Kapit and Tutoh Series are the major soil type. Such areas are severely limited by very shallow soils, very steep slopes and extremely high erosion hazard. They are best left undisturbed for conservation purposes

Source: DOA Sarawak

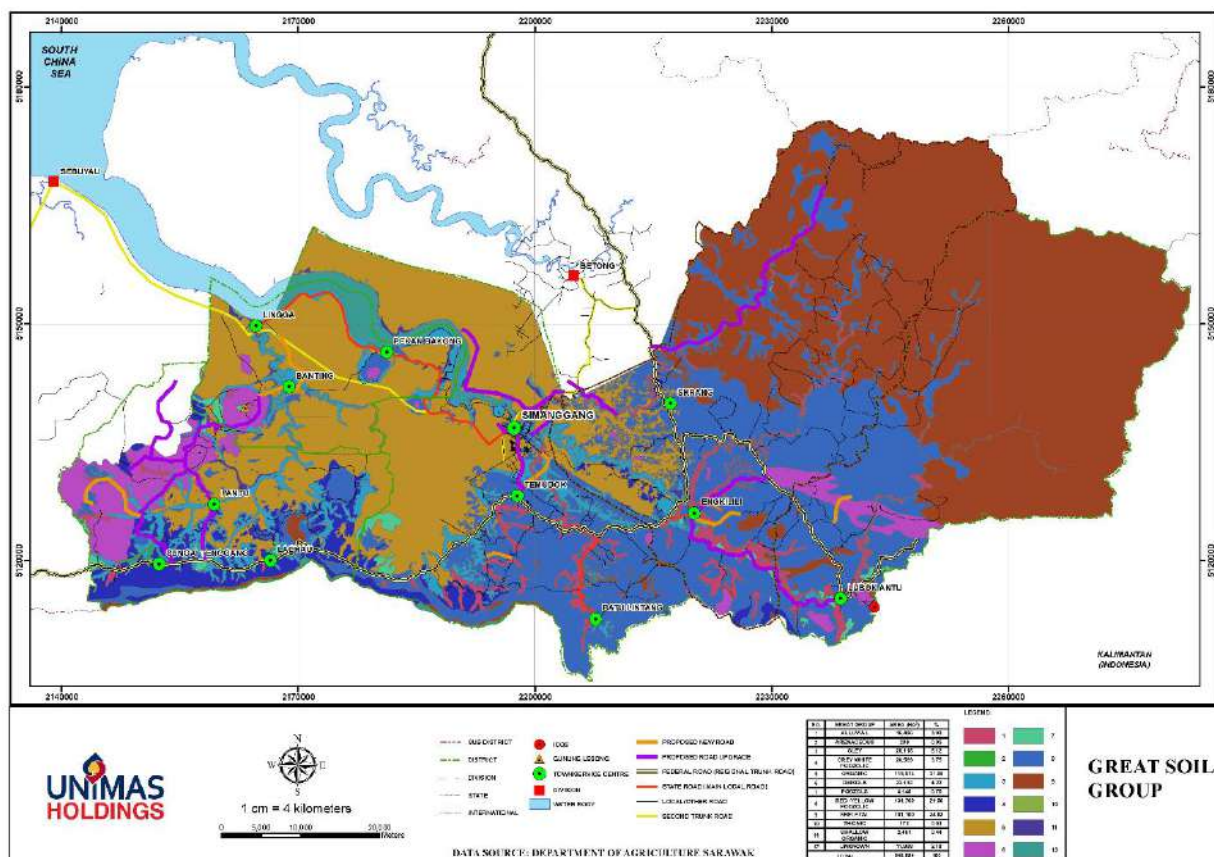


Figure 3-6: Great Soil Group

Source: DOA Sarawak 2019

3.1.5.2.2 Soil Suitability Classification

About 18% of the soils in Sri Aman are considered suitable for agricultural crops. These are made up of Class 2 & 3 soils totalling 97,532 hectares. 59% of the soils are marginally suitable for agriculture. These are made up of some Class 4 and some class 5 soils totalling about 314,118 hectares. The remaining 23% are not suitable for agriculture. These are mainly the deep peat organic soils. Table 3-19 and Figure 3-8 illustrate the soil suitability classification in Sri Aman.

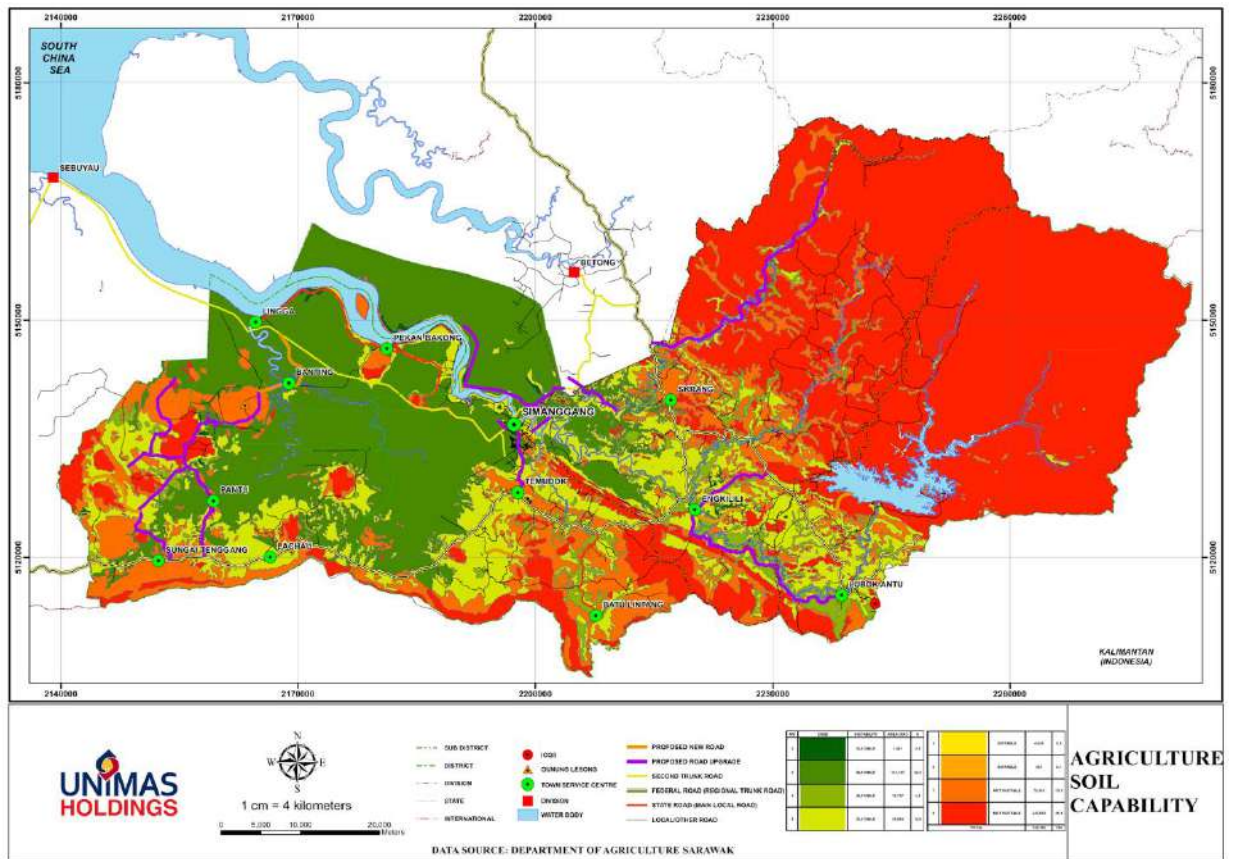


Figure 3-7: Map of Agriculture Soil Capability in Sri Aman

Source: DOA Sarawak 2019

It is estimated that 23 percent of the region consists of class 4 & 5 soils; the serious limitation being deep peat in the coastal areas and steepness of land in the hinterland. Agricultural activities are mainly concentrated along the gley and organic soils of riverine areas and sedentary soils along the hillsides.

Table 3-19: Soil Suitability Classification of Sri Aman-Characteristics & Acreage

Class 1	• Land with no limitation or only one limitation to crop growth • 0 Ha
Class 2	• Land with two or more minor or moderate limitation that restricts the range of crop and or requires special conservation practices • 17,734 ha
Class 3	• Land with two or three moderate or one serious limitation that restricts the range of crop, the degree of possible mechanisation or requires special conservation practices • 79,798 Ha
Class 4	• Land with two or three serious limitations that drastically limit the range of crops or requires special conservation practice, or both • 70,350 Ha
Class 5	• Land with such severe limitations that agriculture not feasible • 243,768 Ha
Class 04	• Land marginally suitable for agriculture comprising organic soils with two or three serious limitations that restricts the range of crops and requires special management practices • 1,010 Ha
Class 05	• Land comprising organic soils with severe limitations in their original state that agriculture is not feasible • 121,160 Ha

Source: DOA Sarawak

Table 3-20: Agriculture Soil Capability in Sri Aman

No.	Soil Composition	Area (ha.)	%	Remarks
1	Suitable	97,532	18	Class 2 – 17,734 ha. Land with two or more minor or one moderate limitation that restricts the range of crop and or requires special conservation practices. Class 3 – 79,798 ha. Land with two or three moderate or one serious limitation that restrict the range of crop, the degree of possible mechanization or requires special conservation practices.
2	Marginally	314,118	59	Class – 4 – 70,350 ha. Land with two or three serious limitations that drastically limit the range of crops or requires special conservation practise or both. Class 5 – 243,768 ha. Land with such severe limitations that agriculture not feasible.
3	Not Suitable	122,170	23	Class 04 – 1,010 ha. Land marginally suitable for agriculture comprising organic soils with two or three serious limitations that restricts the range or crops and requires special management practices. Class 05 – 121,160 ha. Land comprising organic soils with such severe limitations in their original state that agriculture is not feasible.
Total		533,820	100	

Source: DOA Sarawak 2019

Most of the Class 2 & 3 soils are located in the southern part of Sri Aman as shown in Figure 3-8. The focus agricultural areas for food production should be located in these areas.

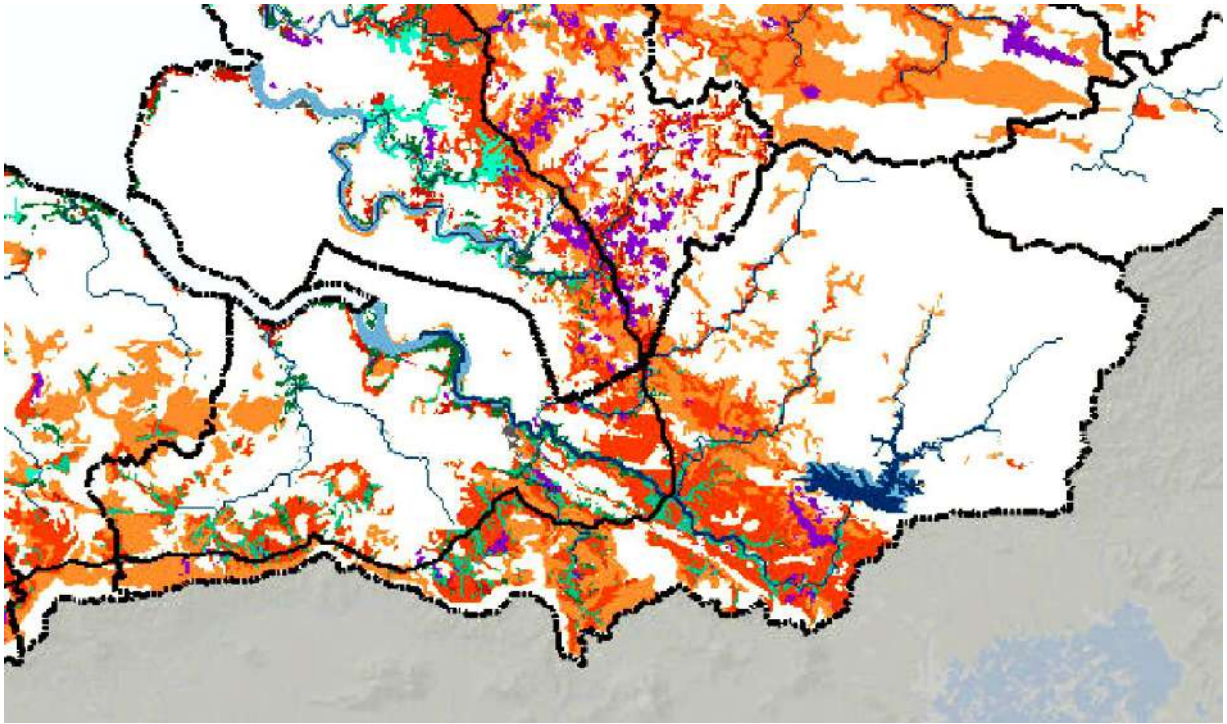


Figure 3-8: Class 2 & 3 Soils of Sri Aman

Source: EPU Sarawak Land Use Master Plan 2021-2050

3.1.6 Environmentally Sensitive Areas (ESA)

Agriculture development must take into account environmentally sensitive areas, including both coastal ESA and inland ESA (Figure 3-9 and Figure 3-10).

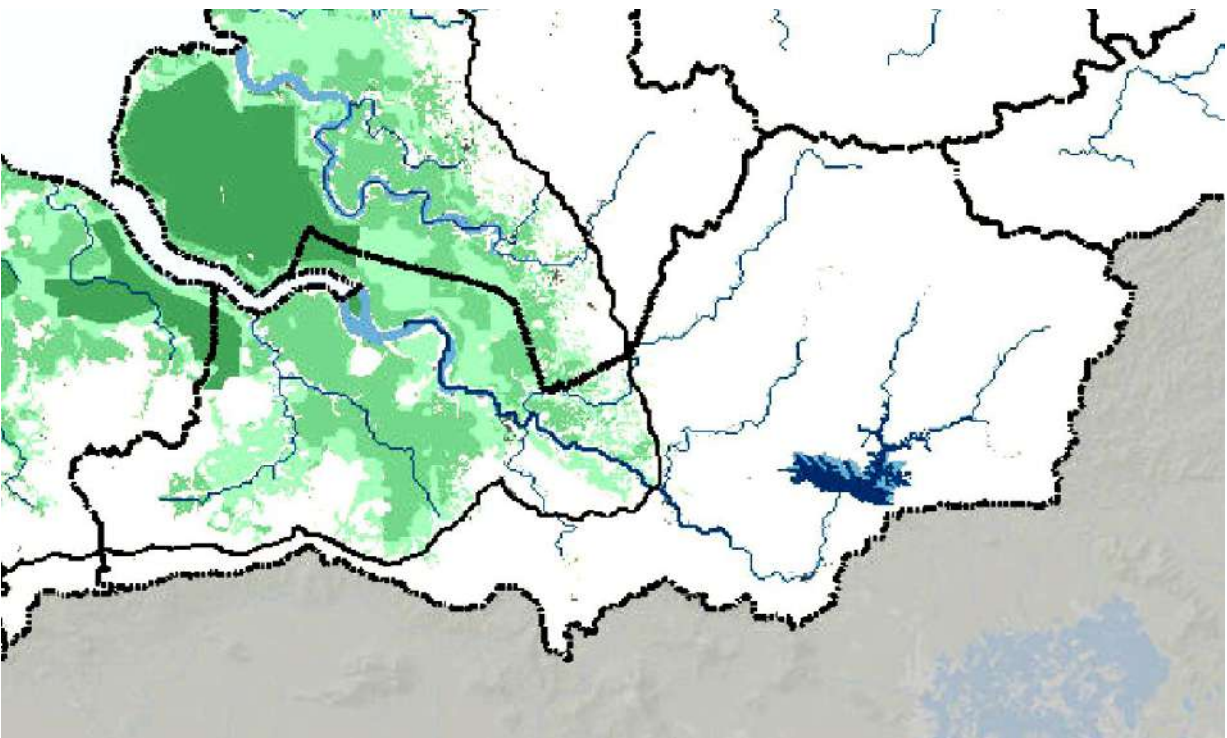


Figure 3-9: Coastal Environmentally Sensitive Areas (ESA)

Source: EPU Sarawak Land Use Master Plan 2021-2050

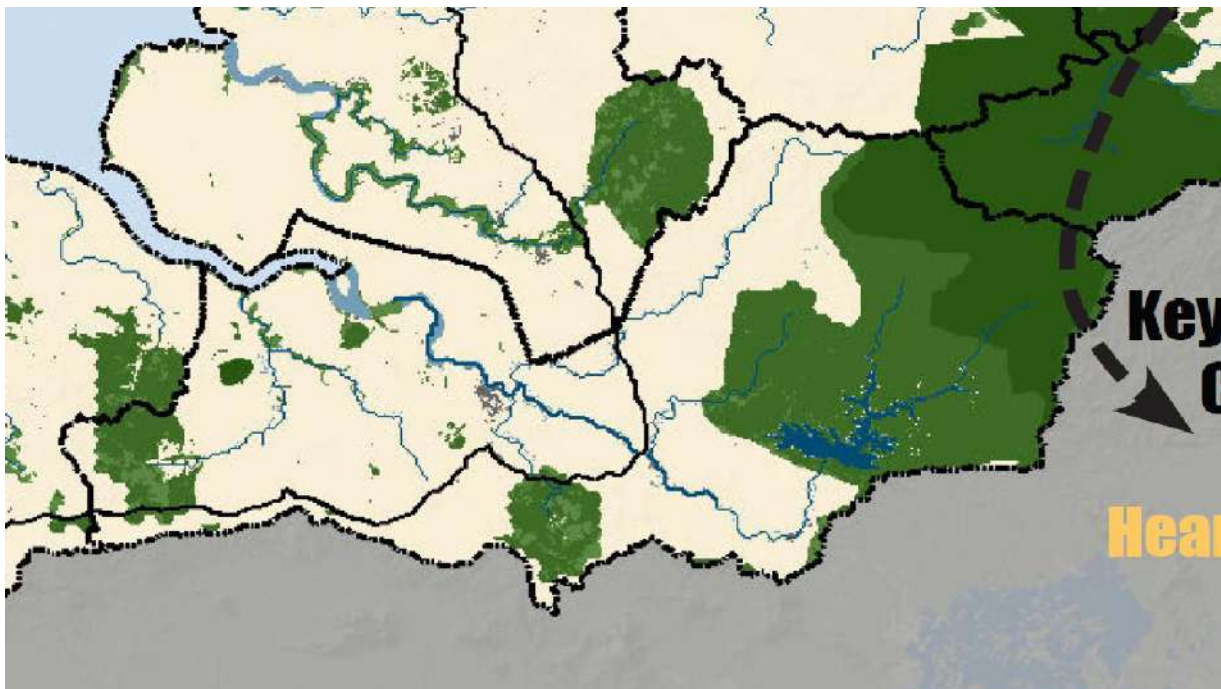


Figure 3-10: Inland Environmentally Sensitive Areas (ESA)

Source: EPU Sarawak Land Use Master Plan 2021-2050

3.1.7 Rainfall and Weather Patterns in Sri Aman

There is significant rainfall throughout the year in Sri Aman (Figure 3-12). Even the driest month still has a lot of rainfall. In a year, the rainfall is 3,331 mm (131.1 inch). The average annual temperature in Sri Aman is 27.0 °C | 80.6 °F

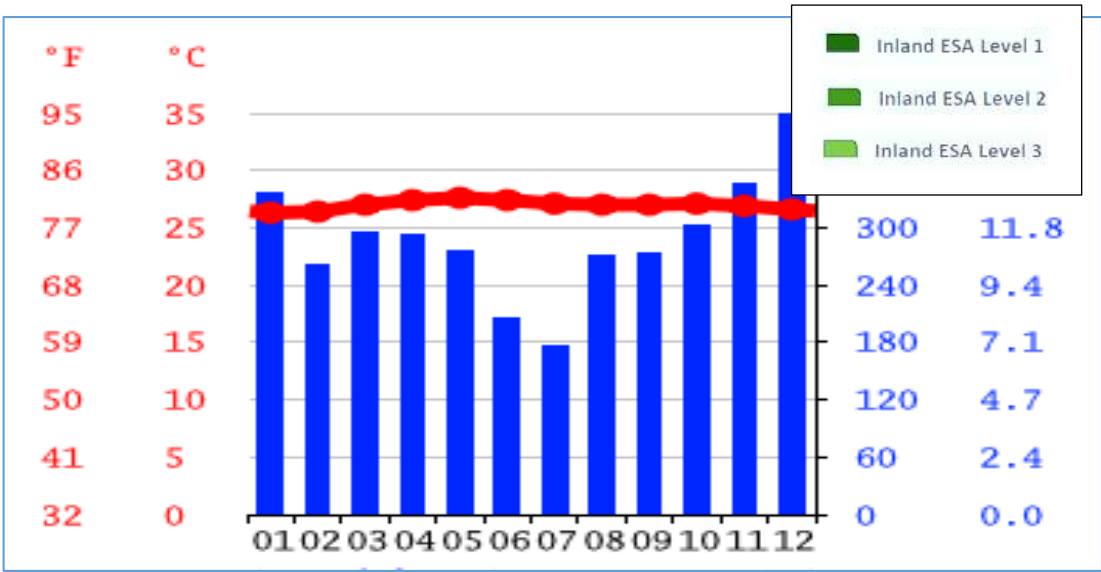


Figure 3-11: Historical Record of Rainfall and Weather Patterns in Sri Aman

Source: Climate DATA.ORG

3.1.8 Livestock

Livestock rearing is not a major activity in Sri Aman compared to other divisions). Pigs and chicken rearing dominate the livestock sector in Sri Aman (Table 3-21).

Table 3-21: Livestock Numbers in Sri Aman 2019

Livestock	Cattle	Buffalo	Goat	Sheep	Deer	Pigs	Chicken	Ducks
Numbers	951	2	603	305	50	13,597	133,209	2,680

Source: DVS Sarawak 2019

3.1.9 Irrigation & Drainage Schemes

Sri Aman Division has a number an irrigation and drainage schemes. The list of irrigation & drainage schemes under DID is shown in Table 3-22.

Table 3-22: Existing Irrigation & Drainage Schemes

Scheme	District	Area (Ha)	Purpose
Banting Irrigation Scheme	Lingga	344	Planting of paddy
Tanjung Bijat Controlled Drainage Scheme	Sri Aman	1,224	To drain peat area to enable more utilization of land for farming
Sungai Gran Controlled Drainage Scheme	Sri Aman	306	To drain area to enable more utilization of land for paddy farming
Sungai Entulang Controlled Drainage Scheme	Sri Aman	134	To improve the existing padi area. With the drainage facilities, it can provide a favourable condition for an off-season cultivation.
Total		2,008	

Source: DID Sarawak

There are also other DID schemes in Sri Aman which need to be rehabilitated under the Sri Aman Master Plan These include:

- Tanjung Seduru (198ha) Engkilili
- Sebrang (230ha)
- Sg. Ensurai (431 ha) Engkilili
- Sebuluk Engkala (265ha) Sri Aman

3.1.10 Agriculture Employment

According to the DOA's estimate, the agriculture sector provided employment to about 16,804 farm household in Sri Aman Division (Table 3-23). Most of these farm households are involved in paddy production, pepper, oil palm cultivation, fruit cultivation and rubber tapping.

Table 3-23: Farm Households

District	Villages	Farm Families	Farm Population
Lubok Antu	276	10,792	30,790
Sri Aman	506	6,012	45,064
Total	782	16,804	75,854

Source: DOA 2019

3.1.10.1 Agriculture Institutional Resources

There are a number of agricultural institutions in Sri Aman. These include:

- Area Farmers Association e.g. Pantu, Lingga and Lubok Antu
- Cooperatives
- Integrated Agriculture Development Area (IADA)
- Division & District DOA & DVS
- Temudok Agricultural Station
- Drainage & Irrigation Department (DID)
- Agro Bank

These institutions deliver a number of services to farmers such as extension services, agriculture training, supply of agriculture inputs (such as fertilizer, seeds, and chemical), loans and infrastructure development.

3.1.11 Issues, Challenges & Potential

3.1.11.1 Issues

A number of key issues have been identified as part of the Study which the Sri Aman Master Plan will need to consider. These will be reviewed, refined and expanded through the community and stakeholder process in order to identify issues that align with community aspirations. The response to these issues would ultimately help achieve the 2030 vision of the Plan. These key issues include:

- Agricultural activities are highly constrained by the soil & topography of the region. It is estimated 80 percent of the region consist of class 4 & 5 soils; the serious limitation being deep peat in the coastal areas and steepness of land in the hinterland. Agricultural activities are mainly concentrated along the gley and organic soils of riverine areas and sedentary soils along the hillsides.
- Agricultural activities undertaken without much consideration to Environmentally Sensitive Areas resulting in flooding & loss of habitat
- Agriculture development dominated by oil palm plantations with little development on food crops
- Competition for land use; e.g. urban development, oil palm development, licenced forest plantations, environmentally sensitive areas (ESA), establishment of National Parks and Heart of Borneo, will limit the availability of land for agriculture.
- Difficulties in the development of NCR land as a commercial undertaking
- Low population base and aging farming population and thus labour shortage for agriculture
- Scattered location of long houses can result in low mobility of labour
- Uneconomic subsistence, low production and backyard farming community; and low technology smallholder production systems
- Small and uneconomic land holdings
- Shifting cultivation still being practiced in the region thus resulting in inefficient use of land resources
- Lack of physical infrastructure such as access roads, drainage and irrigation facilities as well as utilities such as electricity in the Sri Aman region limit accessibility to the region and migration of young labour to other developed regions of Sarawak

3.1.11.2 Challenges & Potentials

Sri Aman has the potential to be developed as one of the main food basket areas for Sarawak through transforming a traditionally small-scale, production-based sector into a **large-scale** agribusiness industry that contributes towards economic growth and sustainability. The transformation will be based on an integrated and **market-centric model** that focusses on economic of scale and **value chain integration**.

A number of projects have been proposed. These include:

- 1) Planting of food crops such as pineapple, durian, rambutan, bananas, sweet corn and coconut on a commercial basis in focused agricultural areas
- 2) Planting of high value crops such as vegetables & fruits under the smart farming system in Agrotech Parks in Lachau & Temudok
- 3) Development of paddy planting under IADA as part of the granary area for food security of Sarawak
- 4) Development of high value specialty rice in Pantu District
- 5) Development of Industrial Crops in NCR land such as oil palm, coffee and sacha inchi
- 6) Livestock development by integration of cattle in oil palm plantations
- 7) Intensification of Swift farming in Lingga

The Implementation of all these programs or projects in high potential growth areas could catalyse a proliferation of business opportunities and employment.

Eventually, Sri Aman will be recognised as a key contributor to Sarawak's food basket owing to the high concentration of priority agricultural areas. Food agriculture production within Sri Aman will be focussed on local and domestic consumption as well as exports in line with the food basket programme.

SECTION 3.2 AQUACULTURE AND FISHERIES

3.2.1 Introduction

Over billions of people globally rely on fish for their regular intake of protein. Sarawak's population similarly depends on seafood, either caught from marine and riverine sources or farmed in cages and ponds. The fisheries and aquaculture sectors are known to provide livelihood to many people, where aside from primary production, significant numbers are also involved in ancillary activities such as processing and marketing.

A sustainable and productive fisheries and aquaculture industry can improve food and nutrition security, increase incomes, and improve additional livelihoods, as well as promote economic growth. In addition to its economic profile, the role of fish in the human nutrition cannot be understated. For instance, fish are known to provide nutrients and micronutrients that are essential, particularly in the early growth of children. In adults, they represent a major protein source, especially for rural communities.

3.2.2 The Wider Picture – Aquaculture and Fisheries in Sarawak

3.2.2.1 Marine and Estuarine Fisheries

Sarawak waters are the most extensive throughout the entire country, accounting for around 160,000 km² (or about 29% of the Malaysian EEZ waters). Despite this, in 2019 they only accounted for only 12.4% of the country's total marine fish landings. In the same year, the Sarawak fishery supported over 12,063 fishermen (11.8% of national total), 5,443 fishing vessels (11.4%) and 5,443 licensed gears (11.4%).

Of the 12,063 fishermen, 83.7% were local fishermen and 16.3% were foreigners. The local fishermen were mostly made up of citizens of Bumiputera status, constituting 84.2% of the total number of fishermen, while the remainder were Chinese (6.1%) and Indians (9.7%). As for fishing vessels, about 3,148 units (57.8%) were fitted with outboard engines, while 2,295 units (42.2%) were fitted with inboard engines. Most of inboard powered vessels (i.e., 1,664 units) operated using less than 60 h.p. Only 631 units (27.5 %) had engines larger than 60 h.p. The fisheries industry is still relatively undeveloped and essentially artisanal in nature, with commercial gears (trawls and purse seines) only accounting for 5.9% of the total fishing gear count (387 units) as compared to 94.1% by artisanal fishing gear (6,137 units).

A review of fishing population data from 2004 to 2019 (15 years) indicated that the total number of licensed fishermen in Sarawak showed a fluctuating pattern i.e., from 13,206 in 2004 till 2015 and peaked at 2016 (16,278 fishermen) then gradually decreasing to 12,063 fishermen in 2019. A similar pattern was also observed for fishing vessels and fishing gears from 2004 to 2019 (Figure 3-12).

Total marine capture fisheries landings have fluctuated over the past 15 years, declining from a peak of 185,927 tonnes in 2004 to 119,459 tonnes in 2011, increasing to 159,861 tonnes in 2013, before stabilizing at around 150,000 tonnes in 2017. The landings increased to around 180,000 tonnes in 2018 and dropped slightly to 171,488 tonnes in 2019 (Figure 3-14). By and large, these trends were driven

by landings from inshore waters, as offshore landings remained mostly consistent over the years, with the exception of 2018, where there was a decrease in inshore landings and increase in offshore landings (Figure 3-13).

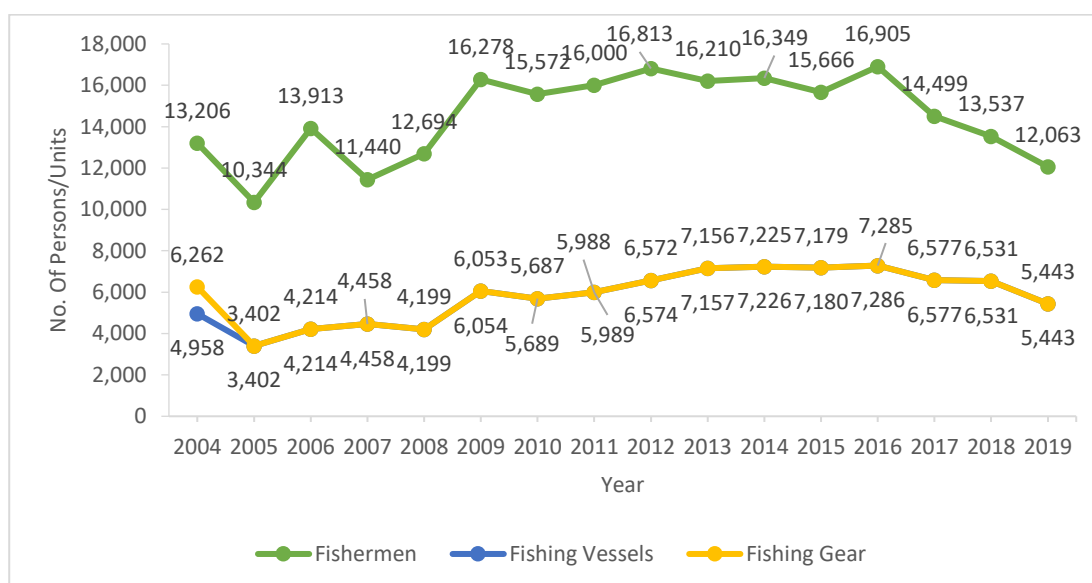


Figure 3-12: Trend of the Number of Fishermen, Fishing Vessels and Fishing Gears in Sarawak, 2004 – 2019

Source: Department of Fisheries, 2005 – 2020

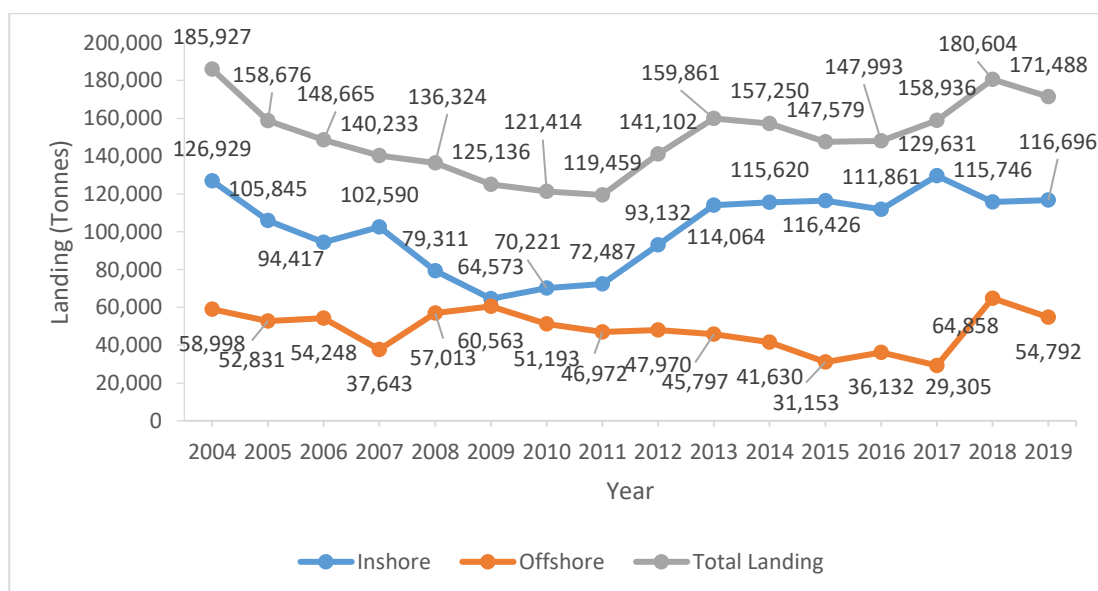


Figure 3-13: Trend of Marine and Estuarine Fish Landings in Sarawak, 2004 – 2019

Source: Department of Fisheries, 2005 – 2020

In that year, 64.1% of total landings were contributed by the artisanal fishery (115,746 tonnes), while 35.9% were by commercial vessels (64,848 tonnes).

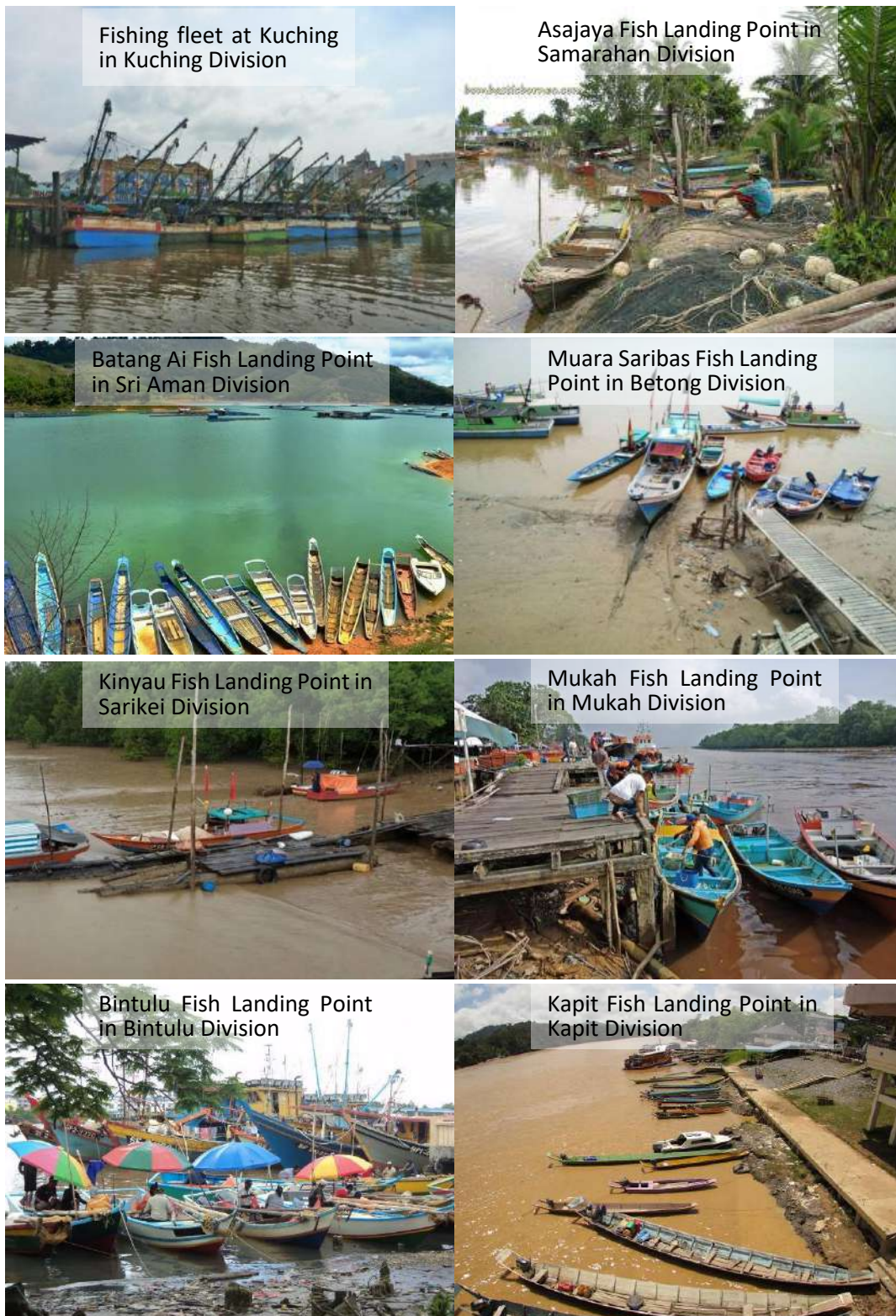


Figure 3-14: Fisheries Activities in Sarawak



Figure 3-15: Fisheries Activities in Sarawak (con't)

3.2.2.2 Inland Fisheries

Inland fisheries were largely focused within the main rivers and their tributaries. Data on inland fisheries is limited compared to the marine fisheries. (Inland fisheries data is collected by the Inland Fisheries Branch of the Department of Agriculture, whereas the marine fisheries data collection is carried by the Department of Marine Fisheries). Available data indicates that inland fisheries landings since 2011 have exhibited a fluctuating pattern, increasing and decreasing every other year (Figure 3-16). However, in the most recent years for which data is available, landings were reported to have decreased as compared to the previous year i.e., 1,646 tonnes in 2019 as compared to 2,173 tonnes in 2018. However, both these landing figures were found to be higher than in previous years, indicating possible higher landings by inland fishermen or better data collection. In terms of catch, highest catch was contributed by miscellaneous fish (19.8% or 325.89 tonnes) of the total landings, followed by Udang galah (Giant freshwater prawn; *Macrobrachium rosenbergii*) (12.5%), Baung (River catfish; *Mystus* spp.) (11.1%), Tengadak (Tinfoil barb; *Barbonymus schwanenfeldii*) (7.9%), and Keli (Clarid catfish; *Clarias* spp.) (7.9%).



Figure 3-16: Trend of Inland Fish Landing in Sarawak, 2011 – 2019

Source: Department of Fisheries, 2012 – 2020

Despite the lack of detailed data, studies on the fisheries at upstream of the Batang Rajang (Pelagus to Belawai) (Envisar, 2012) indicate that ribbon communities relied heavily on riverine catch both as a food source as well as source of income. Fish such as Empurau (*Tor tambroides*), Tengadak (*Barbonymus schwanenfeldii*) and Labang (*Pangasius/Pangasianodon* sp.) command premium prices in towns such as Sibu, Kuching, Bintulu and Miri and are important market for these fish. Other fish such as the Clariid catfish are consumed at the longhouse/village level and are an important food source to these communities, who, because of poor road communications, cannot rely on a dependable supply of good quality marine fish.

3.2.2.3 Aquaculture

Substantial aquaculture activities are also undertaken in Sarawak. There are seven major aquaculture systems practiced i.e., brackishwater pond culture, marine cage culture, brackishwater tank culture, brackishwater pen culture, freshwater pond culture, freshwater cage culture and cement tanks culture. In addition, cockle and mussel farming is also undertaken, though these only operated on a small scale. Beside these, government and private hatcheries producing fish and shrimp/prawn fry also operated in Sarawak. In 2019, there were a total of 4,245 culturists in Sarawak, accounting for 21.1% of the national total. The highest number of culturists were involved in freshwater culture i.e., 4,109 culturists (96.8%), as compared to only 136 culturists (3.2%) in brackishwater culture.

A review of the number of culturists in Sarawak over the past 15 years showed an increasing but fluctuating pattern, up from 2,477 culturists in 2004 to 4,245 culturists in 2019. There were also decreasing trends in number of culturists in the recent years (2015 – 2017), though the number stabilized again over 2018 -2019 (Figure 3-18). Freshwater culturists mostly contributed this fluctuating pattern. As for brackishwater culturists, a lower but a more regular pattern was observed throughout the period (Figure 3-17).

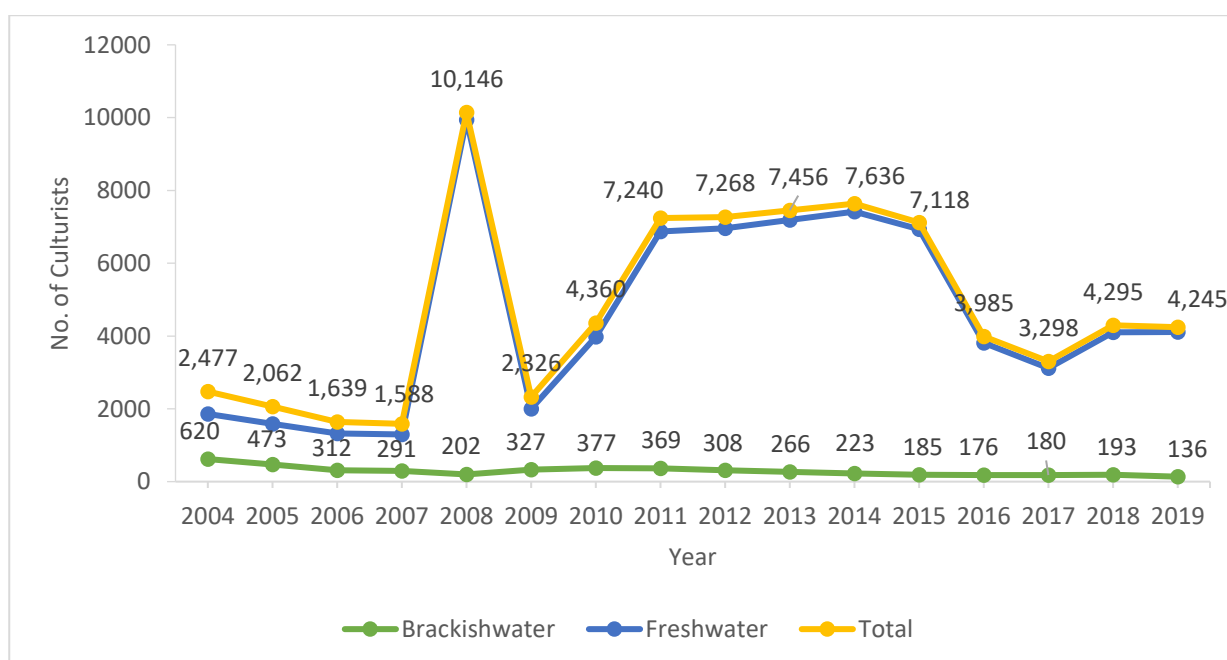


Figure 3-17: Trend of the Number of Culturists Operating in Sarawak, 2004 – 2019

Source: Department of Fisheries, 2005 – 2020

In 2019, aquaculture production amounted to 11,246.48 tonnes, valued at RM 190.77 million. The highest production came from brackishwater pond culture (5,464.98 tonnes), followed by freshwater pond culture (4,154.09 tonnes) and freshwater cage culture (1,262.01 tonnes). The production from other aquaculture systems ranged from 0.66 – 219.26 tonnes. Though the vast majority of culturists were in freshwater aquaculture, the quantum of output was similar between freshwater and brackishwater aquaculture. Aquaculture production fluctuated over the past 15 years, from 12,200.08 tonnes in 2004 to a peak of 15,355.23 tonnes in 2014, before dropping to 7,354.77 tonnes in 2016. The figure has maintained since, before increasing in 2019 when a total production of 11,246.48 tonnes was reported (Figure 3-19).

The difference in the production from both freshwater and brackishwater culture can be observed in Figure 3-19, where, since 2004, production from brackishwater aquaculture was the main contributor. However, from 2013 - 2016, there was sudden increase in freshwater production and a drop in brackishwater production. However, from 2016, the total production gradually increased from 7,354.77 tonnes to 11,246.48 tonnes in 2019.

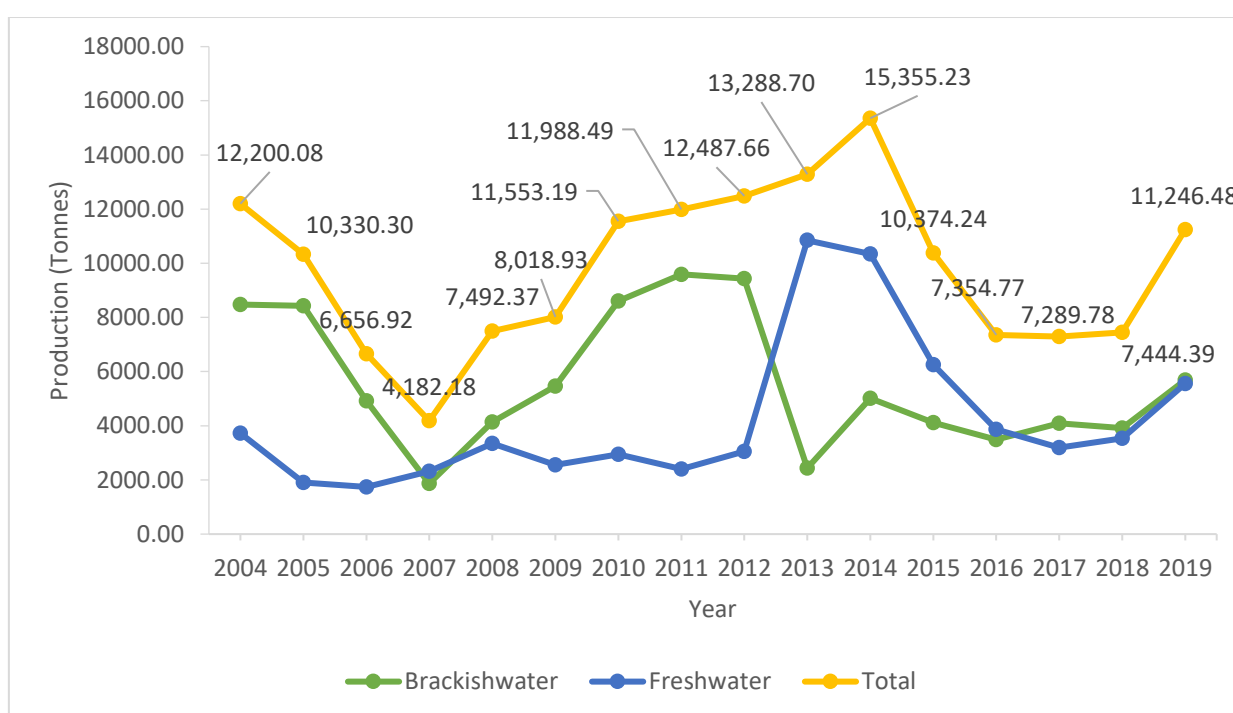


Figure 3-18: Trends in Aquaculture Production in Sarawak, 2004 – 2019

Source: Department of Fisheries, 2005 – 2020



Figure 3-19: Aquaculture Activities in Sarawak

3.2.3 Sri Aman's Place Within Sarawak's Fisheries Sector

The Sri Aman Division's major aquatic feature is the Batang Lupar and its tributaries, which supports the iconic *terubok* fishery, and the Batang Ai Reservoir, where the largest freshwater fish farming cluster in Sarawak is located. Its capital, Simanggang, is located 193 km by road to Kuching. Other main towns within the Sri Aman division include Lingga, Pantu, Engkilili and Lubok Antu.

3.2.3.1 Fisheries

3.2.3.1.1 Estuarine Fisheries

The main fisheries activities within Sri Aman have mostly been within the Batang Lupar river basin, which is one of the major river systems in Sarawak. However, it should be noted that most of the local population only considered fishing as an activity supplementary to agriculture. There were a total of 216 registered and unregistered fishermen in the Sri Aman Division. This may not reflect the total fishing population, since only those who registered for production allowances are recorded.

The highest population of registered fishermen was recorded at the Lingga sub-district with a total of 95 fishermen, followed by Sri Aman sub-district (71 fishermen) and Lubok Antu sub-district (35 fishermen). The high number of fishermen from these sub-districts was probably due to their being located adjacent to Batang Lupar (refer Table 3-24). The Pantu sub-district recorded with the lowest number of fishermen, since fishermen were concentrated only within the smaller tributaries of the main river (Table 3-24).

Table 3-24: No. of Registered and Unregistered Fishermen at Sri Aman Division

District/Sub-District	No. of Fishermen		Total No. of Fishermen
	Registered Fishermen	Unregistered Fishermen	
Pantu	14	1	15
Sri Aman	42	29	71
Lingga	42	53	95
Lubok Antu	35	-	35
Total	133	83	216

Source: Inland Fisheries Division, Department of Agriculture, 2020 - unpublished

**Figure 3-20: Fish Landing Points at Sri Aman Division**

Source: Inland Fisheries Division, Department of Agriculture, 2019 and Google Earth

The type of gear employed by the fishermen include gill nets, portable traps (*bubu*), and hooks and lines. The catch profile from the Batang Lupa included Keli (*Clarias* spp.), Udang Galah (*Macrobrachium rosenbergii*), Baung (*Mystus* spp.), Lais (*Kryptopterus* spp.), Gonjeng (*Coilia dussumieri*), Lumek (*Harpodon nehereus*), Lundu (*Batrachcephalus mino*), Bulu Ayam (*Thryssa mystax*), and Panjang (*Boesemania* sp). While most of the fish caught were for self-consumption, the Udang Galah (*Macrobrachium rosenbergii*) was largely consigned to markets in Sri Aman due to their higher price.

One of the most commercially important fish caught in the downstream regions of the Batang Lupa is the Terubok (*Tenualosa toli*), though the smaller size of this species is locally known as Emprit (Khairul Adha *et al.*, 2014). According to Department of Agriculture (Inland Fisheries Branch), Terubok fishing is considered as a main source of income for more than 90% of fishermen at Batang Lupa.

This species is unique because they are protandrous hermaphrodites (Blaber *et al.*, 1996), meaning they would have male reproductive organs come to maturity first before the female. Terubok is an endemic species at Sarawak and is usually found within the area known as “core Terubok areas”, which also include Batang Sadong, Batang Lassa and Batang Saribas (Khairul Adha *et al.*, 2014). In addition, Terubok is known to inhabit large, fast flowing, and turbid estuaries (Chong *et al.*, 2010) as well as the adjacent shallow coastal waters, which provides zooplankton for its forage (Mohammad Hambali *et al.*, 2011).

The estuary of Batang Lupar also represents a spawning area and nursery grounds by the juveniles of Terubok (Chong *et al.*, 1991).

While the Terubok is a commercially important fish, it has been subject to heavy fishing pressure and, therefore, has suffered major declines since 1980s. According to Blaber *et al.* (2003), the Terubok has a great cultural significance in Sarawak and has been commercially fished for their eggs which can be sold at a very high price. Usually, the number of catches is lower during rainy days and less muddy water conditions (Khairul Adha *et al.*, 2014). Generally, the spawning season is from June to November and peaks around August to October. It is also subject to annual fluctuations.

Due to significant degradation of the Terubok landings in Sarawak, the Department of Agriculture (DoA) has undertaken several actions to replenish the Terubok resources such as closed seasons and limiting types of fishing gear and number of fishing vessels (Mohammad Hambali *et al.*, 2011). The recommended mesh size for monofilament gillnet used for the terubuk fishery is 75 mm to 100 mm to avoid smaller Empirit (*Tenuulosa toli*). In addition, a reseeding program has released more than one million Terubok fingerlings into Batang Lupar from 1996 to 2006 (Phillip, 2006). Further, the department has also established the Terubok fish refugia which covers approximately 80 km along Batang Lupar from the furthest upstream migration from Pulau Seduku to seaward side encompassing Sebang (left) and Maludam (right) (Figure 3-21). However, it has not been formally gazetted as a sanctuary and continues to be subject to riverine development pressures.

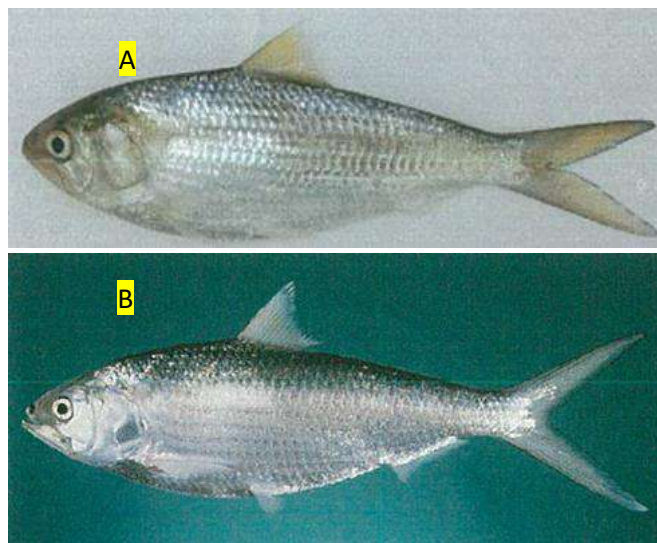


Figure 3-21: Terubok Species at Batang Lupar - Terubok Sungai (*Tenuulosa toli*) (A) and Terubok Laut (*Tenuulosa macrura*) (B)



Figure 3-22: Terubok Fishery Refugia Area at Downstream of Batang Lupar

Source: Inland Fisheries Division, Department of Agriculture, 2019 and Google Earth

3.2.3.1.2 Freshwater Fisheries – Riverine and Lake Fisheries

Available data also indicated that there are substantial landings of freshwater fish, increasing from 275.68 tonnes in 2016 to 437.96 tonnes in 2017. The landing remained constant in 2018, with 435.44 tonnes, before decreasing to 244.23 tonnes in 2019 (Figure 3-23).

Most (but not all) freshwater fishing activities were undertaken at Lubok Antu sub-district, particularly at Batang Lupar and its tributaries as well as within the Batang Ai Reservoir. A total of 35 fishermen were recorded by the Department of Agriculture, Sarawak whom 11 operate within the Batang Ai reservoir (NAHRIM, 2018). Most of the fishermen utilized gill nets that were set overnight. The fish caught were mostly for self-consumption.

Some of the major freshwater species caught included Adong (*Hampala macrolepidota*), Bantak (*Osteochilus vittatus*), Baung (*Mystus nemurus*), Boeng (*Cyclocheilichthys apogon*), Empurau (*Tor tambroides*), Semah (*Tor douronensis*), Keli (*Clarias* spp.), Kalui (*Osphronemus goramy*), Kepiat/Tengadak (*Barbonymus schwanenfeldii*), and Tilan (*Mastacembelus* spp). On the other hand, there were also several exotic species that have been recorded at Batang Ai, which included the Lampam Jawa (*Barbonymus gonionotus*), Tilapia (*Oreochromis* spp.), Leekoh (*Cyprinus carpio*), Tongsan Putih (*Hypophthalmichthys molitrix*), Kap rumput (*Ctenopharyngodon idella*) and Tongsan (*Hypophthalmichthys nobilis*).

The annual fish landings for Batang Ai Reservoir were estimated to range between 42.2 to 79.5 tonnes and valued at RM 0.419 to RM 0.789 million. Most of the fish caught were sold at Lubok Antu Wet Market.

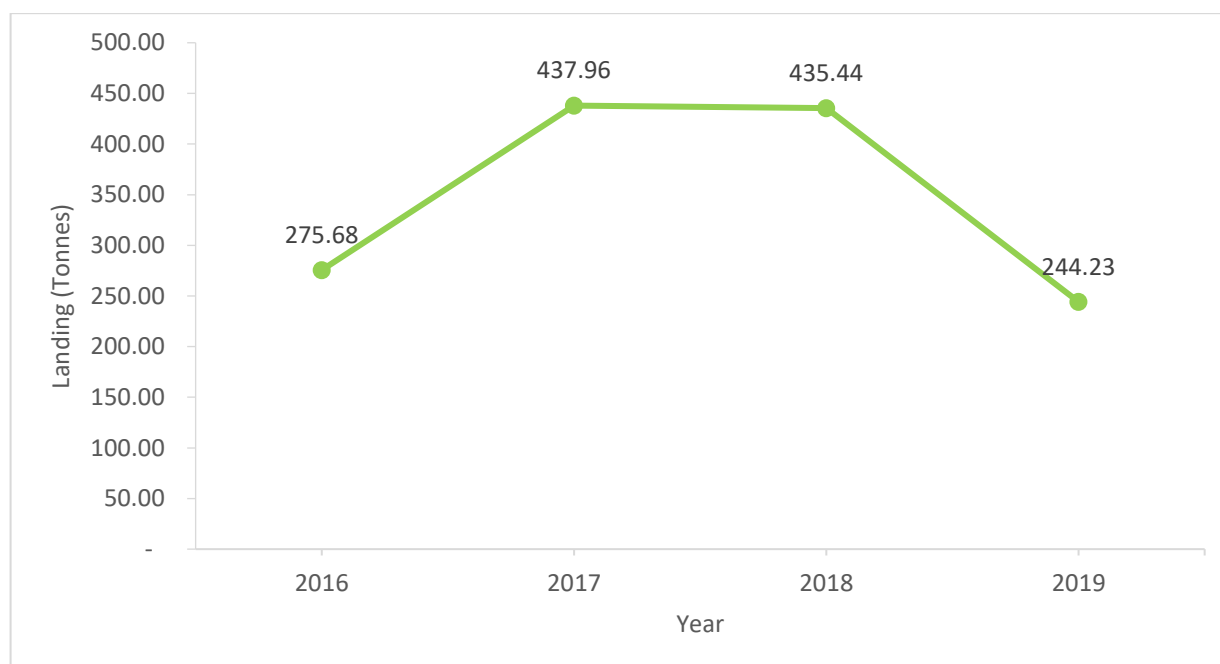


Figure 3-23: Trend of Inland Fish Landing in Sri Aman District, 2016 – 2019

Source: Inland Fisheries Division, Department of Agriculture, 2017 – 2020 – unpublished

In addition to fish, the Batang Lupar also supports significant populations of the Estuarine crocodile (*Crocodylus porosus*). This river is preferred due to the gentle slope of its riverbanks, making it a suitable habitat for nesting. However, there has also been a number of attacks on humans. Estuarine crocodile tends to be territorial, especially during mating season, when the animals are guarding their nests. Along the Batang Lupar and its tributaries, the density of the crocodile was found to be medium and most of the crocodiles were concentrated at the middle part along the river as well as at the mangrove deltas (Zaini et al., 2014).

3.2.3.1.3 Freshwater Fisheries – Tagang (Community Based Fisheries)

Tagang which translates to “conservation” in Iban is a community-based fisheries management system practised both in Sabah and Sarawak. The main objectives of the *tagang* system are to protect, conserve, revive and manage the river environment and its biodiversity, especially the riverine fisheries resources. In addition, it is also expected to increase the economy of the communities at the selected areas.

The *tagang* system was first pioneered in Sabah in 2003 (where it is called *tagal*) and has now been implemented by the Department of Agriculture in a number of areas throughout Sarawak (anak Ansley et al., 2017). The ‘*tagang*’ system is a way of managing local fish stocks in the rivers or streams involving the communities. It involves restocking natural rivers or streams with fish fingerlings and the local communities are then tasked to regulate fishing on a community basis through a set of regulations. Local communities are thus responsible to monitor the river. Fishing activities can only be carried out for certain periods when the fish reach suitable weight for harvest.

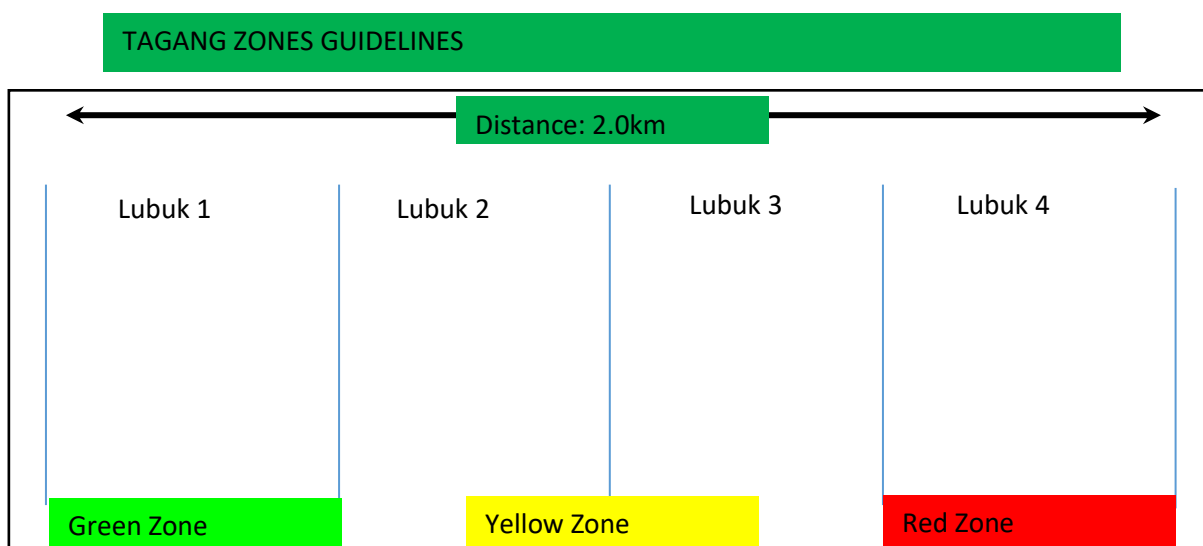


Figure 3-24: Guidelines of 'Tagang' System

Source: Inland Fisheries Division, Department of Agriculture

The *tagang* system generally follows the guidelines as indicated in Figure 3-24. There are three (3) main zones along the river where the *tagang* system is implemented, i.e.:

- Red Zone: No catch is allowed at all.
- Yellow Zone: Catch are allowed either annually or bi-annually, though this will be decided by the Tagang Committee
- Green Zone: Catch of fish are allowed all year long, though this will still be decided by the Tagang Committee.

A total of 23 *tagangs* are located in the Kuching, Samarahan, Betong and Sri Aman Divisions (Department of Agriculture, 2020-unpublished). Out of these 23 areas, 17 '*tagang*' projects have been undertaken in Sri Aman Division. Almost all the *tagang* systems in Sri Aman are monitored by the Department of Agriculture (DoA), Sarawak except for Sg. Ulu Engkari and Sg. Raru, Menyang Taih, both of which are monitored by (ITTO) and the Sarawak Forestry Department respectively. The highest number of active communities involved in the *tagang* system were Sg. Engkari, Spaya with 51 members. The *tagang* system at Sg. Engkari, Spaya was officially introduced in 2012. Other active communities include Sg. Entebar, Undop (22 members), Sg. Ulu Engkari (ITTO) (46 members), Sg. Engkari, Stamang (41 members), Sg. Skrang, Nanga Entalau (27 members), Sg. Skrang, Lubok Tabau (21 members), Sg. Raru, Menyang Taih (24 members), Sg. Skrang, Nanga Seladong (15 members), Sg. Undop, Paku (33 members) and Sg. Menyebat (15 members) (Department of Agriculture, 2020-unpublished).

Out of the 17 *tagang* projects, seven (7) have recently been closed i.e., Sg. Marup, Engkilili (2019), Sungai Abok Pulau, Pantu (2019), Sg. Merio, Engkilili (2019), Sg. Kumpang, Engkilili (2019), Sg. Sterap (Sg. Langgong), Jaong, Pantu (2013), Sg. Raya, Ibol (2013) and Sg. Tapang Rumpit, Gua Dalam (2018). They were closed due to being inactive and lack of cooperation among the communities involved (Department of Agriculture, 2020-unpublished).

Village	River	Year Started	No. of Participant	Status
Tagang Sg. Entebar, Undop	Sungai Entebar	2005	22	Active
Tagang Sg Marup, Engkilili	Sungai Marup	2005	42	Closed (2/5/2019)
Tagang Sungai Abok Pulau, Pantu	Sungai Abok, Pulau	2006	18	Closed (29/4/2019)
Tagang Sg. Merio, Engkilili	Sungai Merio	2006	50	Closed (2/5/2019)
Tagang Sg. Kumpang, Engkilili	Sungai Kumpang	2007	25	Closed (2/5/2019)
Tagang Sg. Sterap (Sg. Langgong), Jaong, Pantu	Sungai Langgong	2007	99	Closed (13/9/2013)
Tagang Sg. Ulu Engkari (ITTO)	Sungai Ulu Engkari	2011	46	Active
Tagang Sg. Raya, Ibol	Sungai Raya	2012	46	Closed (2013)
Tagang Sg. Tapang Rumpit, Gua Dalam	Sungai Tapang Rumpit	2012	17	Closed (28/6/2018)
Tagang Sg. Engkari, Spaya	Sg. Ulu Engkari	2012	51	Active
Tagang Sg. Engkari, Stamang	Sg. Ulu Engkari	2013	41	Active
Tagang Sg. Skrang, Nanga Entalau	Sungai Skrang	2017	27	Active
Tagang Sg. Skrang, Lubok Tabau	Sungai Skrang	2017	21	Active
Tagang Sg. Raru, Menyang Taih	Sungai Raru, Menyang Taih	2017	24	Active
Tagang Sg. Skrang, Nanga Seladong	Sungai Skrang	2018	15	Active
Tagang Sg. Undop, Paku	Sungai Paku	2019	33	Active
Tagang Sg. Menyebat	Sg. Menyebat	2020	15	Active

Source: Inland Fisheries Division, Department of Agriculture, 2017 – 2020 – unpublished

Most of the fish fauna recorded at the *tagang* areas were species that were naturally found within the respective river systems and included Keli (*Clarias* spp.), Tengadak, Kepiat (*Barbonymus schwanenfeldii*), Lampam jawa (*Barbonymus gonionotus*), Enseluai, Bangah (*Rasbora* spp.), Boeng (*Cyclocheilichthys apogon*), Semah (*Tor douronensis*), Baong (*Hemibagrus* spp., *Mystus* spp.), Adong, Juak (*Hampala macrolepidota*), Runtu (*Channa* spp.), Jelawat (*Leptobarbus hoevenii*), Kalui (*Osphronemus goramy*), Entabalong (*Barbodes kuchingensis*), Engkarik (*Desmopuntius johorensis*), Tilan (*Mastacembelus* spp.), and Udang galah (*Macrobrachium rosenbergii*). In addition, Labi-labi (*Amyda* spp.) were caught and consumed by the villagers.

Tagal projects have been successful in supporting significant levels of recreational fisheries in many sites in Sabah, much to the benefit of the communities involved (Hosin, A (2019). However, there is no data on the catch volumes, rates or seasonality patterns from the tagang projects in the study site that would enable an assessment of its socio-economic potential to be made. However, it does represent an opportunity that warrants further investigation. Recreational fisheries need not be limited to fishing per se. Observation of fish in their natural environment can be an attraction in itself. Sg. Chiling in Selangor, for instance an empurau sanctuary that only involves observation, is an example. Visitors simply observe or feed the fish or simply enjoy the river scenery (Figure 3-25). The sanctuary employs the tagang methodology and only differs in that its management is not community based.

In this respect, these areas are analogous to petting zoos for fish. None of these activities involve catching or consuming the fish itself (though it can represent a possibility), thus ensuring the original intentions of setting up the tagang (food security; conservation is not compromised).

However, the current emphasis by management agencies appear to focus on their role in conservation and not so much on their socio-economic potential as a recreational fisheries resource. Taking it from a basic community-based management resource to an economic driver would demand investment in infrastructure and promotion in suitable sites. These would include investment in roads, toilets, etc as

well as promotion of these sites for their habitat values to the general public. There is a need to focus these initiatives on those sites that offer those possibilities.



Figure 3-25: Recreational Water Use at Sg. Chilling Empurau Fish Sanctuary, Selangor.

3.2.3.2 Productive Assets for Estuarine and Riverine Fisheries

Where productive assets are concerned, fishermen employ outboard vessels made of wood or fiberglass and powered by engines with small capacities i.e., 5 h.p. to 15 h.p., due to their limited fuel consumption. The type of fishing gears utilized by the fishermen included gill nets, hook and line and cast nets (Figure 3-26).

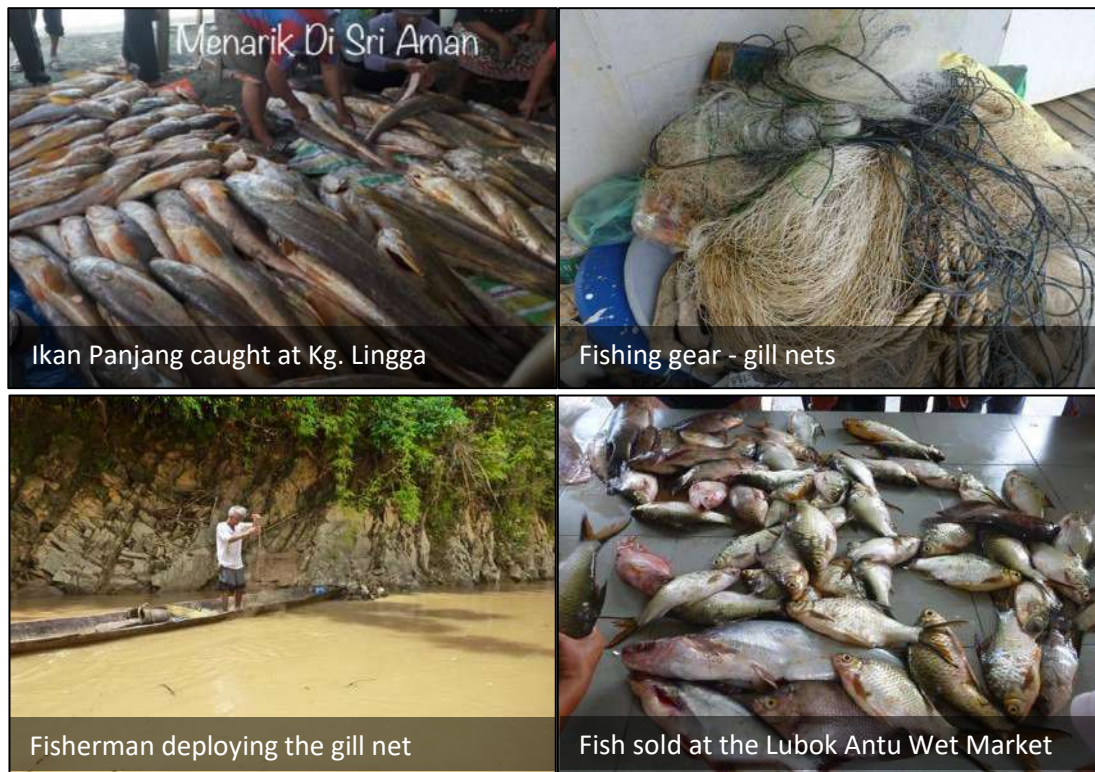


Figure 3-26: Inland Fisheries at Sri Aman Division



Figure 3-27: Location of the Tagang System in Sri Aman Division

Source: Inland Fisheries Division, Department of Agriculture, 2017 – 2020 – unpublished

3.2.4 Aquaculture

Several types of culture systems operate in the Sri Aman division. These are freshwater ponds, freshwater tanks, freshwater cages, brackishwater ponds and hatcheries. The discussion of these various culture systems is provided separately below.

3.2.4.1 Freshwater Pond Culture

In 2019, main areas for freshwater pond culture at Sri Aman district were at Lingga, Bukit Begunan and Simanggang. In the Lubok Antu district, the aquaculture operations were carried out at Engkilili and Batang Ai, while at Pantu sub-district, the activity was mainly located at Balai Ringin and Bukit Begunan. The details on the freshwater pond culture activities at Sri Aman division were presented in Table 3-25.

Table 3-25: Status of Freshwater Pond Culture in Sri Aman Division, 2019

Location	Sri Aman district	Lubok Antu district	Pantu sub-district
No. of Culturist	176	46	36
No. of Ponds	358	126	74
Area (Hectare)	37.29	5.99	3.88
Fish reared	Lampam jawa (Barbonymus gonionotus), Jelawat (Leptobarbus hoevenii), Tilapia merah (Oreochromis niloticus)	Jelawat (Leptobarbus hoevenii), Tilapia merah (Oreochromis niloticus), Empurau (Tor tambroides), Tengadak (Barbonymus schwanenfeldii)	Lampam jawa (Barbonymus gonionotus), Jelawat (Leptobarbus hoevenii), Tilapia merah (Oreochromis niloticus), Keli (Clarias spp.)
Production (tonnes)	151.03		
Wholesale value (RM)	2,294,164.00		

Source: Inland Fisheries Division, Department of Agriculture, 2020 - unpublished

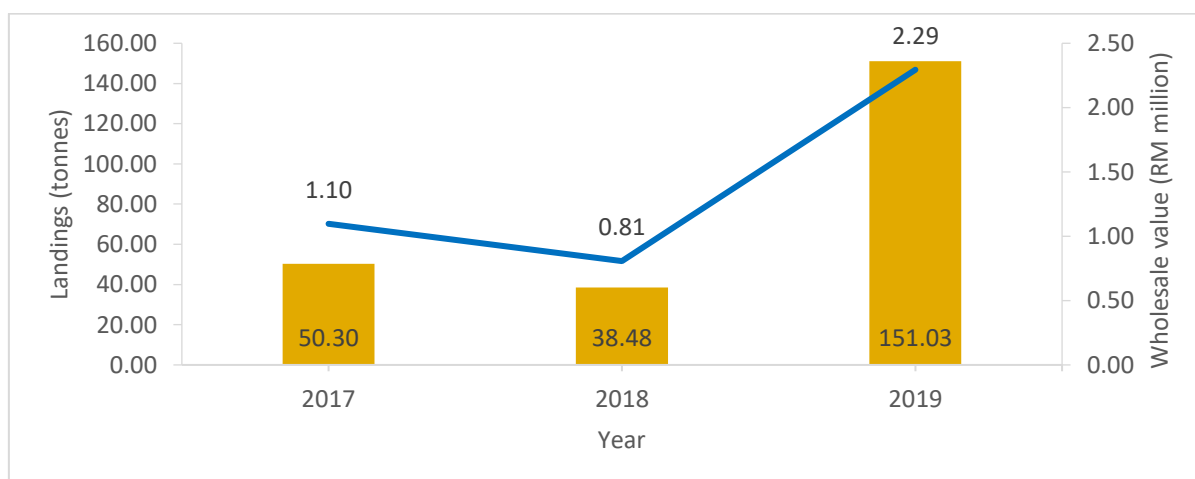


Figure 3-28: Trends in Production and Wholesale Value for Freshwater Pond Culture, 2017 – 2019

Source: Inland Fisheries Division, Department of Agriculture, 2018 - 2020 - unpublished

Production from freshwater pond culture at Sri Aman in 2019 amounted to 151.03 tonnes, with an estimated wholesale value of RM 2.29 million. In comparison to 2017 and 2018, there was an increase in both production and wholesale value of Red Tilapia Merah (*Oreochromis sp*) in 2019 (Figure 3-28).

3.2.4.2 Freshwater Tank Culture

Freshwater tank culture was also undertaken at the district of Sri Aman and Lubuk Antu as well as at the sub-district of Pantu in 2019. A total of 15 culturists were recorded operating freshwater tanks, with the highest number at Sri Aman district (10 culturists), followed by Pantu sub-district (4 culturists), while at Lubok Antu district, there was only one (1) culturist involved. The details of the freshwater tank culture at Sri Aman division were represented in Table 3-26.

The production trend from 2017 to 2019 indicated a steady decline i.e., from 5.13 tonnes (valued at RM 0.097 million) in 2017 to 1.70 tonnes (valued RM 0.030 million) in 2019 (Figure 3-29). The decline was mostly due to the lower number of Keli (*Clarias spp.*) produced each year.

Table 3-26: Freshwater Tank Culture Information at Sri Aman Division, 2019

Location	Sri Aman district	Lubok Antu district	Pantu sub-district
No. of Culturist	10	1	4
No. of Tanks	43	4	27
Area (m ²)	128.84	36	268.22
Fish reared	Keli (<i>Clarias spp.</i>), Tilapia merah (<i>Oreochromis niloticus</i>)	Keli (<i>Clarias spp.</i>)	Keli (<i>Clarias spp.</i>), Patin (<i>Pangasianodon spp.</i>)
Production (tonnes)	1.70		
Wholesale value (RM)	29,532.00		

Source: Inland Fisheries Division, Department of Agriculture, 2020 – unpublished

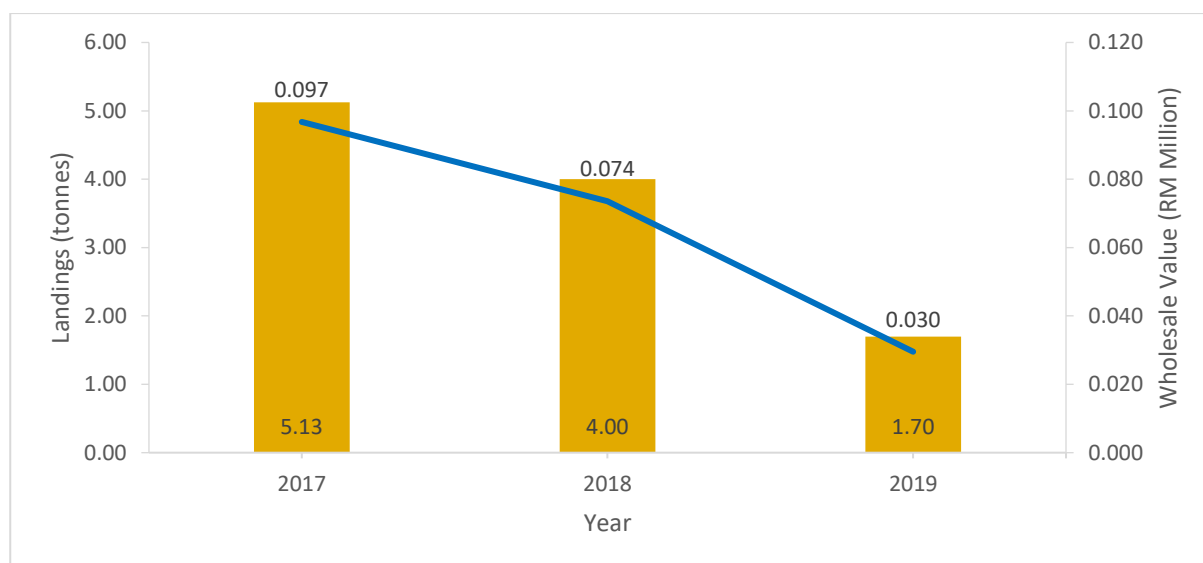


Figure 3-29: Trends in Production and Wholesale Value for Freshwater Tank Culture, 2017 – 2019

Source: Inland Fisheries Division, Department of Agriculture, 2018 - 2020 - unpublished

3.2.4.3 Freshwater Cage Culture

Freshwater cage culture was only undertaken at the Lubuk Antu district, specifically Batang Ai Reservoir, which supports the largest cage culture cluster in Sarawak. In 2019, the main cage culture farms in the reservoir was located at Sg. Piat, Sg. Ara, Teluk Secapan, Teluk Nyato, Teluk Telaus, Teluk Kaong/Teluk Pudai, Teluk Mengkak and Teluk Mepi (refer Figure 3-30). A total of 130 culturists were involved in the

activity, which covered a total area of 85,600m². The details of the freshwater cage culture operation are as in Table 3-27

Table 3-27: Freshwater Cage Culture Information at Sri Aman Division, 2019

Location	Lubok Antu District
No. of Culturist	130
No. of Cages	9,848
Area (Hectare)	8.56
Fish reared	Tilapia merah (<i>Oreochromis niloticus</i>), Tilapia hitam (<i>Oreochromis mossambicus</i>), Tengadak (<i>Barbonymus schwanefeldii</i>), Lampam jawa (<i>Barbonymus gonionotus</i>), Patin (<i>Pangasianodon</i> spp.), Empirau (<i>Tor tambroides</i>)
Production (tonnes)	1,175.69
Wholesale value (RM)	17,661,071.00

Source: Inland Fisheries Division, Department of Agriculture, 2020 – unpublished

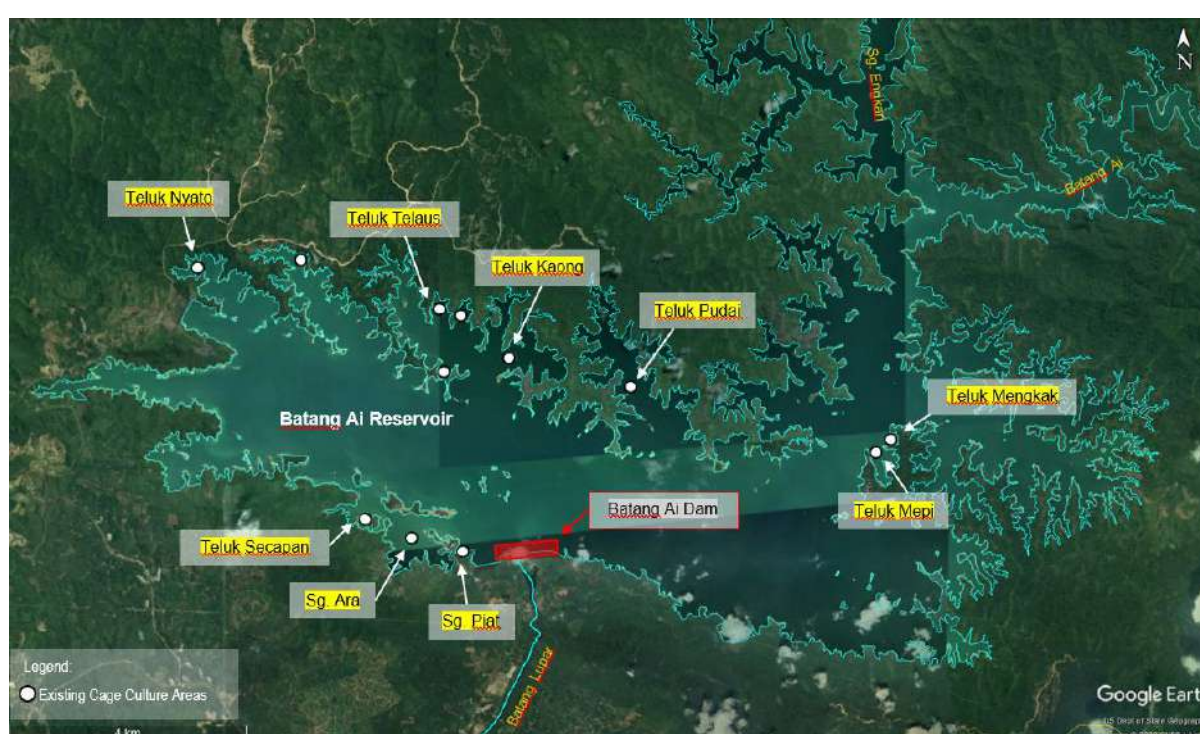


Figure 3-30: Location of Existing Cage Culture System in Batang Ai Reservoir

Source: Inland Fisheries Division, Department of Agriculture, 2017 – 2020 – unpublished

Total production and wholesale value in the same year amounted to 1,175.69 tonnes and RM 17.66 million, respectively (Figure 3-31). This was a substantial increment as compared to that of the previous years. In 2017 and 2018, production amounted to only 627.53 tonnes and 356.71 tonnes respectively. The major reason for the decline in those years was due to large scale mortality caused by Tilapia Lake Virus Disease (TiLV) since 2017. Fish affected by the TiLV showed gross signs include multifocal to coalescing dermal erosions and ulcers, ocular alterations including opacity of the lens and shrinkage of the eyes (Eyngor *et al.*, 2014). In addition, diseased fish also exhibit loss of appetite, pale color, gathering in the bottom, slow movement, and stopped schooling prior to death (Dong *et al.*, 2017).

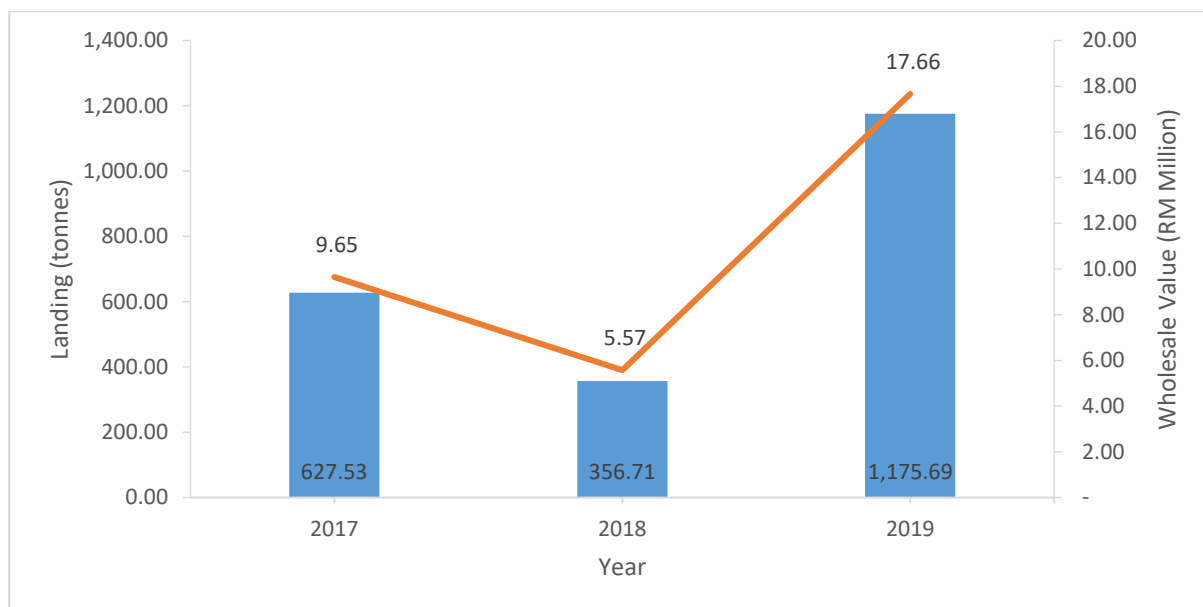


Figure 3-31: Trends in Production and Wholesale Value for Freshwater Cage Culture, 2017 – 2019

Source: Inland Fisheries Division, Department of Agriculture, 2018 - 2020 - unpublished

Most of the cages operating in the reservoir were self-financed by individual owners from the Iban longhouses downstream of the reservoir. Some of them were partially assisted by the Department of Agriculture (DoA) (under the Commercial Aquaculture Scheme (CAS)) or the Lembaga Getah Malaysia (LGM) before they were able to sustain operations on their own. In addition to the individual owner-operators, large scale cage culture operations were also carried out by various companies and corporate bodies. These included the Sarawak Land Consolidation and Rehabilitation Authority (SALCRA) and Borneo Eco Fish Sdn. Bhd.

The Borneo Eco Fish is the main company in the reservoir, operating over 4,084 cages at Teluk Kaong and Teluk Telaus. Borneo Eco Fish had bought 3,633 cages from 19 participants from Teluk Kaong and 451 cages from three (3) participants from Teluk Telaus and has since expanded the number of cages. Another important player is SALCRA. Currently, their farm consists of 400 HDPE cages with dimension of 6 x 5.4 - 5.6 m. In addition, they took over earlier efforts with Polar Circle cages, of which there were three (3) units of 4.5 m diameter cages, one (1) unit of 7.5 m cage and one (1) unit of 1.5 m cage.

Overall, the farm operated a total of 405 cages covering a productive area of 410 m². SALCRA farm is MyGaP certified. More recently, SALCRA signed a MoU with Borneo Ecofish for the company to operate some of their cages.

The most important commodity grown in the cages is tilapia (*Oreochromis* sp), though smaller quantities of other fish are also reared. Borneo Ecofish has also pioneered the farming of Labang hybrid. The tilapia is reared for 6 - 8 months and the harvested size is about 0.8 – 1kg/ind. Overall, feed consumption is about 300 metric tonnes a year while the feed conversion ratio is about 1.8, depending on the farm.

Most of the seed stock requirements of Batang Ai aquaculture cluster are supported by at least two (2) hatcheries, none of which are in Sri Aman. Feed is largely imported from feed mills in Peninsular Malaysia and comes through Kuching and sent directly to Batang Ai. In short, Sri Aman does not benefit economically from current arrangements, where both inputs into the industry or its offtakes do not contribute significantly to its economy. The establishment of the inland fisheries centre in the Division dedicated to production of seed stock for the Batang Ai cluster, which in addition to producing Specific

Disease-Free tilapia, can explore the mass production of seed stock of the fish such as Labang (*Pangasius* sp.) that command a wide demand, thus may be able to correct this situation.

Additionally, several new locations have been identified by the Inland Fisheries Division, DoA for the expansion of the cage culture activities in Batang Ai reservoir. The proposed areas were Kg. Peninggah, Teluk Engkubung, Teluk Santu, Teluk Selalau, Teluk Pudai, Teluk Barau, Teluk Bekatan, Teluk Sebangki and Teluk Kaong Ulu. The department plans to sponsor the establishment of 1,500 cages for 50 smallholders (30 cages per operator) under the 11th Malaysian Plan. However, the participants would need to undergo training and obtain the MyGAP certification.

Production of the Borneo Ecofish cages ranged from 1,000 – 2,000kg/180m² (11kg/m²) per cycle, with survival rate of fish culture around 70 – 80%. However, survival rates during the TiLV epizootic were only at 30 – 40%. Even in 2019, average production was only 119kg/cage or 13.7kg/m². This compares poorly with Temenggor, Perak where production from the high technology Trapia farm amounted to 159kg/m² (Mazuki, 2015) or even with the national average for freshwater cage farms of 28.7kg/m² (Department of Fisheries, 2019). For smaller farms, production rates are even more depressing, where for example, a 3 x 3m cage hosting 500 fingerlings can only yield RM320kg per cycle. The survival rate of fish culture within these farms was reported as being between 30-35%, where the low survival percentage continued after the TiLV epizootic but have since increased slowly.

In addition to the already proposed cage culture at Batang Ai reservoir, there is still larger potential for aquaculture farm expansion, which is based on the carrying capacity in the Catchment Management Plan for Hydropower in Sarawak (Envisar, 2018). Though there appears to be potential to greatly enhance the aquaculture industry at Batang Ai a number of studies undertaken over the last 20 or more years have suggested that the carrying capacity of the Lake could be as high as 78,000 tonnes/year (Ecosol, 1999) and 4,240 tonnes/year (Lee et al, 2019). These assessments were based on ‘box-model’ analyses of the Lake (using the Dillon – Rigler model), and assumed a total turnover of the reservoir volume, assuming total mixing and evenly dispersed flow. However, this is clearly not the case with Batang Ai Lake as flow short-circuits from the main tributaries (Batang Ai and Sg Engkari) through the middle of the Lake, to the outlet at the power station. The east and western portions of the Lake are largely backwaters, with low to minimal water exchange. In the areas further from the main flow path water exchange is achieved almost solely through the action of rise and fall in the reservoir levels.

Thus, aquaculture carrying capacity is highly dependent on the location of the cages within the reservoir. Relatively high cage density would be feasible in areas with high water exchange, while much lower densities should be applied to areas with low water exchange. It is also notable that water quality is seasonally variable. Generally nutrient concentration is lower after the wet season, and higher during the dry season. This accords with the dilution and water exchange associated with rain events in the catchment. It is notable that water quality sampling has indicated a possible trend toward increased nutrient loads in the time that the cage culture has been in place. Phosphorous concentrations are generally used as the critical parameter for fish culture. The outcomes of three sampling events is indicated below.

Report	Sampling Period	Number of sampling sites in Lake	P Concentration (average)	P Concentration (max)
Ecosol	Dec 1998	5	<0.02 mg/L	n/a
Lee et al	Aug 2016	4	0.043 mg/L	0.09 mg/L
SEB	Nov 2018	8	0.12 mg/L	0.18 mg/L
SEB	Mar 2019	6	0.012 mg/L	0.14 mg/L

It is notable that the 1998 values may be influenced by rain events in the early part of the wet season. The march 2019 values are towards the end of the wet season. The early studies adopted a P concentration level of 0.05 mg/L as the threshold level above which problems may become apparent. Later studies adopted a value of 0.2 mg/L as the acceptable upper limit for P.

Notable from this data is the increase in the dry season values from 2016 to 2018. Also, that the Nov 2018 values show that the P limit of 0.2 mg/L is potentially getting closer. The peak value of 0.18 mg/L was recorded at the western extremity of the Lake where water exchange is lowest, but also where cage farms are located. Given these circumstances, three (3) zones are proposed:

- Zone 1: remote inlets with minimal water exchange, which limits the number of cages to 240 cages/km².
- Zone 2: parts of the lake which is remote from the main flow but with a large body of water, allowing water exchange with rise and fall of lake levels. The number of cages is limited to 750 cages/km².
- Zone 3: areas that are likely to be affected by the general flow from the upstream tributary to the dam outlet, where the possible number of cages is 1,500 cages/km².

In overall, the total capacity for cage culture within Batang Ai would be about 23,000 cages. It should be noted, however, that the calculation of cages is based on the current standard cage size at Batang Ai. Given the current number of cages (9,848) and DoA's proposed expansion (1,500 cages), that means the reservoir can sustainably support another 12,500 – 13,000 cages. Assuming each cage had a 10 m² this would amount to a productive area of 230,000m². Assuming the national average output of 28.7kg/m² (Department of Fisheries, 2019), the total volume generated by the 23,000 cages can be expected to be about 6,600 tonnes. However, with the use of enhanced production techniques, both production figures and production area can be tweaked to ensure that development of the industry is carried out in a sustainable manner. In the project proposal in Section C below, a more conservative figure of 50 kg/m² is assumed.

In practical terms, it is anticipated that the industry would expand by another 14,000 cages by 2030 with investments by two major investors. However, it is important to emphasize that the success of Borneo Ecofish underscores the fact that future development of the cage culture industry cannot be based on small scale farming operations as has been pursued in the past. Investment must be made in large scale operations that have the economies of scale to justify investments in technology, sustainable husbandry and biosecure infrastructure as has been the case in Temenggor, taking into account that Batang Ai is only 66% of Temenggor's size. The operation in Temenggor consists of large circular cages, employ high quality hybrids, quality feed and mechanical harvesting and handling equipment to ensure high productivity. A similar approach should be pursued in Batang Ai.

The capital input of each investor is estimated at RM25 million inclusive of boats, storehouses and worker accommodation. Investments by small scale operators should be discouraged though local participation of contract farmers to bigger players should be promoted. The Ministry of Agriculture stipulates that a maximum of 60% of the cages should be owned by parties outside Batang Ai, while 40% should involve locals. The problem with this ratio is that it uses 3m x 3m cages as a basis. It may need to be reviewed in line with large cages employing sophisticated technologies. However, local participation in terms of employment and contract farming would ensure local populations benefit from the further development of the reservoir

It is also important to note that the need for biosecure protocols and infrastructure has taken on a stark profile since the TiLV epizootic. While some measures such as the removal and burial of dead fish (as required by the Sarawak Department of Marine Fisheries under MyGaP) is currently being undertaken,

however, the lack of proper infrastructure for quarantine, disease monitoring and management seriously undermines the long-term sustainability of the industry.

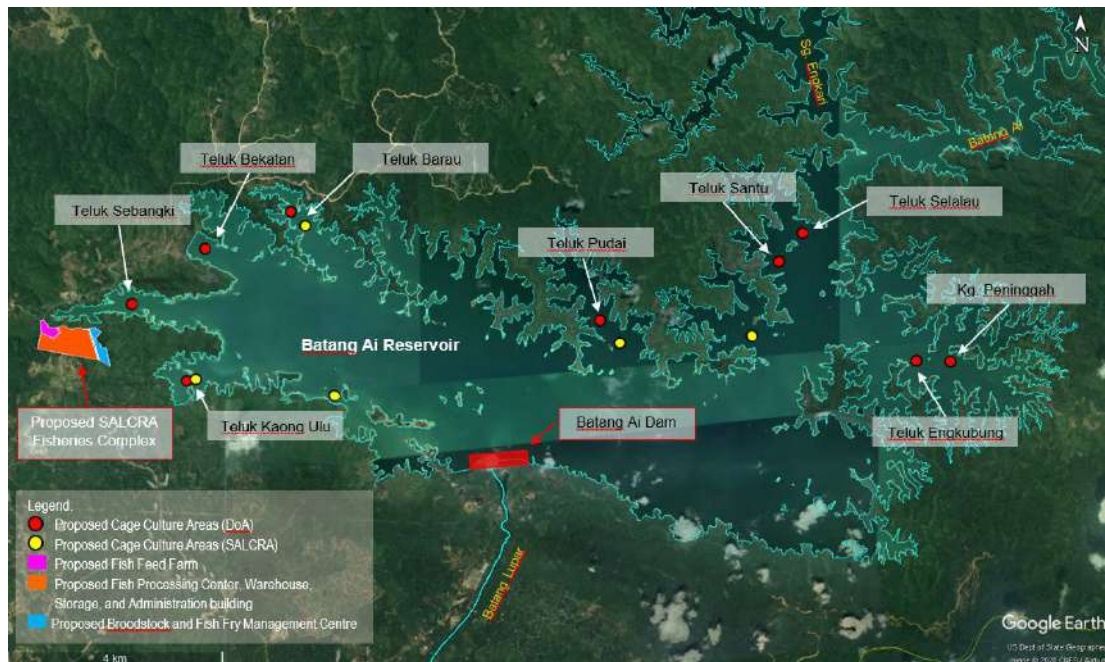


Figure 3-32: Proposed Cage Culture Areas in Batang Ai Reservoir

Source: Inland Fisheries Division, Department of Agriculture, 2019 – unpublished



Figure 3-33: Fish Cage Culture Operated in Batang Ai Reservoir

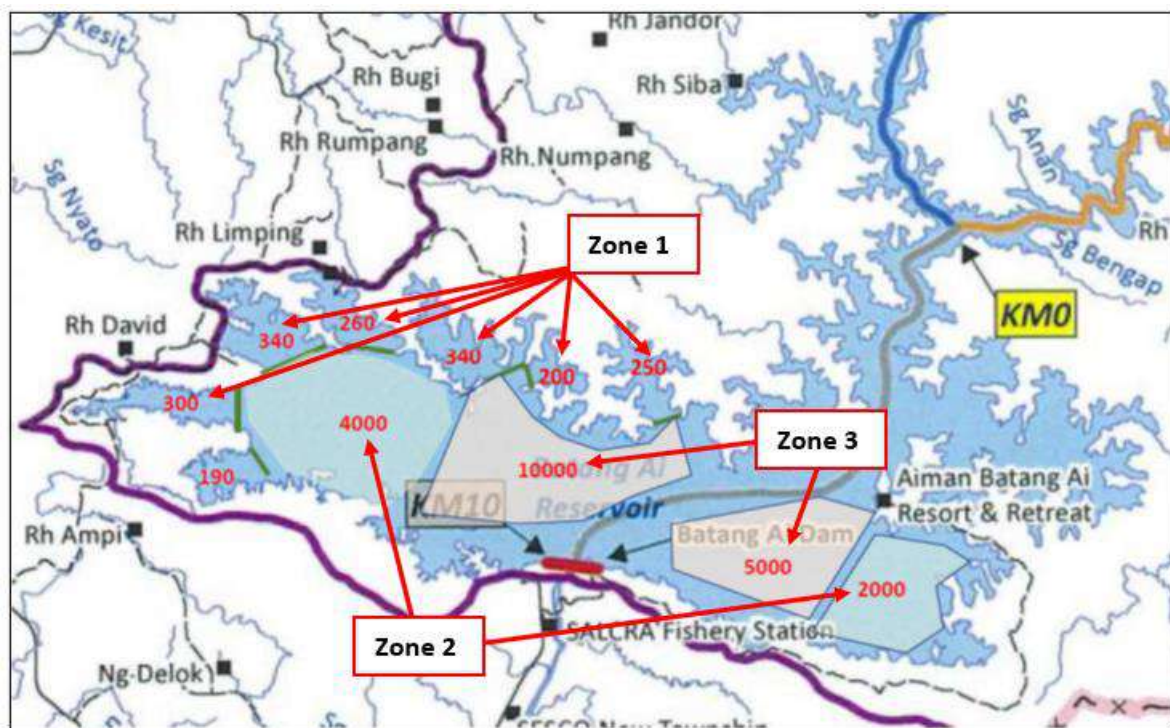


Figure 3-34: Carrying Capacity within Batang Ai

Source: Envisar, 2018

3.2.4.4 Brackishwater Pond Culture

Brackishwater pond culture was limited to a total of 20 culturists were recorded operating 46 ponds covering a productive area of 9.50 hectare. Though they are categorized as brackishwater ponds by the DoA statistics, they abstract freshwater and raise freshwater fish. The main species cultured was only Javanese Carp (Lampam Jawa or (*Barbonymus gonionotus*) (Department of Agriculture, Sarawak, 2020 – unpublished). The fish has limited market appeal and any expansion of the activity is not deemed tenable.

3.2.4.5 Hatchery

There were two (2) main hatchery operations that were undertaken in the main districts of Sri Aman and Lubok Antu. All were small scale. There were three (3) culturists operating the hatchery in Lubok Antu, with a total of 45 ponds and total area of 1.44 hectare. There was one (1) hatchery operator recorded in Sri Aman, with a total of 10 ponds and total area of 1.13 hectare (Department of Agriculture, Sarawak, 2020 – unpublished). These hatcheries were only known to produce Red Tilapia (*Oreochromis niloticus*) fry for the surrounding area.

3.2.4.6 Markets and Marketing

3.2.4.6.1 Fisheries

Simanggang is the market centre for locals for local produce, which includes freshwater fish and prawns. Most are consumed domestically within the Division. Those commodities that have sufficient value are

exported to Kuching. These would be the Terubuk (*Tenuulosa* spp.) and Udang galah (*Macrobrachium rosenbergii*). Movement of these selected fisheries commodities is from Simanggang.

Simanggang simply acts as a trading and exchange point. There is little revenue capture in their trade.

3.2.4.6.2 Aquaculture

Where aquaculture commodities are concerned, Borneo Ecofish exports substantial quantities of their Batang Ai output to Kuching and Singapore in chilled form. Again, the commodity moves through the division with little economic accrual. More recently, they have received orders amount to RM12 million for farmed fish to be supplied to Singapore market.

Batang Ai fish are currently sold chilled degutted or live depending on consumer demand. A processing plant is co-located with the Borneo Ecofish hatchery at Batang Ai and has capacity of 1.4 tonnes for plate freezer, 14 tonnes for cold room and 1 tonne for ice flake plant. Ex- farm price for the Tilapia is RM12/kg either processed or unprocessed. Borneo Ecofish has been successful in exporting its output to Singapore. In September 2020, the company closed a deal to export six tonnes of patin and 5.5 tonnes of tilapia to the Sheng Siong Group, Singapore's third largest supermarket chain with 63 stores nationwide.

3.2.4.7 Committed Plans

The committed plans for fisheries and aquaculture were mostly concentrated within or related to the Batang Ai reservoir for the aquaculture sector due to its potential and return of investment. Some of the committed plans include:

- Inland Fisheries Branch, Department of Agriculture
 - Development of 50 small scale cage farms (30 cages each) in compliance with MyGAP standards.
 - A biosecurity centre in Lubuk Antu.
- Private Sector
 - Revitalization of the existing DoA hatchery in Temuduk by Supreme Cold Storage.
 - The establishment of a processing centre in Stubin by Ceria Holdings Sdn. Bhd.

3.2.5 Issues, Challenges and Potential

3.2.5.1 Fisheries

Some of the major issues regarding the fisheries sector in Sri Aman include the uncontrolled development upstream of Batang Lupar such as from logging and agriculture. This has led to habitat degradation of the aquatic environment through modification of ecosystems, surface water runoff, water pollution, eutrophication, and navigation problems.

Water quality monitoring undertaken by Natural Resources and Environment Board (NREB) from 2017 – 2019 (3 years) has focused at Batang Lupar and Batang Undup as well as Batang Ai Hydroelectric Dam reservoir. Though the Class IIB standard has been set as the water quality goal for all three rivers in Sarawak, based on the data, most of the downstream stretches of Batang Lupar were generally classified as Class III (Slightly Polluted), only upper stretch was classified as Class II (Clean). In terms of fisheries,

Class III was still considered to be suitable for the protection of common and moderately tolerant aquatic species of economic value. As for the Batang Ai reservoir, most the water quality status for the reservoir was classified into Class I to Class II, indicating Clean status. Overall, the water quality level of the river within the Sri Aman division would still be considered clean and suitable for aquatic life.

However, there is also the problem from the heavy exploitation of fisheries resources, which would come from commercial and recreational fisheries activities. The effect from heavy fishing pressure can translate to reduction of desired species and amount of catch. In addition, there is also potential of transformation of fish community structures due to the decreasing numbers of certain species.

3.2.5.2 Aquaculture

The main issues pertaining to aquaculture activities in the Batang Ai reservoir would be:

3.2.5.2.1 Environmental Degradation

- The possible deterioration of the water quality in the Batang Ai Reservoir accompanying excessive aquaculture development. The availability of good water quality is one of the requirements for a successful aquaculture project, as poor water quality can seriously affect the health of the farmed animals, thus leading to diseases outbreaks and eventually decrease their production. The pollution in the water body can occur due to effluent discharge and solid waste from commercial and residential areas as well as agricultural activities.

As the Batang Ai reservoir is a major asset for Sri Aman division, and the reservoir water quality maintains the value of the asset, reducing nutrient loads would enhance the water quality of the reservoir. In addition, there were also other potential threats to its water quality, which include sewage effluent, debris, and sediment carried directly into the reservoir by the tributary rivers. The main objective for the environmental management would be to maintain the water quality of the reservoir and its feeder rivers at Class IIB (recreational use).

Our review indicates water quality sampling data is considered sparse and the results may be considered uncertain. However, this data does suggest that additional sampling across seasonal periods, and covering all areas of the reservoir, is highly advised before embarking on an expansion of aquaculture activities. In addition, a 3-D water quality model for the Lake may be undertaken to provide more certainty around zoning and appropriate cage density levels in different zones. Towards this end, the following are the steps that must be taken to ensure its water quality:

i. Zoning of Aquaculture Areas

Zoning of the reservoir, so that cages are distributed throughout the reservoir and not concentrated in some areas in accordance with recommended density limits based to manage nutrient levels. The Ecosol Report (1999) recommended establishing zones in the Lake for aquaculture. We recommend taking that a step further and adopting zones of different allowable aquaculture densities in the Lake. The zones correspond with areas of high, medium and low water transfer. The low water transfer areas are found at the western part of the Lake which is basically a backwater with minimal catchment or tributary inflow, while the high water transfer areas are in the vicinity of the main flow path from the major tributaries (Btg Ai and Sg Engkari) to the outlet at the power station. A suitable zonal arrangement can be seen in Figure 3-35. This arrangement provides for aquaculture production to be expanded from approximately 1,000 t/a (current) to 2,300 t/a;

ii. Establish Development Limits based on Carrying Capacity of the Reservoir

Establish reservoir carrying capacity for aquaculture, based on the water exchange in the different zones, and limit permits to this.

- Carrying capacity can be based on the conservative assumptions in this paper, or, more precisely, on 3D modelling to establish water flows, water exchange, and nutrient distribution.
 - Develop an improved water quality monitoring programme that would involve;
 - Better coverage of catchment. Includes water column, and not just the surface values.
- iii. The Ecosol Report (1999) also recommended a water quality monitoring programme be undertaken. The Report recommended monitoring on a monthly basis. We consider that a sampling programme at maximum two-month intervals would be satisfactory. The sampling sites should correspond to the sites sampled in November 2018. Samples are to be taken at surface, 5 m depth and 10 m depth. The main parameters that are to be tested are:

- pH
- DO
- Turbidity
- Temperature
- BOD
- COD
- Ammoniacal Nitrogen
- Total Phosphate
- Total Coliform
- Faecal Coliform
- Streptococcus

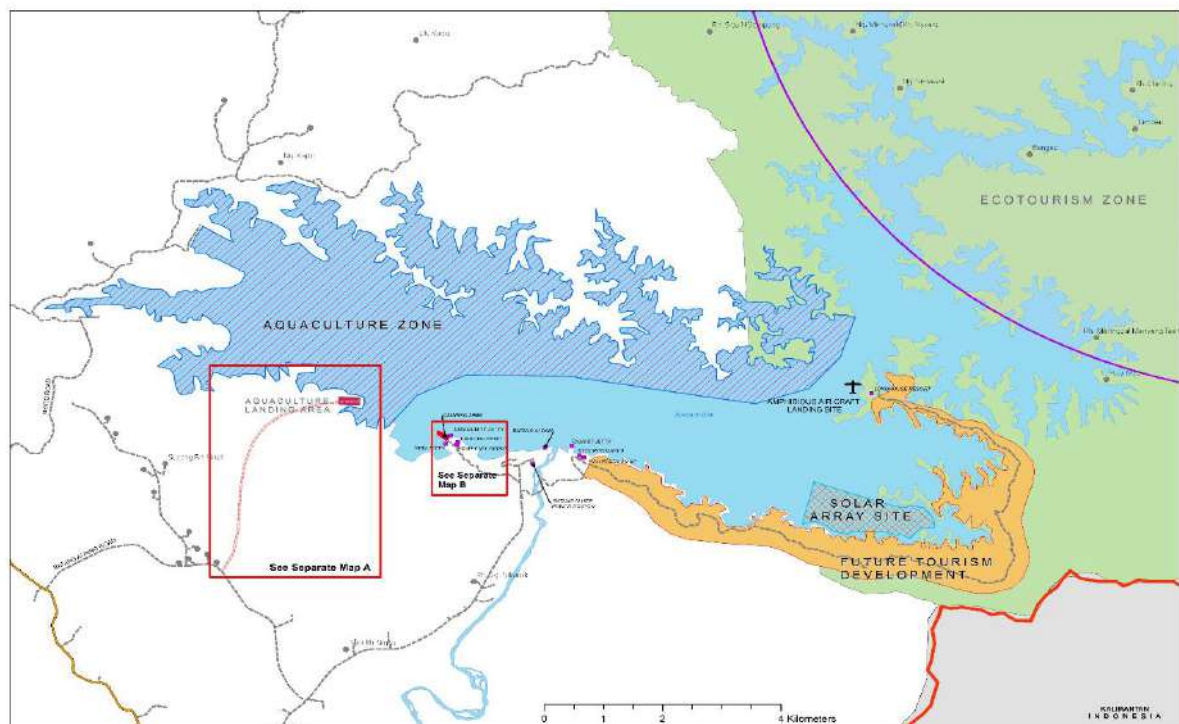


Figure 3-35: Proposed Zonal Distribution of Aquaculture Farms within the Batang ai Reservoir

Source: Daya Rancang

Note: Base map source from UNIMAS Holdings

Individual farms should also be required to monitor water quality at the farm site. At least two samples are to be taken – one at the upstream side of the farm and one at the downstream side.

In addition to these steps, there are other steps that involve other agencies need to take, which are as follows:

- *Department of Agriculture*: ensure cage farmers adhere to MYGAP practices, including waste disposal
- *Forestry Department*: Limit/phase out timber extraction in catchment
- *Ministry of Health*: Improve/upgrade sewage effluent management in settlements.

3.2.5.2.2 Biosecurity

A second factor would be the lack of biosecurity infrastructure particularly on certification of incoming fingerlings. In 2018, there was a major decline in cage culture production due to the large-scale mortality caused by Tilapia Lake Virus Disease (TiLV), first reported in 2017. Due to the TiLV, the survival rate for the tilapia cultured within Batang Ai was reduced to 30 – 35%. Biosecurity concerns are not limited to fingerlings alone. More recent studies have indicated that zoonotic transmission of *Streptococcus* sp. Infections from farmed fish (in raw form) to humans, indicating a potential human health hazard. Though it may be argued that fish is never consumed raw, poorly cooked fish and occasions that call for raw fish dishes provide a gateway for bacteria to jump the animal – human barrier.

A biosecurity centre should be established at the access road to Batang Ai Lake. A suitable site is shown in Figure 3-36 below, but alternative sites may also be investigated.

Aquaculture farms in the reservoir will be required to comply with biosecurity norms. This would include, but not be limited to, the following:

- Procuring SPF certified fingerlings from biosecure hatcheries or nurseries.
- Using only formulated feeds and not using of raw feeds, such as chicken viscera.
- Ensuring compliance to the highest standards of animal husbandry.

The biosecurity station will check certification of all these materials before they can be delivered to the Lake.

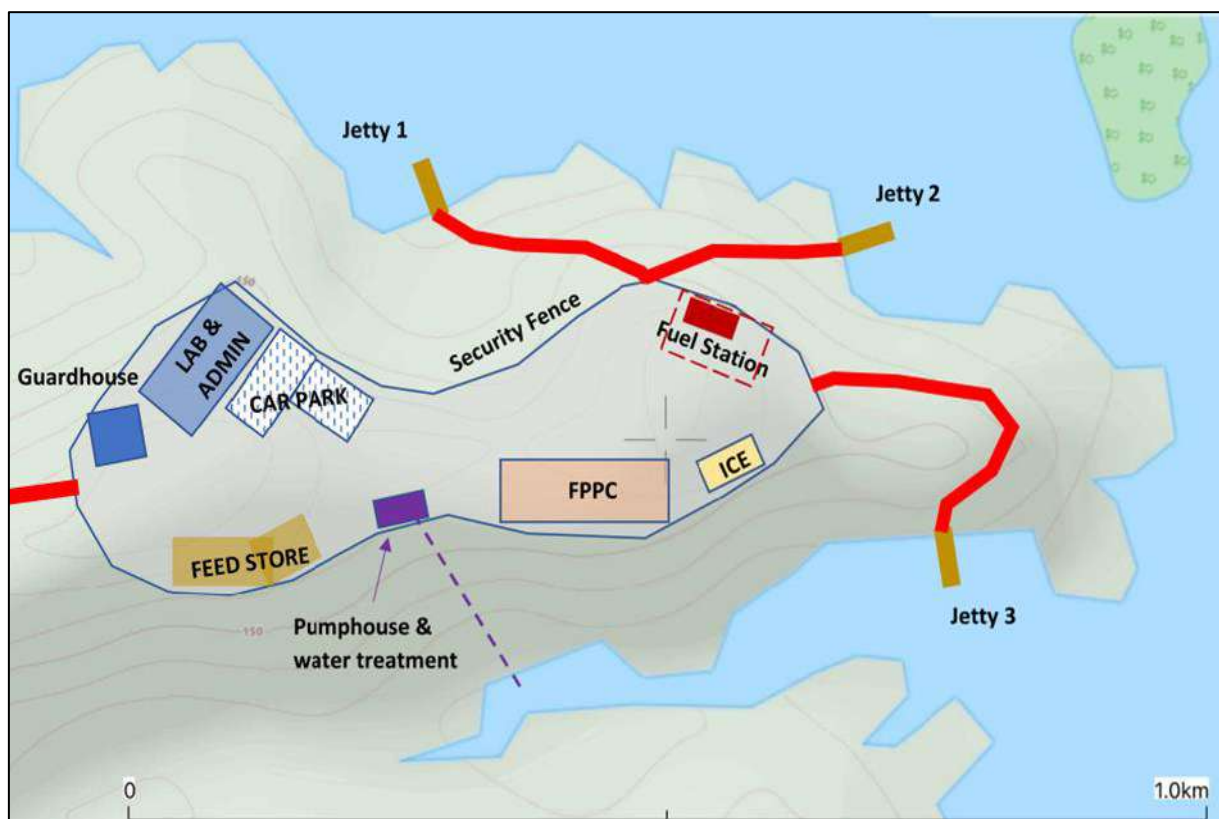


Figure 3-36: Proposed Location of the Biosecurity Centre

Source: Daya Rancang

Note: Base map source from UNIMAS Holdings

3.2.6 Digital Fisheries Presence

The presence of digital services is pertinent to the coming future, in two major areas:

- Remote monitoring of the fish production environment and its management. This would enable systems to continuously monitor the production environment and actuate mechanisms such as aeration devices and feeders on an as-required basis promoting production efficiencies currently facilitated manually. It would require real-time data to be transferred digitally to managers so that they can make the necessary decisions regarding the actions that need to be undertaken under specific circumstances.
- Marketing and distribution, where most of the buying and selling transactions could be done online. This holds true especially when even fisheries produce could be marketed and sold online. In conjunction with the plan to set up a data centre for Sarawak, which would provide business opportunities to local small and medium enterprises (SMEs) in terms of logistics, foods and other supplies, the future for fisheries would greatly be dependent on the digital services.

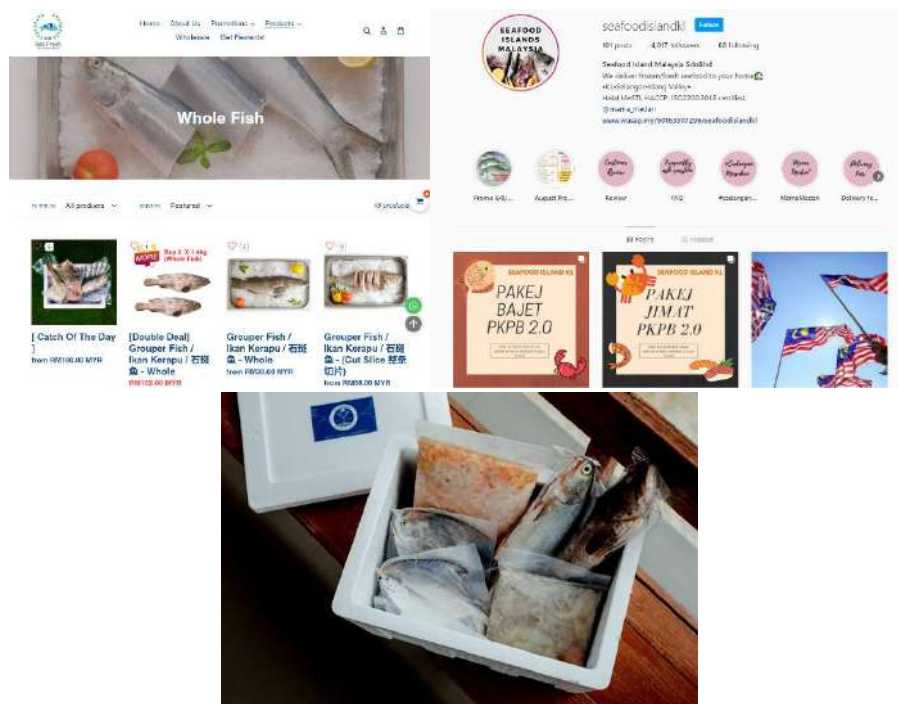


Figure 3-37: Examples of Fisheries Products Sold Online

Source: Google images from <https://seafoodisland.com.my/media/> and <https://seafreshdaily.com/collections/merdeka>

3.2.7 Marketing

Sri Aman lies abutting the Kalimantan border. There could be opportunities to tap into the Kalimantan supply catchment to augment the development of fisheries-based industries in the Division. This needs to be explored further.

3.2.8 Hazards, Effects and Resilience Planning

There exists the potential for diseases to enter the aquaculture sites in Batang Ai via fingerlings or feed. Environmental changes can be stressful to aquatic fauna and lower the resistance of fish diseases. Studies have shown that a wide variety of bacterial, parasitic, or other diseases become a problem only if fish are held under unfavourable environmental conditions i.e., overcrowding, temperature fluctuations, inadequate dissolved oxygen and high concentrations of toxic gases like hydrogen sulphide, carbon dioxide and ammonia.

In addition, the persistence of epizootics is also dependent on a pathogen reservoir, which the feral *Tilapia* populations represent. Their reduction in the wild would also reduce the risk of disease outbreaks.

Disease pathogens are also host-specific. The current near total dominance of *Tilapia* in the farming industry in Batang Ai means that the disease, once established, can spread very rapidly. There is also currently an unacceptable risk with regards to the introduction of alien invasive species. Invasive species, once introduced, become extraordinarily difficult to control and almost impossible to eradicate.

3.2.9 Covid-19 and Its Impact on the Fisheries Industry

The impact that the Covid-19 pandemic has had on the fisheries industry can be measured in both negative and positive ways. As fish and fisheries products are among the most traded food products in the world, with about 38% of the fish/seafood entering international trade, their markets suffered during the early development of the global pandemic. This was due to the closure of the food service sectors (e.g. hotels, restaurants, and catering facilities) as well as the processing sector, where the consumer demand was reduced/lost for fear of the pandemic.

Additionally, seafood trade has also been affected by the lockdowns implemented by some countries, particularly by transportation and border restrictions. There has also been shortages of seeds, feeds, and related aquaculture materials (e.g. vaccines) affected by the restrictions. Therefore, with the drop in the number of supplies and the price, both culture and capture fisheries demand has been significantly reduced.

Moreover, there have been concerns over Covid-19 virus contamination of fish products. China has detected the coronavirus on seafood packaging on several occasions, more recently at a cold storage warehouse in Lanzhou, Gansu province. The single positive sample was taken from a package of frozen shrimp. China's customs office has suspended imports from the Indian company Basu International for one week after detecting the novel coronavirus on three samples taken from the outer packaging of frozen cuttlefish.

Within Sri Aman, however, fishermen were still able to undertake fishing, albeit were limited in terms of personnel due to physical distancing requirements. However, they probably were not able to send their catch to major markets in Kuching due to the MCO. It is likely that they were forced to sell their fish directly to local consumers or use it for their own consumption.

On the other hand, there could have been some positive impact arising from the pandemic, the reduced fishing effort can lead to a potential increase in the wild fish stocks, though the effect was possibly for short-term only.

Furthermore, there was also a probable increase in domestic seafood sales which was contributed by consumers cooking at home due to Covid-19 shelter-in-place and dining restrictions.

SECTION 3.3 MINERALS AND MINING

3.3.1 Introduction

This chapter is an overview on the topic of Geology and Mineral Resources in the Sri Aman Division. It looks at the geology and minerals in a broader perspective of the mining industry in Sarawak and a discussion of Sri Aman's place within the State mining industry's outlook. This is followed by an evaluation of mining resources and inventory of the Division.

The final sections present an overview of issues and opportunities and recommendations for the sector's development in Sri Aman.

3.3.2 The Wider Picture – Mining in Sarawak

In 2017, Sarawak makes up 8.3% or 12 of 145, of Malaysia's mineral production operated at worth of approximately RM428.03 million. This represents about 20% of Sarawak's GDP. Sarawak's mineral resource industry consists of six coal mines, three silica sand mines, two ball clay mines, and a limestone quarry operated on a mining lease as shown in Figure 3-38.

Data from the Department of Mineral and Geoscience Malaysia (2017) shows Sarawak was involved in the commodity production of aggregate, clay, earth material, limestone, sand and gravel, silica, sand and coal. In addition, the opening of a ball clay mine in Sarawak made significant contribution to the rise of production value for non-metallic minerals in 2017 and the production of coal, the only energy mineral produced, and which only Sarawak was involved, also increased by 28% in 2017.

The mineral deposits and occurrences in Sarawak can be grouped into two broad zones on its geological setting which is West Sarawak and Central-North Sarawak. Most of the metalliferous mineral deposits are found in West Sarawak, west of the Lupar Valley. As shown in Figure 3-39, fossil fuels such as petroleum in Central-North Sarawak. Coal is also found in the eastern part of West Sarawak (i.e. Silantek Coal Deposits). Industrial minerals such as ball clay and silica sand are distributed in both zones.

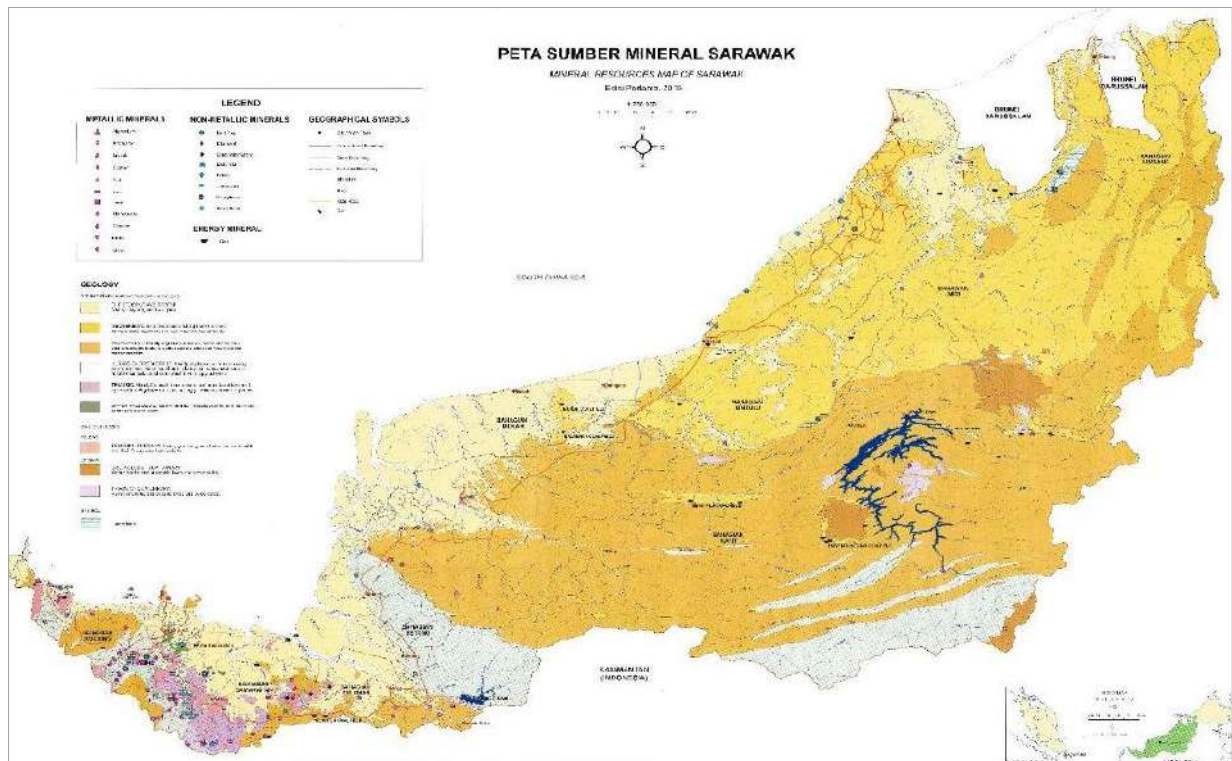


Figure 3-38: Location of Mineral in Sri Aman

Source: Department of Mineral and Geoscience Malaysia



Figure 3-39: Location of Mines in Sarawak, 2017

Source: Ministry of Natural Resources and Environment (Malaysian Mining Industry 2017)

3.3.2.1 Coal

Malaysia's coal resources are located primarily in the states of Sarawak and Sabah with smaller occurrences in the states of Selangor, Perak and Perlis. Some 80 per cent of these resources are in Sarawak, 19 per cent in Sabah and only 1 per cent in Peninsular Malaysia. The largest reserves of coal are located in Merit Pila, Sarawak and in Maliau and Malibau, Sabah. Production in 2016 decreased to 2,414,765 tonnes from 2,559,444 tonnes produced in 2015 that came from eight mines, all in Sarawak.

Reserves estimated by JMG amounts to some 1,724 million tonnes, of which 275 million tonnes are measured, 347 million tonnes indicated and the balance of 1,102 million tonnes as inferred.

Malaysia imports large quantities of coal for its domestic requirements. Its most significant sources of import are Indonesia, Australia and China. The imported coal is consumed mainly by the power generation and cement plants and to a lesser extent by the iron and steel plants. Coal is one of Malaysia's current domestic energy mix under its Five-Fuel Policy comprising oil, gas, hydro power, coal and renewable energy. Coal extraction in Sarawak is strictly for domestic use for power generation.

3.3.2.2 Aggregates

Sarawak stands out amongst the other states in Malaysia for possessing some of the most naturally abundant resources of aggregates in Malaysia and it comes from two primary sources, namely quarries and river beds. These aggregates are the primary construction materials used for the many on-going infrastructure and mega projects throughout the State.

West Sarawak geology usually found the stone aggregate source mainly from igneous rocks such as granite, microtonalite, andesite, basalt, and volcanic breccia. Limestone and sandstone are also used, but are quarried mainly in Central-North Sarawak. Greywacke sandstones from the Belaga formation are suitable aggregates and have been used for constructing the Bakun HEP and the Murum HEP projects. Gravel and sand sources are mainly won from the rivers in Sarawak such as the Sarawak River, the Batang Rajang, and Limbang River since gravel can form naturally in riverbeds, streams and other geographical formations. Sand which is smaller than gravel is a granular material derived from the erosion of rocks, ranging in size from 0.075 mm to 4.75 mm and similarly for gravel which also a derivation from erosion of rocks, ranging in size from 4.75 mm to 75 mm. Both of these aggregate materials are used in construction in Sarawak such as asphalt and concrete.

Bricks and earthenware pipes are produced in a small scale from clay deposits which is widespread in West Sarawak.

3.3.2.2.1 Gravel and Sand

Quaternary deposits in Sri Aman consist primarily of riverine and swamp alluvium, as well as minor gravel terraces found at the base of steep hills and mountains. The terrace deposits, which can be found at Marup southwest of Engkilili, at various locations north and south of Lubok Antu, and along the Batang Lupar between Engkilili and Lubok Antu (see Figure 3-40), are possibly the oldest known Quaternary deposits. Gravel terraces can be found up to 12 metres (40 feet) above the Batang Lupar's current level. The gravel deposit is made up of hornfels, chert, sandstone, vein quartz, and siltstone granules, cobbles, and a few boulders in a sandy clay matrix overlain by a metre or so of clay and sand. In the Marup area, diorite blocks are present in the older alluvium (gravel deposit) which has a thickness of up to 4 m (13 feet) in places.

Alluvium is classified into two types: riverine and swampy. Peat swamps and riverine alluviums are low-lying sediments that have formed as a result of heavy weathering and erosion in tropical areas. Riverine alluvium is a common feature along river banks, and it is frequently the water's boundary during the rainy season when the river overflows onto the banks. Alluvium in the river valleys is mostly clay overlying sand and gravel except in the headwaters of some streams and rivers where there are boulder gravels. Terrace gravel coexists with riverine alluvium in some places, such as Sungai Dandi. The majority of the recent alluvium is located along low swampy land bordering the Batang Lupar and north of the rock formation outcrops, which is bordered on both sides by the Batang Lupar. This alluvium is typically made up light-gray, dark-gray to black, silty clay and is rich in organic matter, such as roots, leaves, and logs.

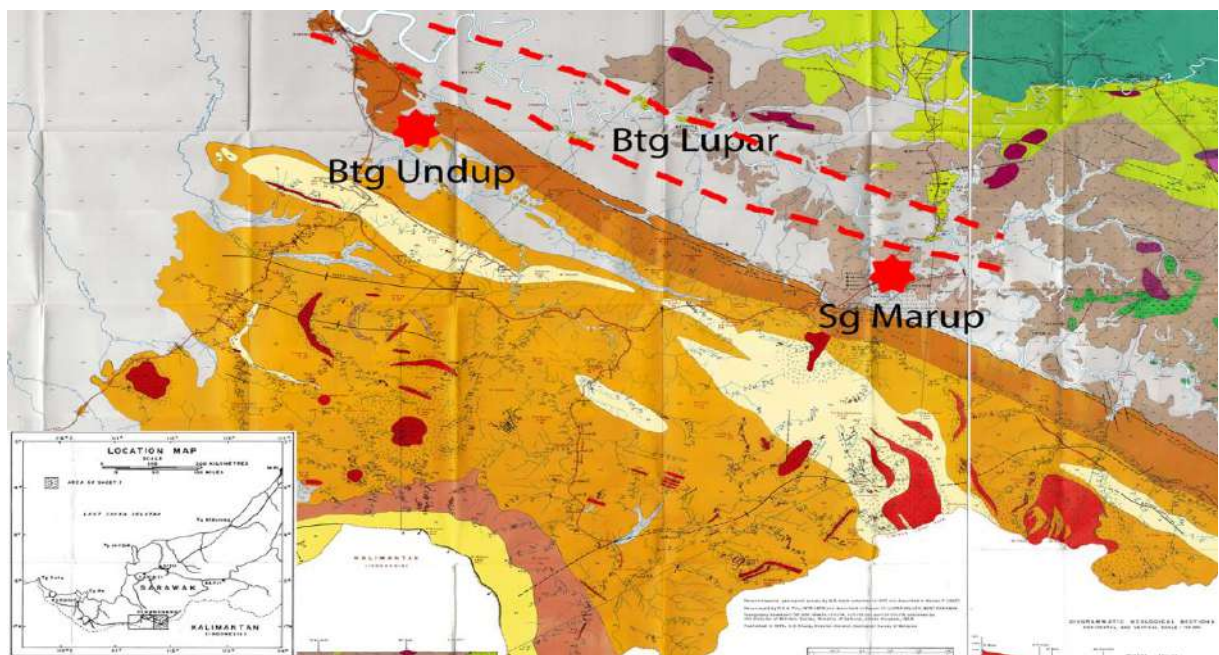


Figure 3-40: Location of Gravel and Sand Extraction at Batang Lupar

Source: Department of Mineral and Geoscience Malaysia

Gravel and sand were primarily collected locally from riverbeds for construction work in Sri Aman. Simanggang's supplies come from the Batang Lupar, which lies between Simanggang and Batang Lemanak, as well as Batang Undup, and Sungai Marup as shown in Figure 3-40. The gravel and sand were transported by large to Simanggang, where they were unloaded and stacked at the water's edge. In the past, material was collected from the gravel banks located near Lubok Antu bridge for use in road maintenance at Lubok Antu.

In Sarawak, Magna Focus Sdn Bhd (MFSB) has been given a mandate by the Sarawak government as the sole license holder for all sand extraction activities. MFSB then appoint qualified contractors to extract sand & gravels from its numerous license areas.

There have been many reported environmental issues related to the sand extraction activities that affect river morphology and ecological systems. Some of these effects such as riverbank erosion is considered serious as it affects settlements and built infrastructure along the affected rivers. Damages can sometimes run into millions. The problems created by sand mining are numerous where the problems can lead to such as increase in turbidity, physical disturbance of the habitat caused by dredging, degraded stream habitats that caused by instream mining and destruction of riparian

vegetation that caused by heavy equipment, processing plants and gravel stockpiles at or near the extraction site activities.

Mitigation must occur concurrently with sand and gravel extraction activities. Restoration is therefore a part of mitigation and the aim of restoration should be to restore the biotic integrity of a riverine ecosystem, not just to repair the damaged abiotic components.

In the Sri Aman division there have been potential areas identified for sand and gravel extraction at Batang Skrang to Lubok Tedong at Engkilili along the Batang Lupar. Demand for fill materials is on the increase with the increase in economic and development activities in the region. It has been acknowledged that applications for sand mining licenses for these areas have been made to the government. At the time when this study was carried-out, no decision yet has been granted for the proposed extraction activities.

3.3.3 Sri Aman's Place Within Sarawak's Mining Sector

3.3.3.1 Sri Aman Regional Geology

The geology of West Sarawak has been recognized as belonging to two distinct provinces, corresponding to the two main geographic regions of West Sarawak and Central-North Sarawak. The Lupar Line, which is geomorphologically expressed as Batang Lupar is the major tectonic feature that divides the two provinces. The Geological Map of Sarawak is illustrated as shown in Figure 3-41.

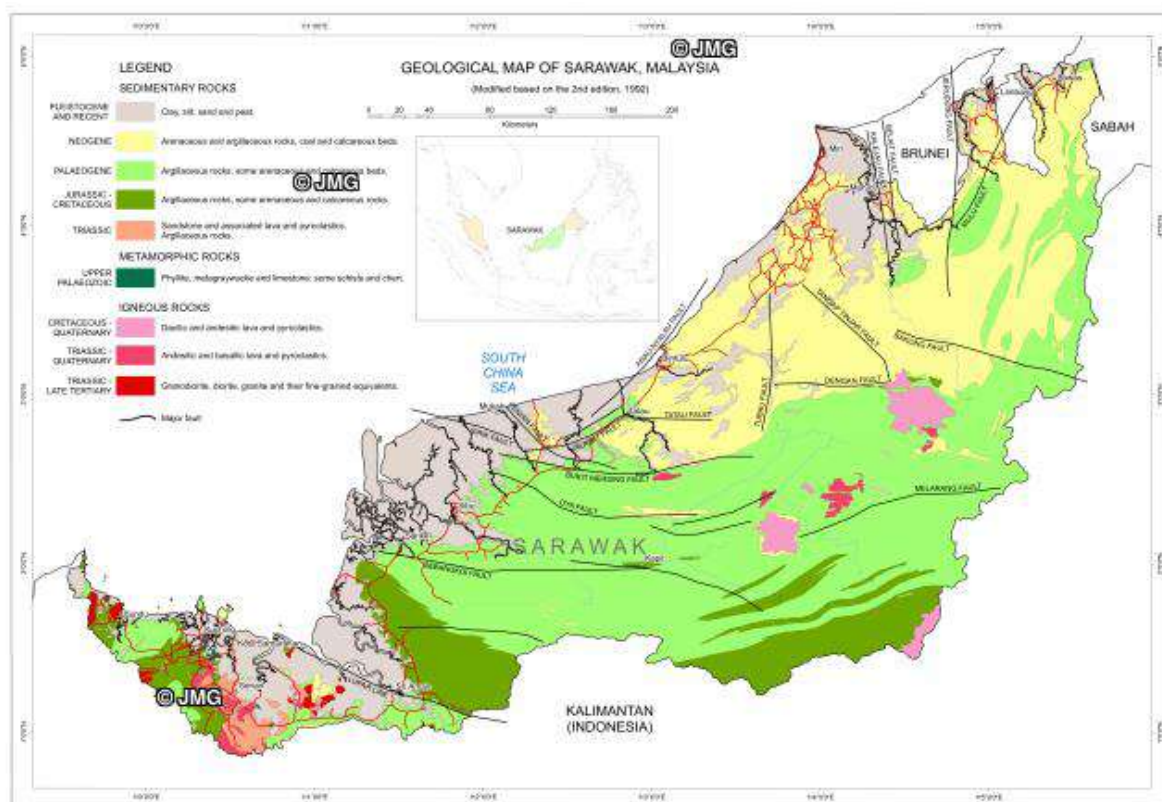


Figure 3-41: Geological Map of Sarawak (2012)

Source: Department of Mineral and Geoscience Malaysia

As demonstrated by the Geological Map of Sarawak in Figure 3-41, the West Sarawak starting from is built up of rocks of Paleozoic and Early Mesozoic ages and forms part of the West Borneo Basement. These rocks are largely concealed with a thick cover of Tertiary strata. The oldest comprise chiefly schist and phyllite of pre-Upper Carboniferous age; succeeding sedimentary formations of Upper Carboniferous, Lower Permian, Triassic, Upper Jurassic, Cretaceous and Lower Tertiary ages consist mainly of shale, sandstone and limestone deposited in environments ranging from continental to deep marine.

Igneous rocks found in this province include basalt and andesite of Upper Triassic age, granodiorite intrusives of Late Jurassic age, adamellite and granodiorite of Late Jurassic to Late Cretaceous age, and widespread hypabyssal acidic stocks, dikes and sills of Tertiary age. Regional Metamorphism is confined to the older pre-Carboniferous rocks. Faulting and folding are common, of which there are four main such episodes.

The region east and north of the Lupar Line is underlain with rocks of the Northwest Borneo Basin. The oldest are of Cretaceous age comprising chiefly greywacke, shale and minor chert and conglomerate found between the Lupar Line and the southwestern watershed of the Batang Rajang. The rest of the province is underlain by a great thickness of mainly greywacke, argillite, shale and other arenaceous sediments.

Regional metamorphism is widespread affecting mainly rocks older than Late Eocene. Faulting and folding appear to have affected rocks of all ages; rocks older than the Upper Eocene being more severely faulted and tightly folded.

Igneous rocks include: basalt, spilite and gabbro of Cretaceous age found mainly just northeast of the Lupar Line, and extensive outpouring of dacitic to basalt rocks and minor intrusions of granodiorite, gneiss and acidic stocks, sills and dikes during Late Eocene – Miocene times.

Quaternary sediments underlie a large area of the coastal zone. They are composed of mainly littoral sand, alluvial clay and silt, and minor amounts of sand and gravel of marine and riverine origins; large swamp basins of peat are commonly found between rivers. The depth of decomposition of rocks is determined by the relative resistance of the individual lithological unit and the groundwater regime, in association with the geological structure.

The rock unit formation in West Sarawak are described below:

a) Serian Volcanic Formation (Late Triassic)

The Serian Volcanic Formation crops out in South and Southeast Kuching, in the Serian area, to the east of Sg. Simunjan, Sebuyau and Sri Aman. The volcanics comprise pyroxene andesite, basalt, trachyte and rhyolite lavas, pyroclastics, and some diorite intrusions. Quartz veins are common. Aquifer zones may be found in the pyroclastics, fault and fracture zones, and contacts with volcanic sediments.

b) Sebang Hornstone (Jurassic-Cretaceous)

The Sebang Hornstone crops out between Btg. Sadong and Btg. Lupar north of Simunjan but south of Sebuyau. It is also found in the Asajaya Peninsula. The hornstone is metavolcanic in origin, and believed to be of Jurassic-Cretaceous age. It is dark grey green and siliceous, and therefore not a good aquifer material. However, fractures will be common, and larger fault zones in the formation may contain substantial groundwater.

c) Diorite Intrusives (Late Cretaceous)

Large outcrops of granite and granodiorite occur in the Sebuyau area. They are massive and poorly jointed and do not have good groundwater potential. However, groundwater production from granite fracture zones is common in West Malaysia. Thus, areas with granite intrusives should not be discounted.

d) Silantek Formation (Paleozoic - Eocene-Oligocene)

The Silantek Formation occurs between Batang Sadong and Batang Lupar. The formation contains conglomerate, sandstone, siltstone and shale at the basal part of the sedimentary sequence, becoming finer in the middle part and contains coal seams and thick sandstone. In the upper part of the sequence, the sedimentary sequence is mainly siltstone and mudstone. The sequence overlies unconformably over the Sadong Formation. Groundwater potential in this formation is good in the deeper parts.

e) Plateau Sandstone (Miocene)

The Plateau Sandstone occurs on the Bako Peninsula, southeast of Simunjan, and the northside of the Batang Lupar. The formation contains massive bedded, sugary, friable sandstone with lenses of conglomerate and minor siltstone and claystone. The formation has good potential for groundwater storage.

f) The Lupar Formation (Cretaceous)

The rock formation is a chert-spillite development, and includes shale, slate, phyllite greywacke, conglomerate and rare limestone, along with basic intrusive and extrusive rocks, and is tightly folded along east and southeast axis. It occurs north of Batang Lupar and the Lubok Antu Melange. Due to its wide variety of rock types, the formation was tectonically disturbed, and therefore contained fractured zones and thus has good groundwater potential.

g) Engkilili Formation (Late Cretaceous)

The formation occurs in the Lupar Valley, occupying a belt of 3km wide and 15km long. The main rocks are disturbed shale with blocks of limestone. It is part of the Lubok Antu Melange occurs at the eastern end of Sri Aman.

3.3.4 Mining Resource Inventory Map

Consequently, the information on the availability of potential quarry sites will be important in the development of Sri Aman particularly for the expansion of urban areas, the development of new growth areas and construction of roads and infrastructure.

3.3.4.1 State Policy on Coal Mining

In 2017, Sarawak was the only State in Malaysia producing coal extracted in Mukah and the Kapit Division in accordance with the Sarawak government Coal extraction policy where the coal extraction focuses only at Mukah-Balingian and Merit Pila Kapit. Coal extraction in Mukah and Kapit involves six (6) open pit mines and about 69% of the country's coal reserves are located at Merit Pila Kapit, Sarawak. The coal production value, according to the Malaysian Mining Industry in 2017, was about 2.988 million tons valued at RM 405.37 million. The coal mine in Silantek at Pantu, Sri Aman with concession area estimated to be 2100 (ha) was prospected several times and mining leases given out contained proven reserves of 7.3 million tonnes with indicated and inferred reserves of over 51 million tonnes. The coal mine in Silantek is not preferable due to the limited knowledge and skills in underground mining.

3.3.4.2 Mineral Resource Potential

In the Sri Aman Division no metalliferous deposits of economic importance have been found. The mineral deposits and occurrences, if any are mainly sedimentary in origin. However, industrial minerals of rock-based and sand-based resources could be found in the study area.

Consequently, the information on the availability of potential quarry sites will be important in the development of Sri Aman particularly for the expansion of urban areas, the development of new growth areas and construction of roads and infrastructure.

3.3.4.3 Coal

Coal reserve have been identified in the Selantik area located adjacent to the Indonesian border south of Sri Aman. Underground mining started in the early 2000s which has since mined an estimated 7million tonnes reserve but the mine ceased its operation in 2018 due to technical, environmental and safety reasons. It is highly unlikely the mine will restart its operation in the near future as the 20-years ML period has already expired. A suggestion that the mine is to be re-open as an open-cast mine is highly unlikely as the policy of the state government is to limit open-cast operation only in 2 areas Mukah and Kapit. Furthermore, the Selantik coal reserve is coincidentally located adjacent to an area that has already been identified for TPA gazettelement as shown in Figure 3-42. Consequently, the likelihood that the ML to be renewed by the state government is very remote.

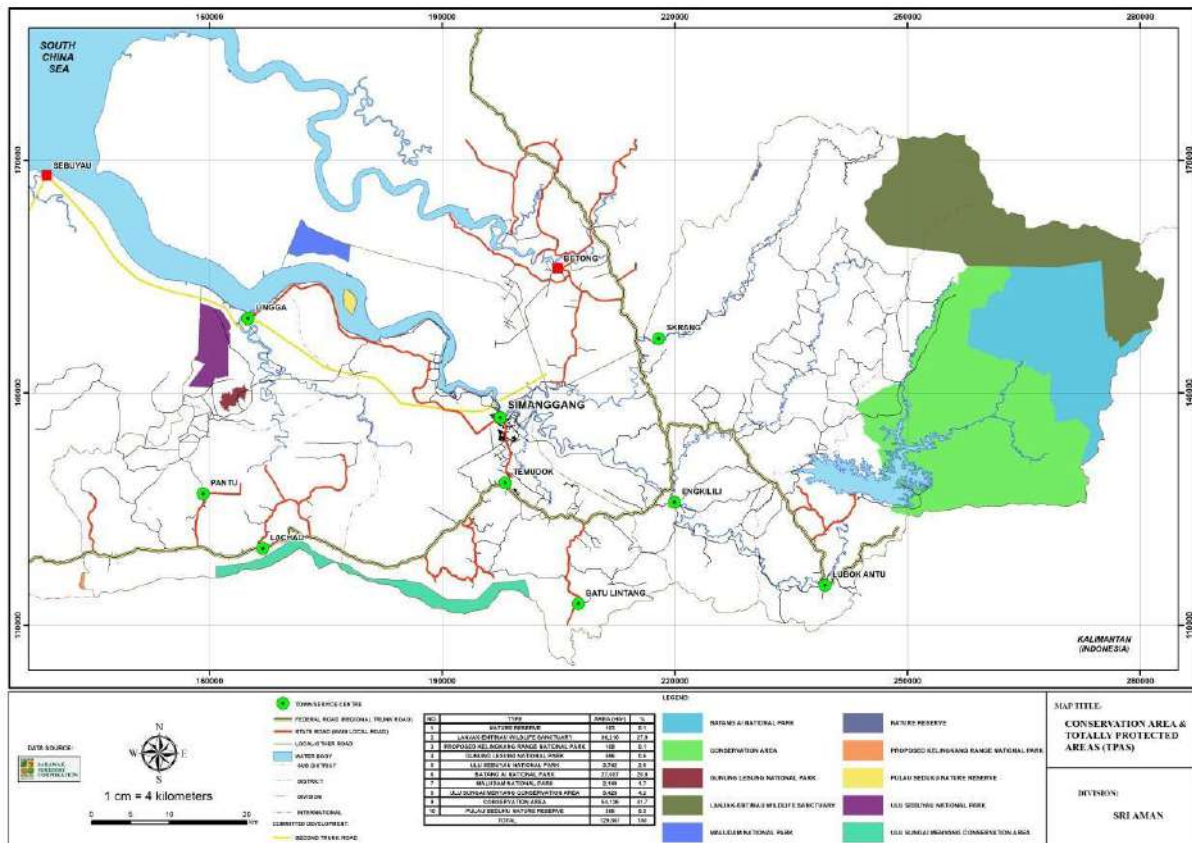


Figure 3-42: Existing and Proposed TPA in Sri Aman Division

Source: Sarawak Forestry Corporation

3.3.4.4 Construction Resource Potential

3.3.4.4.1 Quarry Potential

Due to the increasing domestic demand for aggregates, especially in property development, construction industry as well as road infrastructure projects, quarry business has recently been seen as an important resource development activity in the state. The surge was also attributed to the construction of the Pan Borneo project.

Given the geological structure of Sri Aman, there are two areas are being developed as quarry sites to supplement existing rock quarry operations and supply in the region as shown in Figure 3-43. Currently, one of the key players in the quarry business in the region are the CMS group that operated by the Tung Hup (TH) Group with a 460-acres quarry site producing granite aggregates for heavy engineering works, infrastructure projects and the construction industry in Melugu, Sri Aman. The TH Group operation is capable of producing approximately 378 million metric tonnes of crush stone aggregates, which equivalent to RM8 billion. Besides, Kuching Stone Sdn Bhd operated a 64 acres quarry site at Bukit Balang since 1981 and producing approximately 37 million metric tonnes of sand stone.

Based on Figure 3-43, JMG has identified five (5) potential areas for quarry of igneous rocks that located near Batang Lupar that known as Bt. Gran, Bt. Balau, Gunung Lesong, Bt. Berabit and Bt. Batu Bedan. The igneous rocks are suitable for use as roadstone and concrete aggregate. Among these potential areas, Gunung Lesong is indicative as a stronger granite which suitable for use in all engineering construction purpose. However, Gunung Lesong unable to be developed for quarry as it is identified as totally protected area.

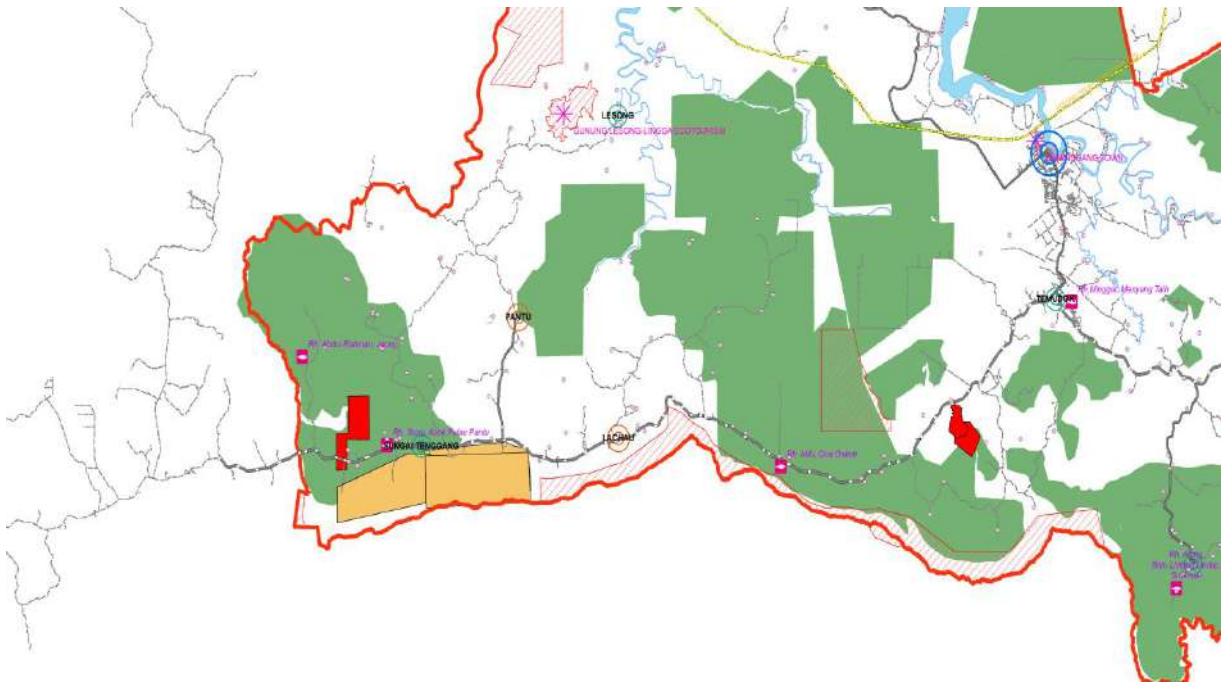


Figure 3-43: Location of Existing Rock Quarry Operations and Supply in Sri Aman Division

Source: Land & Survey Dept. Sarawak

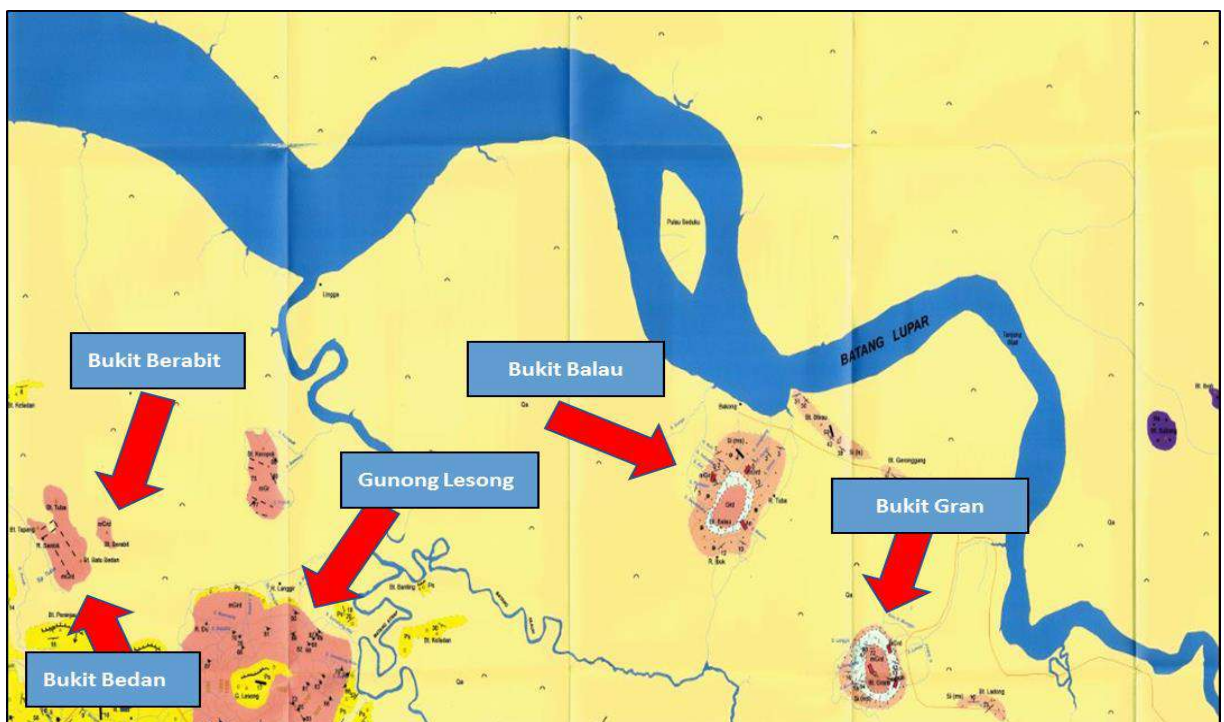


Figure 3-44: Potential Location of Quarry in Sri Aman (near Batang Lupar)

Source: Department of Mineral and Geoscience Malaysia

3.3.5 Issues, Challenges and Potential

There are likely other mining and quarry leases issued by the government in the Sri Aman Division. This information will be reported upon confirmation of the approved leases and licenses with the relevant authority.

Resources extraction projects come with certain trade-offs in the forms of environmental repercussions and disturbances to nearby communities. Mineral extraction such as rock quarry is needed for development and is particularly true for a less developed division like Sri Aman. More development projects will be planned and infrastructure projects to be implemented. All these would require a steady supply of construction materials and rock aggregates is the primary component among others. In the future planning of Sri Aman, any new quarry areas would be subjected to extensive scrutiny on the environmental compliance and requirements to prevent unmitigated environmental and social impacts to the local environment and communities.

Sarawak Coal Resources Sdn Bhd, a subsidiary of the State Government of Sarawak, was established in the year 2005 with the aim of consolidating coal resources in the State of Sarawak. Through this Sarawak State Government's Coal Consolidation Policy, Sarawak Coal Resources have been entrusted to ensure availability, reliability and price stability of coal supply for domestic market obligation, as well as ensuring continued sustainable coal mining in Sarawak. Since its inception, the Mukah-Balingian Coalfields have been the focus of development with 60 – 70% of the coal supply for Mukah Power Generation (275 MW Coal-Fired Plant) in Metadeng and the remaining for Sejingkat Power Corporation (220 MW Coal-Fired Plant) in Kuching. In effort to effective monitoring and environmental compliance, this policy should be maintained and supported to ensure the viability and environmental accountability of the industry in the future.

3.4 TOURISM

3.4.1 Introduction

This chapter begins with an overview of tourism in Sarawak and a discussion of Sri Aman's place within Sarawak's wider tourism industry. This is then followed by a discussion on the impact of Covid-19 on tourism in the State as a whole and its implications for Sri Aman. An evaluation of tourism attractions follows. This includes a rating / scoring process to identify high priority attractions and an inventory of the division's tourism resources.

An accommodation inventory is then provided followed by sections on various niche tourism segments. The final sections present an overview of digital presence, committed plans, issues and opportunities and resilience planning. The tourism chapter ends with a set of initial recommendations. These recommendations will be developed further in the next stage of the Master Plan Study and included in the final report.

3.4.2 The Wider Picture – Tourism in Sarawak

Both unique geography and history have provided Sarawak with a diverse range of tourism attractions that helps differentiate it from Peninsular Malaysia (Pearce, 2002). In contrast to the urban attractions, coastline and beaches of Peninsular Malaysia, Sarawak's tourism products are focused on natural and cultural resources (Pearce, 1997). Protected areas are core tourism assets and feature strongly in Sarawak's destination imagery and marketing activities. Key culture-based tourism products comprise three elements: heritage tourism in Kuching, the Sarawak Cultural Village, and Iban longhouse tours (Yea 2002).

The bulk of tourism activities in Sarawak take place in the wider Kuching area. Kuching serves as the gateway and the jumping off point for a cluster of nearby attractions (e.g. Bako and Semenggoh). Attractions in the interior of Sarawak receive fewer visitors due to access constraints and long travel times from Kuching to other entry points. Tourism activities in the northern region is centred around Miri and mostly focused on cross-border arrivals from Brunei. Mulu National Park, a flagship product and UNESCO world heritage site in the northern region, receives relatively few visitors due to access constraints.

Sarawak's tourism industry faces numerous issues and constraints. The most significant constraint for the expansion of tourism is Sarawak's limited direct international air access. The State heavily relies on both Kuala Lumpur and Singapore to channel foreign tourists into Sarawak. Brunei is another potential hub for air travel to Sarawak owing to Royal Brunei's international network and connecting flights to major towns in Sarawak. In the future, Pontianak and the new Indonesian capital in Kalimantan could become important hubs for channelling arrivals to Sarawak. Other issues seen as hampering the expansion and enhancement of the tourism sector include the financial sustainability of the attraction sector; inadequate visitor facilities; ineffective management of the national parks; a lack of tourism research; insufficient community involvement; regulatory and licensing issues; and insufficient emphasis on maintenance, destination management and tourism planning (Tarman, 2010).

Various policies and planning documents have identified tourism as a key sector for Sarawak's future economic growth. According to a Department of Statistics (2019) study on the regional tourism satellite account for Sarawak, the Gross Value-Added Tourism Industry (GVATI) generated revenue of RM 11.0 billion in 2018, around 7.5% of Sarawak's GDP.

Over recent years international arrivals to Sarawak have stagnated. In 2019, Sarawak recorded 2.1 million foreign arrivals, down from 3 million in 2014. In contrast, Sarawak has seen strong growth in domestic arrivals. In 2019 the State received 2.6 million arrivals from West Malaysia and Sabah, up from 1.9 million in 2014. Foreign arrivals are dominated by Brunei (1.3 million) and Indonesia (420,000) who together make up 82% of Sarawak's foreign arrivals.

According to Sarawak Tourism Board (2018), the average length of stay is 5.1 days and expenditure per tourist is RM 2,300 (foreign) and RM 1,350 (domestic).

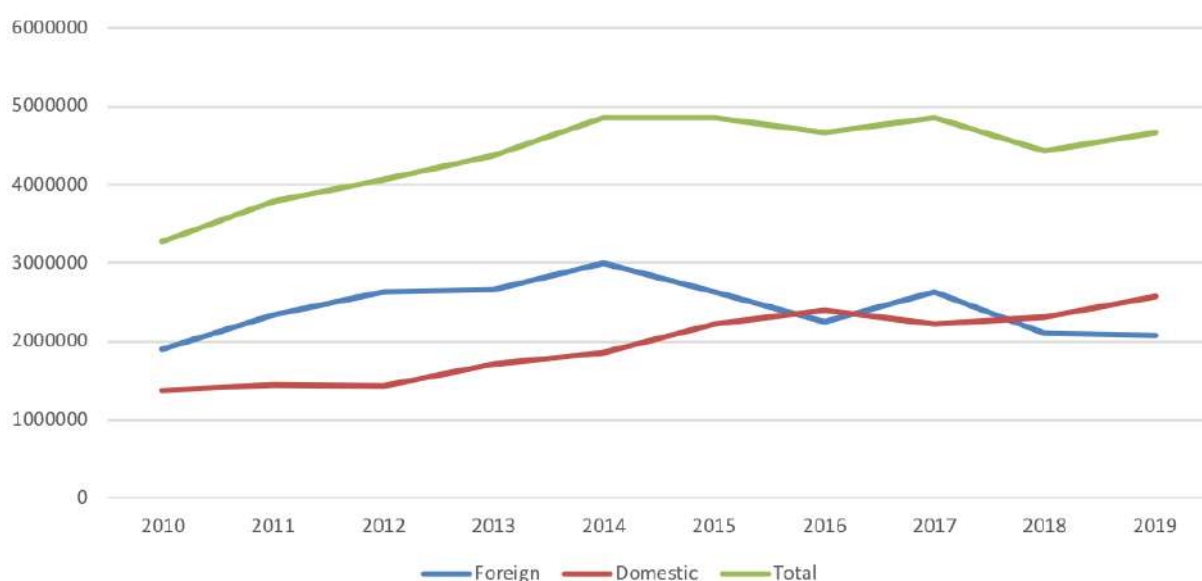


Figure 3-45: Visitor Arrivals to Sarawak 2010-2019

Source: MTCP Sarawak

3.4.3 Sri Aman's Place Within Sarawak's Tourism Industry

Sri Aman's tourism attractions mostly feature the natural environment (national parks, rivers, lakes, etc.) with cultural tourism products focused on Iban longhouses, events, festivals (e.g. Pesta Benak) and built heritage (e.g. Fort Alice).

Leisure tourism is currently not a major component of Sri Aman Division's economy and mostly consists of the 'Visiting Friends & Relatives' (VFR) market, day trips to local recreational spots; and ecotourism activities at Batang Ai. Simanggang town attracts hotel demand from government and business segments but does not attract many leisure tourists.

Existing tourism circuits largely by-pass Simanggang town. One tour operator in Kuching offers niche cycling tours that visit Sri Aman, Lingga & Banting but visitor numbers are very low. Since launching the product three years ago, only 20 tourists have gone on the tour.

Currently, the only attraction in the Sri Aman Division that consistently attracts both domestic and foreign tourists is Batang Ai. Low volume, high-value international ecotourism activities have operated in the Batang Ai area for over 30 years. Visitation to the Batang Ai region is relatively small and estimated at 15,000 tourists per year (Yong & Basiuk, 2015).

The Sri Aman Division is home to the iconic orangutans which are found in Lanjak Entimau Wildlife Sanctuary, Batang Ai National Park and the Ulu Sungai Menyang landscape. There is also a small, isolated population of orangutans at the Gunung Lesong National Park. Orangutan tourism is an important component of Sarawak's tourism industry as it attracts high spending tourists and orangutan imagery is used heavily in marketing. It also generates positive publicity for Sarawak.

Community-based tourism programs in the division are focused on the Batang Ai region. The most successful are partnerships between Kuching-based tour operators and local communities. Examples include the Ulu Ai Project (Borneo Adventure and Nanga Sumpa longhouse), CPH Travel's lodge at Nanga Ukom and Project Orangutan's work with Jingin longhouse. Compared to other divisions, Sri Aman's homestay sector is not widely developed. According to the Ministry of Tourism, Creative Industry and Performing Arts Sarawak (MTCP), there is only one official homestay project in the Division (MTCP, 2019).

Historically, rivers such as the Skrang and Lemanak were major tourism attractions and 'must-see' places for any foreign tourist visiting Sarawak. Modern longhouse tourism on the Skrang dates back to the 1960s. Today, Skrang & Lemanak attract very few tourists. Improved road access, poor quality accommodation, river pollution and the general degradation of the natural environment made these destinations less attractive to tourists.

The division has some recreation / beauty spots (e.g. waterfalls) that are visited by residents of local towns but facilities at these places are very poor or not maintained.

The Sri Aman division currently plays a relatively small role in Sarawak's tourism industry. The only destination that attracts tourists is Batang Ai. There are very few linkages and tourism circuits or clusters in the division. The main tourism circuit is Kuching-Batang Ai-Kuching. A series of new roads (either under planning or construction) will significantly improve access and open up new destinations in the coming years. This will create opportunities to develop new tourism attractions and experiences in previously hard-to-reach locations.

3.4.3.1 Portfolio of Attractions

The Study's Terms of Reference state that "this division is rich in tourism products and experience particularly in Culture, Adventure and Nature segments."

However, the reality is somewhat different. The view that Sri Aman is rich in tourism products is not reflected in the tours and experiences that are marketed to tourists. For example, an analysis of tour operator websites shows that very few products from Sri Aman are promoted.

Currently, the only destination in the Sri Aman division that is sold by a range of local and international tour operators is Batang Ai. The Sarawak Tourism Board (STB) website also does not feature many attractions in Sri Aman. A STB brochure on Sri Aman only features 16 attractions, some of which are not even open to the general public. Many of the listed attractions are local recreational sites. Some of these sites have potential to attract domestic tourists but hold limited appeal to international tourists. Sri Aman is poorly featured on influential tourism platform Trip Advisor but does have a reasonable presence in social media (see section Digital Presence below).

Sri Aman's attractions are not as readily accessible as those located elsewhere in Sarawak. Access is a critical success factor for tourism. Tourism attractions located within a two-hour drive of an airport or major urban area have a better chance of attracting tourist demand, both domestic and international. Sri Aman's attractions are 3-7 hours journey time from Kuching. The completion of the Pan Borneo Highway will reduce travel times but access will remain a limiting factor.

Whilst attractions in Sri Aman can complement those in other regions of Sarawak and be part of a tourism circuit; it is important to note that tourism attractions in Sri Aman compete with those in other divisions. For example, a new crocodile watching tour near Seduku Island will have to compete with existing wildlife cruise products offered in Kuching that offer good opportunities to see crocodiles and other wildlife. Any products aimed at domestic tourists will have to compete with existing and emerging tourist destinations accessible from Kuching, for example, Damai, Lundu and Telok Melano. The Sematan-Tanjung Datu coastline is expected to see a range of new resort and chalet developments in the next few years and become a focal area for domestic tourism activities in Sarawak.



Figure 3-46: Tourists and Guide Looking for Orangutan, Upper Delok River, Batang Ai

Source: Borneo Adventure

3.4.4 Covid-19 & Its Impact on the Tourism Industry

Malaysia's tourism industry has been hit hard by the coronavirus pandemic and the measures taken to control its spread (Foo et al, 2020). The tourism industry was the first sector to be impacted by the coronavirus and will be one of the last to recover. The Federal Ministry of Tourism, Arts & Culture (MOTAC) reported estimated losses for the tourism sector to be RM 45 billion for the first half of 2020.

According to the State Minister of Tourism, Sarawak lost RM 3 billion in tourism receipts during the three months of the Movement Control Order (Borneo Post, 2020). Monthly foreign arrivals have plummeted to 2,000-3000 per month, compared to 150,000-175,000 per month last year.



Figure 3-47: Monthly Foreign Arrivals to Sarawak 2020 vs 2019

Source: MTCP Sarawak

With borders closed, tour operator revenues have dropped to zero or negative income as companies refund previously booked tours. Many tourism businesses in Sarawak have retrenched staff or put some on unpaid leave or reduced salaries. With no border opening date for Malaysia as of the writing of this report, there are very few enquiries and forward tour bookings from foreign tourists. Foreign tourists interested in visiting Sarawak in 2021 are reluctant to book until an opening date is announced.

Sarawak's tours and activities sector is currently undergoing an unprecedented shake up. Tourism SMEs are fighting to survive by reducing staff counts and selling off assets such as tour vans and buses. Some tour companies have closed their offices or only open a couple of days a week. If Malaysia's borders do not open by mid-2021, many tour companies in Sarawak will be forced to close. The sector will be hollowed out with a reduced number of inbound tour operators remaining.

Worldwide there is likely to be a preference for short haul and regional travel in the short to medium term. Long haul travel will take longer to recover. Traditionally, higher spending tourists in Sarawak have been from long haul markets. Tourism recovery is going to be a slow process in Sarawak. It may take 3-5 years before international arrivals to Sarawak recover to 2019 levels.

Domestic tourism in Sarawak has recovered with strong demand for destinations that cater to family holidays (e.g. Lundu, Telok Melano). Star rated hotels in Kuching are reporting occupancy rates of 20-30%, up from a low of 5-10% a few months ago but still not enough to cover operational costs. The budget hotel sector is still struggling. Many budget hotels remain temporarily closed and some hotels have closed for good.

In response to the pandemic both the Federal and State governments have implemented a range of economic assistance programmes such as Prihatin, Penjana, etc. An important component of the Federal stimulus packages was a wage subsidy scheme that provided valuable aid to the tourism sector. The Sarawak government has also provided grants to tourism SMEs and direct payments to individuals employed in tourism (e.g., tour guides, etc.). The Sarawak government's hotel quarantine programme has provided critical financial support to the hotel sector. This has had a significant impact and helped to retain jobs in the hotel industry. Unlike other states in Malaysia, Sarawak has not seen closures of 3-5 star rated hotels. The tours and activities sector have also benefited from the Sarawak Tourism Board's 'Sia Sitok' promotional campaign. This campaign boosted domestic travel and provided 50% subsidies

to assist inbound tour operators. Sia Sitok includes packages promoting destinations in the Sri Aman Division.



Figure 3-48: Monthly Domestic Arrivals to Sarawak 2020 vs 2019

Source: MTCP Sarawak

Whilst an uptick in domestic demand is a welcome sign, industry bodies believe that this will not be enough to sustain the tourism industry. According to the Malaysia Hotel Association, foreign tourists spend four times more than domestic tourists (Astro Awani, 2020). Much of the increase in domestic travel in Sarawak is local excursionists going on day trips rather than overnight stays.

Despite the easing of the lockdown regulations in Sarawak, it has not been able to attract many domestic tourists from West Malaysia or Sabah. There are many competing destinations in the Malaysian Peninsula and Sabah which have strong attractions. In addition, spikes in the number of Covid-19 cases have resulted in the Sarawak government periodically imposing additional entry procedures, compulsory tests and/or 14-day quarantine periods on travellers from West Malaysia and Sabah.

Within Sarawak, foreign tourism demand is vital for many key destinations. For example, in 2019 foreigners comprised 65% of visitors to Bako National Park and 70% to Mulu National Park. Foreign tourists make up over 95% of visitors to the community-based tourism Ulu Ai Project at Batang Ai.

The bottom line is that domestic demand will be insufficient to sustain many tourism businesses in Sarawak. More job losses and business closures in the tourism industry are expected. This will also have a knock-on impact on rural communities that rely on tourism as a source of cash income.

3.4.4.1 Estimated Arrivals to Sarawak (2020-2024)

Global tourism demand will be largely suppressed over the next few years. The Economist Intelligence Unit expects a slow recovery with global outbound travel numbers expected to recover to pre-pandemic levels in 2023 (Chung, 2020). IATA reports that air passenger numbers may not recover to 2019 levels until 2023-2024 (UNCTAD, 2020). Malaysian Airlines recently announced that its restructuring plan is based on the assumption that demand in domestic and Southeast Asian markets returns to 2019 levels by the second and third quarters of 2022 (Straits Times, 2020).

The total number of 2020 visitor arrivals to Sarawak are expected to be around 1,400,000, 70% down from 2019. Whilst domestic arrivals will see a drop of 60%, foreign arrivals will be 80% down from last year. The decline in international tourists is in line with UNWTO forecasts of 60-80% drop on international arrivals for 2020 (UNWTO, 2020).

The early optimistic view of establishing a 'travel bubbles' or air corridors in Asia has failed to materialise (Cripps, 2020). Travel bubbles are complex agreements to negotiate and hard to implement. With fresh waves of the virus hitting many countries in Asia (including Malaysia) most governments are reluctant to move beyond bilateral discussions.

Malaysia's borders are likely to remain closed to foreign tourists for most of 2021. Any reopening is not expected to occur before the third quarter of 2021. Prior to the current spike in cases the Federal Tourism Minister said that Malaysia would keep borders closed until the second quarter of 2021 (Kumar, 2020). However, the director general of the Ministry of Health has stated that borders should not be open in the medium term.

The initial reopening will have limited impact on Sarawak's tourism sector as it will likely be after the peak season. Furthermore, loosening of entry requirements will focus on selected countries in the Asia Pacific region. These 'green lanes' are likely to be quite restrictive as countries take a cautious approach to avoid imported cases of Covid-19. Initially these arrangements may focus on business travellers and exclude tourists. Whilst they may have significant impact on travel and tourism in the Peninsular, Sarawak is unlikely to see major benefits in the first phase of border reopening unless the Sarawak-Brunei border is opened. In view of the uncertainties around border restrictions, 2021 foreign arrivals to Sarawak are projected to be similar to 2020.

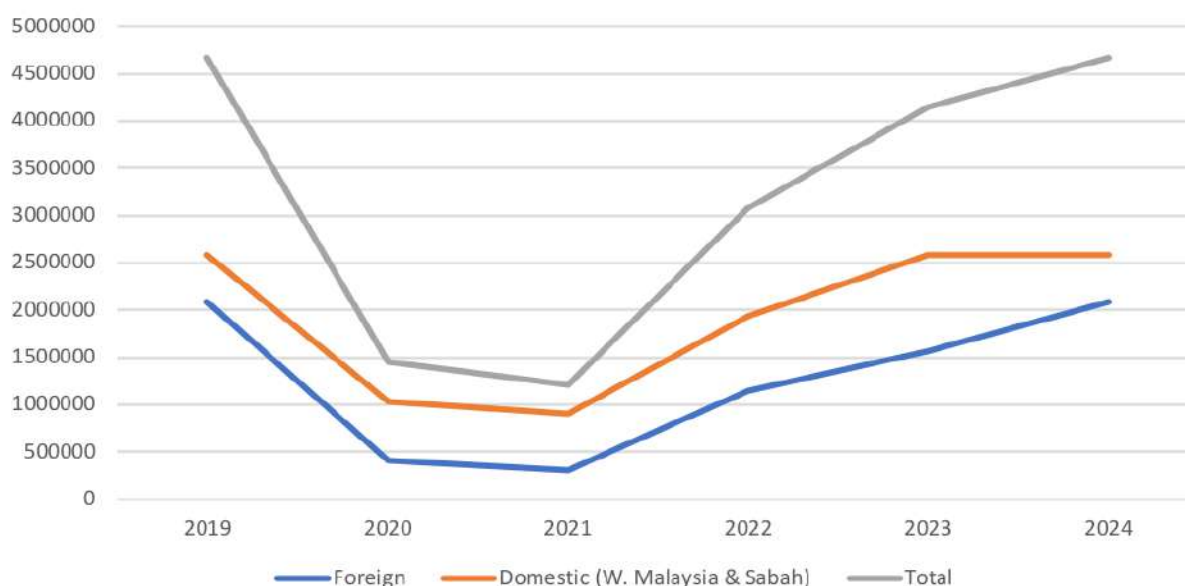
Recovery in foreign arrivals is expected to start in 2022 as vaccines roll out and borders reopen. Advances in testing will also assist the expansion of travel. Recovery will begin with regional arrivals plus some demand from long haul markets. Important long-haul markets will take time to recover, especially if key source countries are unable to suppress the virus. Cross border arrivals (e.g. Brunei) should recover relatively quickly when borders reopen and this will benefit Sarawak. There is an overhang of cancelled and postponed tours from 2020. 2022 is the likely time for these to return as there is too much uncertainty with 2021. International arrivals to Sarawak are expected to continue improving in 2023 and return to 2019 levels by 2024.

Arrivals from Semenanjung Malaysia and Sabah are likely to be subdued in 2021. Cycles of 'lockdown and lift', with the State or Federal government imposing travel restrictions to tame the virus. then lifting restrictions as case numbers drop, are a feasible scenario for the next year or so. This will deter domestic travel between West and East Malaysia.

Sarawak is expected to continue with its successful approach of containment and tight border controls. Periodic quarantines and entry permit requirements are expected to continue for domestic visitors. Domestic arrivals from West Malaysia and Sabah should be in the range of 30,000-70,000 per month in 2021, i.e. similar to levels seen in the second half of 2020. Recovery in domestic arrivals will speed up in 2022 and possibly return to 2019 levels in 2023.

Table 3-28: Estimated Arrivals to Sarawak as % of 2019 Levels

	2019	2020	2021	2022	2023	2024
Foreign	2,082,444	18%	10-20%	50-60%	70-80%	100%
Domestic (W. Malaysia & Sabah)	2,579,975	40%	30-40%	70-80%	100%	100%
Total	4,662,419	30%	20-30%	60-70%	85-90%	100%

**Figure 3-49: Visitor Numbers to Sarawak (MTCP)**

Source: MTCP Sarawak

Assumptions

- The Q4 2020 spike in cases in Malaysia is brought under control before year-end.
- Malaysian borders are not open to tourists until Q3 2021.
- 2021 border opening is only for a limited number of countries mostly in the Asia Pacific region
- Sarawak follows national border opening policies.
- Travel between Semenanjung and Sarawak is periodically disrupted in 2021 owing to inter-state travel restrictions and quarantine requirements in Sarawak.
- The federal government or Khazanah Nasional bails out MAS so that it can continue to operate in some form and provide an air bridge to Sarawak. Air Asia & Malindo survive but with smaller fleets.
- General public in developed countries receive the vaccine in 2021.
- Front liners and vulnerable populations in Malaysia receive the vaccine in late 2021.
- Vaccine starts to roll out amongst the wider population in Malaysia and ASEAN region in 2022.

MTCP Sarawak's internal forecast of total arrivals follows a similar trajectory as the study team's above assessment with a flat 2021 and recovery picking up pace in 2022 and accelerating in 2023. The Ministry predicts full recovery in total arrivals by 2024.

3.4.4.2 *Implications for Sri Aman*

The Covid-19 induced downturn in tourism has major implications for Sri Aman and the formulation of the Sri Aman Master Plan.

Domestic arrivals to Sarawak from Semenanjung Malaysia and Sabah are likely to be weak for the next 1-2 years as Malaysia deals with spikes in coronavirus cases. On a more positive note, domestic demand from Sarawakian travellers is expected to increase. There are therefore opportunities for Sri Aman division to create tourism products and experiences that target this expanding demand segment.

International tourism arrivals to Sarawak are likely to remain at reduced levels for the short to medium term. Tourism recovery in Sarawak will initially focus on unique and iconic attractions in the Kuching region. Established, well-known products such as Mulu and Batang Ai should also benefit.

New tourism products in Sri Aman could find it hard to attract demand over the short to medium term, unless they are designed specifically for the local domestic market. With regards to domestic tourism, the Sri Aman Division will face competition from existing and new tourism products in the wider Kuching region.

It would be a risky strategy for Sri Aman Division to rely on tourism as a core development pillar in the first half of the master plan period as Sarawak's tourism industry faces a long road to recovery. Tourism is likely to play a relatively minor role in economic development of Sri Aman for the next five years. It will also be focused on certain geographic areas rather than being dispersed throughout the division.

It may also be difficult to justify investments in minor tourism attractions in Sri Aman. Minor attractions will face challenges attracting meaningful tourist demand in the short and medium-term.

Instead, a tourism development strategy for Sri Aman should focus on the Division's high-quality nature-based attractions. These resources are centred on the Batang Ai region, which is already one of Sarawak's main tourism destinations. There are opportunities to develop tourism products and activities at other locations (e.g. Gunung Lesong-Lingga tourism cluster) that cater to both domestic and international tourists. The next few years will also be a good time to build out tourism infrastructure and facilities so that the division is well positioned when full recovery takes place.

3.4.5 **Tourism Attraction Ratings**

Tourism attractions are one of the most important motivating factors for travel to a destination. Whilst accommodation, supporting services and infrastructure influence the decision-making process of whether a tourist will visit, it is the attractions that draw visitors. Tourism attractions are the building blocks of a destination. Having a portfolio of high-quality attractions is a key factor in the expansion and success of a tourism destination.

The distinctiveness of an attraction determines its 'pulling power'. Some attractions are unique and have the ability to draw international tourists whilst others may only attract domestic tourists. Some attractions are not distinctive and may only appeal to local residents.

A number of tourism attraction rating systems or models have been developed to classify attractions according to their recreational value and attractiveness to tourists. Many of these systems are designed for destinations with highly developed infrastructure and well-established tourism industries. They require historic data and established policy and planning strategies. These models are less suitable for

use in developing destinations such as Sarawak, which has a less developed tourism sector and limited tourism research data.

After reviewing various attraction rating systems, it was decided to adapt a model previously used by the Sarawak Tourism Board to rate attractions in the Kuching Region. This study used a destination specific approach to evaluating tourism attractions and created a rating system for use in the Sarawak context. The model recognised Sarawak's position in the destination development life cycle and the fact that many supporting factors (e.g. public infrastructure & facilities) are lacking. It was designed "to identify the attractions with inherent 'drawing' power and areas where supporting infrastructure needs to be improved" (Sarawak Tourism Board, 2006).

Tourism attractions in Sri Aman division were rated based on the following categories:

- Uniqueness
- Access
- Quality
- Parking / staging area
- Public supporting infrastructure
- Seasonality
- Information & Interpretation
- On-site activities (where applicable)
- Accommodation (where applicable)
- Carrying capacity
- Brand communication, awareness & marketing
- Development potential

Uniqueness was allocated a maximum of 10 points whilst other categories were rated on a scale from 1-5. After a scoring and standardisation process the attractions are given a score with a maximum rating of 10.

The following table shows the scores of the attractions in Sri Aman.

Table 3-29: Ratings of Tourism Attractions in Sri Aman Division

Attraction	Theme(s)*	Score
Batang Ai (Upriver Areas)	Nature & Adventure Cruise & Riverine Culture & Heritage	6.7
Batang Ai (Lake)	Lake Tourism Nature & Adventure Sport Tourism	5.7
Simanggang Town	Culture & Heritage Food Tourism	6.3
Gunung Lesong-Lingga Ecotourism Cluster	Nature & Adventure	6.2
Gunung Lesong National Park	Nature & Adventure	5.2
Wong Ajong (Engkilili)	Nature & Adventure	4.9
Skrang River	Cruise & Riverine Culture & Heritage	4.7
Lemanak River	Cruise & Riverine Culture & Heritage	4.7
Engkilili Town	N/A	4.6
Pantu Town	N/A	4.3
Wilson Bana homestay	Culture & Heritage	4.0
Lingga Town	Culture & Heritage	4.0
Lubok Antu Town	Border Tourism	4.0
Mount Hosanna Chapel	Culture & Heritage	4.0
Kemantan Lidi Waterfall (Kumpang Langgir, Engkilili)	Nature & Adventure	4.0

Attraction	Theme(s)*	Score
Wong Pupu	Nature & Adventure	3.8
Wong Merah, Panjai Ruai	Nature & Adventure	3.5
Seduku Crocodile Sanctuary	Nature & Adventure	3.5
Batu Nabau	Culture & Heritage	3.3
Sungai Raya Recreation Area	Nature & Adventure	2.8
Tapang Rumpit Recreation Area	Nature & Adventure	2.8

* These are the themes used to classify products in the Sarawak Third Tourism Master Plan.

As can be seen from the ratings table, many sites in the Sri Aman Division that are currently promoted as tourism attractions have weak scores (below 5). These attractions are not unique or special and have limited tourism potential at this time. For example, there are thousands of rivers and waterfalls in Sarawak, the fact that a waterfall exists does not mean that it is a tourism attraction. Sites such as Wong Pupu & Sungai Raya should be viewed as local recreation areas or picnic spots. They can attract day trippers from local towns & villages but it is unlikely that they will attract many domestic or international tourists. There are numerous waterfalls within an hour or so of Kuching. A resident of Kuching is unlikely to travel 3-4 hours to Sri Aman to see a small waterfall. Likewise, an international tourist travelling from Kuching to Batang Ai is not going to take a detour to see a minor waterfall.

The attractions rating process helps to identify priority tourism attractions. The best-rated attractions are Batang Ai (Upriver Areas), Batang Ai Lake, Simanggang town and Gunung Lesong National Park. These four areas all have a rating above 5. The Gunung Lesong-Lingga cluster also has potential to be developed into a circuit when road access has improved. Wong Ajong scores under 5 but was also assessed for its potential owing to the quality of the attraction and potential appeal to domestic tourists.

High priority attractions were also rated based on their potential, i.e. if services, facilities and activities were improved.

Table 3-30: Priority Tourism Attractions in Sri Aman - Current & Potential Ratings

Attraction	Current	Potential
Batang Ai (Lake)	5.7	8.9
Batang Ai (Upriver Areas)	6.7	8.1
Gunung Lesong-Lingga Ecotourism Cluster	6.2	7.1
Simanggang Town	6.3	7.0
Gunung Lesong National Park	5.2	6.3
Wong Ajong (Engkilili)	4.9	5.7

Source: UNIMAS Holdings

A number of Sarawak's most popular tourism attractions were also rated to provide a reference point for the rankings of Sri Aman's attractions.

Table 3-31: Popular Tourism Attractions Sarawak - Current & Potential Ratings

Attraction	Current	Potential
Semenggoh	7.8	9.2
Bako National Park	7.7	9.1
Sarawak Cultural Village	8.1	9.1
Mulu National Park	8.5	9.1
Tanjung Datu National Park	6.6	8.3

Source: UNIMAS Holdings

The following sections provide further details of Sri Aman's attractions.

3.4.6 Tourism Resource Inventory

3.4.6.1 Batang Ai (Upriver Areas)

Tourism at Batang Ai is based on natural and cultural resources. Tourism activities in Batang Ai commenced after the completion of the Batang Ai dam in 1985. The creation of a reservoir reduced travel times to the previously remote longhouses and Kuching based tour operators started to offer longhouse tours to various locations at Batang Ai. The Hilton Batang Ai Longhouse Resort opened in 1994. The addition of an internationally branded hotel resulted in increased arrivals and opened up the destination to other market segments.

Batang Ai quickly became the main location for longhouse tourism in Sarawak after both Skrang and Lemanak declined in popularity. Today, Batang Ai is an important component of Sarawak's tourism product portfolio. It is also the only destination in Sarawak for orangutan tours. It also plays a significant role in the promotion of Sarawak with imagery from Batang Ai used in websites, social media, brochures and other promotional materials.

Yong and Basiuk (2015) estimate that 15,000 local and foreign tourists visit Batang Ai each year. Until recently, domestic demand was largely resort-based and focused on the Longhouse Resort. Domestic demand is a mix of leisure and MICE (e.g. government and corporate meetings). International demand is entirely leisure and focused on special interest tourists and high yield ecotourism activities.

There is substantial involvement of longhouse communities in tourism at Batang Ai (See 8.5.8) and many activities take place in non-protected forests and community-owned land.

3.4.6.1.1 High Quality Tourism Resources

Batang Ai has a diverse range of high-quality tourism resources including Iban longhouses, Batang Ai National Park, orangutans, clean rivers, a network of trekking trails and areas of non-protected forest. (The lake is covered separately in a different listing).

3.4.6.1.2 Iban Longhouses

Visiting a longhouse is a key motivating factor for tourists to travel to Batang Ai. The most popular longhouses that host tourists include Mangkak, Ukom, Mengiling, Menyang Tais, Nanga Sumpa and Jinggin. The key components of a longhouse tour include:

- The boat rides to the longhouse
- Experiencing the longhouse and gaining insight in to the lifestyle of the Iban.
- Tours and activities near the longhouse (e.g. farm visits, handicraft demonstrations, etc.)
- Entertainment in the evenings (dances, rice wine tasting, gathering on the ruai, etc.)
- Nature-based activities and experiences (e.g. trekking, wildlife watching, boat rides, visiting waterfalls, picnics, etc.)

3.4.6.1.3 Batang Ai National Park

Batang Ai National Park was gazetted in 1991 and covers an area of 24,040 hectares. The park is located at the headwaters of the Batang Ai and Lubang Baya rivers and is accessed by longboat from the Batang Ai jetty, a journey of approximately 2 hours. There are no accommodation or visitor facilities at the park and it receives very few visitors.

Illegal hunting is a problem at Batang Ai and mostly takes place within a boat ride of the ranger station / HQ and on the borders of the park. Without investment in visitor facilities and greater efforts to curb hunting, arrivals to Batang Ai National Park are likely to remain low.

Nature-based tourism at Batang Ai is largely focused outside of the park and this benefits the local longhouse communities. Rather than developing tourist facilities at the park, a rainforest studies centre could be developed to attract foreign researchers and develop a SAVE (Scientific, Academic, Volunteer and Education) travel niche for Sri Aman Division.

Table 3-32: Arrivals to Batang Ai National Park

Year	International	Domestic	Total
2011	53	135	188
2012	91	62	153
2013	74	142	216
2014	34	36	70
2015	24	50	74
2016	42	17	59
2017	36	76	112
2018	33	10	43
2019	50	31	81

Source: Sarawak Forestry & Sarawak Tourism Board

3.4.6.1.4 Orang Utans

Batang Ai is the last remaining viable habitat for the orangutan in Sarawak (Yong & Basiuk, 2015). It is estimated that there are around 1,600 orangutans in Sarawak, with 95% living in the Batang Ai-Lanjak Entimau landscape. Regular orangutan watching tours take place at two locations of Batang Ai. These tours cost RM 2,000-3,000 per person. Borneo Adventure offers orangutan treks in the upper Delok River and Lalang River. NGO Project Orangutan operates trips near Jinggin longhouse. Orangutans are sighted on 30-40% on these tours. In addition to specialist treks many standard tours include a trek through orangutan habitat.

3.4.6.1.5 Trekking Trail Networks

Trekking trails within the Batang Ai national park are not well maintained and hardly used by tourists. In contrast, there is a network of jungle trails outside the park that are used by tourists and maintained by local communities. (See Figure 3-50).

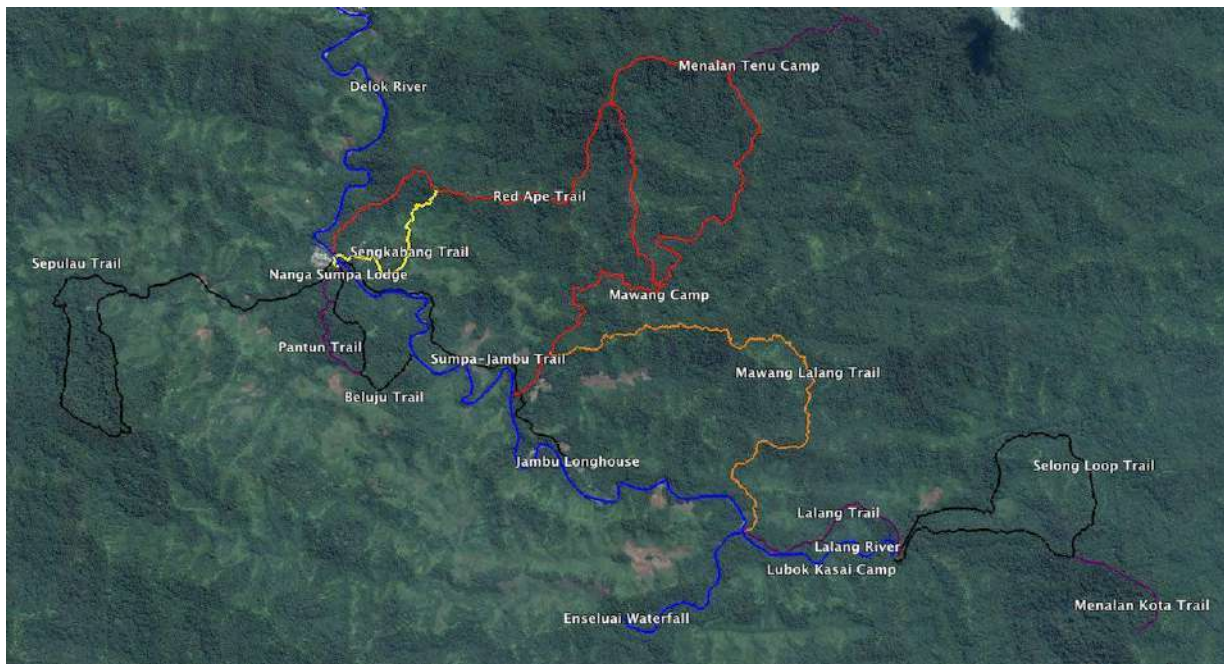


Figure 3-50: Jungle Trail Network Maintained by Borneo Adventure and Local Community Outside of Batang Ai National Park

Source: Borneo Adventure

3.4.6.1.6 Rivers

Batang Ai is one of the few areas in Sarawak where tourists can travel along clean, rainforest-lined rivers. The river journey is a key part of the Batang Ai travel experience and one of the area's main selling points. The rivers of Batang Ai provide access to the attractions but they are also a significant tourism resource and base for a range of activities. Clean rivers are a critical component of Batang Ai's tourism appeal. As has been seen in the Lemanak and Skrang, if rivers are polluted or degraded tourism demand declines rapidly and local communities lose a source of cash income.

3.4.6.1.7 Non-Protected Forest Areas

Many tourism activities at Batang Ai take place in non-protected forests located outside of Batang Ai National Park. For example, Borneo Adventure's tours and orangutan treks focus on the rainforest habitat on the upper Delok River. Likewise, Project Orangutan's tours take place around Jinggin. The bulk of high value ecotourism activities (including orangutan treks) take place outside of Batang Ai National Park. This demonstrates the value of the non-protected forest to the tourism sector.

3.4.6.1.8 Ulu Sungai Menyang Landscape

International tourists visit Batang Ai to experience the pristine environment. Any deterioration in this natural environment can impact tourism in a negative way. In 2012/13 a logging concession was issued for the Ulu Sungai Menyang landscape. This area of forest is situated between the lakeside resort and the upper Delok River. 14,000 hectares was proposed for logging under Timber License No. T/8495 (Sarawak Forestry Corporation et al, 2013). This whole area had been used for ecotourism for over thirty years. Key sites within the concession had also been used for location filming for numerous international TV programmes.

In response to the news that the area was under threat, government agencies, NGOs, local communities and tourism industry players started to highlight the importance of the area. These stakeholders conducted a series of orangutan nest surveys in 2012 and 2013. It was found that a globally significant population of up to 200 orangutans lived in Ulu Sungai Menyang. In April 2013 the Sarawak State Government announced that this forest would be gazetted as a national park or orangutan conservation zone.

Today, Ulu Sungai Menyang is still not legally protected. The process of sanctioning a national park takes time and requires extensive liaison with local communities. However, it is vital that this forest receives some form of protection. When Ulu Sungai Menyang eventually receives legal protection, it will safeguard a significant population of orangutan and a very important tourism asset for the State of Sarawak.

3.4.6.2 Proposed Road Developments

Over recent years there have been several proposals and suggestions for roads at Batang Ai to connect upriver communities. Some of these proposals envisage roads going through prime orangutan habitat. If any of these roads were to proceed it will destroy key orangutan habitat and likely result in bad publicity for Sarawak. In addition, it will jeopardize high value ecotourism activities and the current revenue that communities receive from tourism.

Instead of building roads through important orangutan habitat that supports high yield ecotourism activities; there are other ways to improve access to the upriver communities. For example, river transportation could be upgraded by building good quality jetties and boat ramps. Subsidised fuel could also be provided to upriver communities. There may also be scope for introducing river taxis or an express boat service from the lake to Nanga Delok and other communities on the lake. The cost of a ferry service and building jetties would likely be substantially less than building a road through hilly terrain. New jetties and river (or lake) taxis could provide major socio-economic benefits for upriver communities.

3.4.6.3 Future Outlook

The long-term prospects for tourism at Batang Ai are generally positive. Interest in ecotourism is growing worldwide and there is increasing interest in the great outdoors amongst Sarawakians. Batang Ai's excellent tourism resources can support a wide range of activities. Importantly, tourism can also be dispersed over a wide geographical area at Batang Ai. There is also potential to develop lake tourism (see below).

The presence of a significant population of orangutan in the Ulu Sungai Menyang landscape presents opportunities for expanding low volume, high margin orangutan tourism. Gazetting the Ulu Sungai Menyang landscape as a national park or different category of conservation area could provide a boost to tourism and give Sarawak positive media coverage around the world.

The future of Batang Ai's tourism sector is highly dependent on the conservation of the natural habitat. Development of large-scale agriculture (e.g. oil palm) and / or logging activities have the risk of negatively impacting tourism at Batang Ai and significantly impact the income that local communities receive from tourism. In contrast, if the natural environment is preserved and well-managed, Batang Ai will continue to be one of Sarawak's most important tourism destinations for decades to come.

3.4.6.4 Batang Ai (Lake)

The Batang Ai reservoir serves as a jumping off point for the longhouses and upriver attractions. However, it is currently under-utilised as a tourism or recreational resource. Very few activities take place on the reservoir. For example, there is a limited range of water-based activities (kayaking), hardly any organized recreational fishing and no sunset cruises.

In the early 1990's the Pernas Group built the Hilton Batang Ai Longhouse Resort on the shores of the lake. From the beginning, the 100-room resort was hampered by its bad design and experienced low occupancy rates. Nevertheless, the resort played an important role in developing tourism at Batang Ai with many tour operators using it as a base for longhouse trips. Operators also offered 3-day, 2-night packages that included one night in a longhouse homestay with the second night at the resort. The resort was taken over by the Aiman Group in 2016. However, the new owners struggled to revive the ageing resort and it closed down in April 2020.



Figure 3-51: The Batang Ai Reservoir is an Underutilized Tourism Resource

The only other tourism facilities at the lake are a small park (the Batang Ai Recreational Park), boat jetty and a wooden building that serves as a reception area for tourists waiting to board a boat to the resort or upriver areas. The tourist boat jetty has not been maintained since the Aiman Resort closed. The toilets and rest shelter are also run down. The park comprises of a small island accessed via a suspension bridge. Facilities include a camping site, viewing platform, toilet blocks, jet ski ramp and rest shelters.

The Batang Ai reservoir (Figure 3-51) could be developed as a lake tourism destination. This would require substantial investment in facilities and infrastructure such as boat ramps and mooring pens; a waterfront park; swimming pontoons; cycling and walking tracks; a range of lakeside accommodation; and a scenic road from the current tourist jetty to the existing lakeside resort. A range of low-impact water sports and water-based activities (e.g. angling, dinghy sailing, windsurfing, kayaking) could be offered at the lake.

With a wider range of activities and accommodation, the lake would increase its potential to attract domestic tourists. Good quality, lakeside resort accommodation would also allow foreign ecotourists to extend their stay at Batang Ai. For example, they could spend a few nights in upriver areas and then spend time relaxing in a resort setting by the lake. A lake destination could also attract Indonesian visitors from across the border.

3.4.6.5 Simanggang Town

Simanggang is a regional administration centre serving a large area.

3.4.6.5.1 Historical Precinct

The town was a significant outpost during the Brooke era and was visited by the naturalist Alfred Russel Wallace and by the writer W. Somerset Maugham. Maugham's stories about the tidal bore and outstation life provide interesting historical anecdotes about the town. In the 1960's, Simanggang played a key role in the konfrontasi conflict and the ending of the communist insurrection.



Figure 3-52: Fort Alice, Sri Aman

Fort Alice, built during the Brooke era, is a reminder of the rich history of the area (Figure 3-52). The Fort has been restored to its original beauty and now serves as a gallery-cum-museum. The town's former rest house, now named Rumah Sri Aman, is another historic building in the town centre.

Simanggang scores relatively highly in the ratings as it already has a range of supporting facilities. It also has historical significance and a unique attraction - the tidal bore. The town attracts hotel demand from government and business segments but does not attract as many leisure-focused tourists. Existing tourism circuits largely by-pass Simanggang town.

With the completion of the Pan Borneo Highway, access to Simanggang will significantly improve and the town will be less than 2-hours' drive from Kuching. This should boost domestic tourism, especially during weekends and public holidays. If facilities are developed, attractions improve accessibility from the town (e.g. Wong Ajong); signage is improved; and attractions are promoted more (e.g. tidal bore times), there will be better scope for developing self-drive tourism circuits centred on Simanggang. Food could be an integral part of these tourism circuits. For example, visitors could visit Lingga for a seafood lunch. A range of touring routes combining city attractions (e.g. Fort Alice, tidal bore viewing), food and nearby recreational sites could be created to cater to the domestic market.

3.4.6.5.2 Batang Lupar Tidal Bore

The tidal bore or benak is one of Simanggang's most significant attractions. The bore arrival times used to be shown on a sign near the river but this is no longer the case as a new riverfront is under construction. There is a need to better publicise the tidal bore times as other countries do with their tidal bores. A dedicated website with general information and tidal times at various sites along the river would be beneficial.

The Batang Lupar tidal bore starts to appear near Seduku and Bakong and travels approximately 45 km past Simanggang town and ends somewhere near Berangan. The tidal bore is relatively small on most days of the month but is larger at the new moon and full moon. This gives around 8 days per month where there are larger waves. The weather can also play a role in influencing the size of the wave. However, as the timing of tides changes each day the tidal bore cannot be easily scheduled as part of a tour programme.

There is a benak observation platform next to Fort Alice. A tidal bore festival (Pesta Benak) is held in Simanggang each year. The festival includes a range of activities and attracts local and occasionally international paddle boarders to surf the benak.

According to local wave rider Oscar Ho, the best places for stand-up paddle boarders to surf a high and long wave are Tanjung Bijat, Bakong and Skirau. At these locations it is possible to ride the wave for up to 30 minutes. In Simanggang town it is only possible to ride the wave for around 5 minutes.

3.4.6.6 *Gunung Lesong National Park*



Figure 3-53: The Forested Slopes of Gunung Lesong

Gazetted in 2013, the Gunung Lesong National Park covers an area of 595 hectares of mixed dipterocarp forest, kerangas and patches of swamp forest. The park is located approximately 13 km from Pantu and is accessed via dirt tracks and plantation roads. At present there are no park facilities and Gunung Lesong receives very few tourists. Most visitors are church groups who visit the park and stay at simple camping shelters on the slopes of the mountain, outside the park boundary.

Gunung Lesong is a small park that only protects the summit and upper slopes of the mountain (Figure 3-53). The park is surrounded by community forest, oil palm plantations and nine villages. The park and surrounding forest are home to a small, isolated population of orangutans. According to villagers, the black morph of the Borneo Banded Langur (or Sarawak Langur) is found in the unprotected forest on the borders of the park. This monkey is critically endangered and one of the rarest primates in the world.

The existence of orangutans and the Sarawak Langur offers opportunities to develop high value ecotourism activities at the park. The northern border of the park from Kampung Menuang to Kampung Langgir could potentially support a range of soft adventure and ecotourism activities targeted at international tourists. This would be dependent on the forest being preserved and no road being built in this area.

The park also has the potential to become a domestic tourism destination. With the appropriate facilities and safety measures put in place the summit trek could prove a popular activity for domestic tourists. A range of camp sites could also be built at appropriate locations on the slopes of the mountain. Road access and a range of accommodation options are required before the park's tourism's potential can be harnessed.

In preparation for the further development of the tourism industry, WWF Malaysia and Sarawak Forestry have been conducting capacity building programmes with the Gunung Lesong Community-Based Ecotourism Committee. This committee includes representatives from the longhouses and villages that surround the park.

The Gunung Lesong Management Plan (Forest Department Sarawak, 2018) recommends that a park HQ is built at Pantu and an interpretation centre is built at Lachau. We consider that it would be more sensible to provide a park HQ, visitor facilities and interpretation centre close to the park.

Existing proposals for tourism include developing traditional homestays in multiple villages that surround the park. Whilst this makes sense to ensure that each community participates in tourism, it is unlikely to be successful. Some villages are located further away from the park's attractions or lack tourism appeal. Other villages (e.g. Munggu Sawa and Menuang) are strategically located near key attractions. For example, Munggu Sawa is the jumping off point for the current summit trek whilst Menuang is located in an area where the rare Sarawak Langur is sometimes sighted. A more focused accommodation strategy is required that takes into account visitor preferences and the location of each village. Alternatives to the traditional homestay model also need to be considered. For example, community-based tourism could be centred on chalet-style 'kampung stays' and camp sites.

Gunung Lesong has the potential to be a major attraction and therefore serve as an anchor attraction of a thematic tourism cluster. This will only be possible when access improves and there is a sealed road from Pantu. Significant funds will need to be invested in visitor facilities. According to SFC, RM400,000 has been allocated for the development of two ranger stations but no funds have been allocated to develop tourism facilities or park infrastructure.

3.4.6.7 *Lingga Town*

Lingga is a small coastal fishing town situated on the Lupar River, approximately 50 kilometres from Simanggang town. The town consists of a small row of wooden shophouses, government offices and village houses. Currently, there is little to attract tourists and travelling time from Kuching is 3-4 hours.

Access to Lingga will greatly improve when the coastal road or Sarawak Second Highway network is completed. When the road is complete Lingga will only be a two-hour drive from Kuching. This could open up tourism opportunities. For example, Lingga could attract day trippers from Kuching interested in seafood meals in the same way that Sematan attracts local visitors today. There may be potential to have a monthly street food festival similar to Siniawan Old Town's night market. Lingga could also be part of a wider tourism cluster centred on Gunung Lesong (see below).

3.4.6.8 Banting

Banting is small settlement on the Seterap River. At present it is only accessible by boat. The main attraction is St Paul's Church which was established in 1859. The Seterap River has a relatively high population of crocodiles and these animals can often be seen at night near the settlement. Banting receives very few foreign tourists owing to its isolation and the fact that it is only accessible by boat. One tour company in Kuching has tried to sell a cycling tour featuring Lingga & Banting. The tour has largely failed to generate demand. In four years, it only attracted 20 tourists. A new road linking Banting to Balau and on to Sri Aman will improve access to this historic settlement. Improved access should lead to an increased number of visitors and allow Banting to be part of a wider tourism cluster.

3.4.6.9 Seduku Nature Reserve



Figure 3-54: A Crocodile Surfaces near Seduku Jetty

Seduku Island is located in the middle of the Lupar River, approximately 30 km from Sri Aman town. The 360-hectare island was gazetted as a Nature Reserve in 2015 to protect the resident crocodile population. There is a jetty on the mainland that serves as the jumping off point for the sanctuary.

Whilst Seduku Island has conservation value as a protected area, it has limited tourism potential. Firstly, it suffers from accessibility constraints as it is only reachable after a 4 hours' drive (and boat ride) from Kuching. This limits demand from both domestic and international tourists. Secondly, Seduku faces stiff competition from other attractions in Sarawak (and Sabah) that offer superior wildlife watching and the chance of seeing crocodiles in their natural habitat. For example, wildlife watching cruises near Kuching offer the chance to see a range of wildlife including crocodiles. These tours are easily accessed from Kuching, only requiring a 45-minute journey.

At present no tourism activities operate in the area. There have been various proposals and suggestions to develop crocodile watching tours at Seduku. None of these suggestions have seriously evaluated the actual feasibility of developing a tourism product at this location.

The Sri Aman & Betong Urban & Regional Study Plan (2009), proposed a RM4.5 million viewing platform. This recommendation is not based on market-based assessment of demand. A key question is 'who would visit such an attraction?' It would face serious challenges attracting international tourists as there are existing wildlife cruises near Kuching that have opportunities to see crocodiles. Crocodile watching also holds limited appeal for Sarawakian tourists.

The Seduku ‘mainland’ is a reasonable place to watch the tidal bore. In addition, crocodiles can sometimes be seen at the jetty. There are existing plans to develop a tidal bore watching platform near Seduku. This could become part of a tourism circuit (see below).

3.4.6.10 Gunung Lesong-Lingga Ecotourism Cluster

Whilst Lingga, Banting and Seduku score poorly as stand-alone attractions, these sites can be combined with Gunung Lesong (a more significant attraction) to form a tourism cluster. The National Ecotourism Plan (2015) defines a tourism cluster as “a critical mass of competitive (and/or complementary) tourism products including one or more major attractions in a concentrated geographical area”.

A SADA Lab (Non-Agriculture Economy) document outlines the Lingga Ecotourism Project as comprising a Batang Lupar River Cruise, Seduku Nature Reserve, Banting, Benak Experience and Rickshaw Memorial Lane.

The Lab document proposes Lingga as a gateway to Gunung Lesong. However, from an operational perspective, this does not make sense as accessing Gunung Lesong from Lingga is time consuming and more expensive than alternative routes. Pantu is a better gateway to Gunung Lesong.

The Lingga Ecotourism Project is currently a theoretical concept rather than an established circuit that already attracts tourists. Whilst it includes a cluster of attractions it lacks a major tourism product. For this initiative to be successful it needs to be tied to a major attraction. As such it is suggested that this project is re-branded as the Gunung Lesong-Lingga Ecotourism Cluster. When road access improves, this could become a key tourism attraction for Sri Aman division.

3.4.6.11 Skrang River

Longhouse tourism has long been a flagship product for Sarawak with most tour companies offering some sort of longhouse tour. The Skrang river was initially the main destination for overnight longhouse tours with subsequent expansion to the Lemanak river and then Batang Ai.

Today very few foreign tourists visit the Skrang and this once popular tourism destination has gone into product decline. According to tour operators, a key reason for the decline is that the longhouses are now accessible by good roads and thus the experience of travelling upriver by boat has been lost. The Skrang river is also not as clean as it once was and is now often visibly brown in colour. Tourists prefer to visit clean rivers elsewhere in Sarawak. In addition, there was limited investment in guest accommodation by either tour operators or longhouse communities.

In essence the things that have made life better for local residents of the Skrang (access by road instead of boat, income from oil palm, etc.) had a negative impact on the tourism experience. Sarawak’s longhouse tourism market has shifted to the Batang Ai region, which offers a pristine environment as well as both culture- and nature-based activities.

3.4.6.12 Lemanak River

When the appeal of the Skrang River diminished, longhouse tourism shifted to the Lemanak River. For a period in the late 1980s and 1990s the Lemanak was a popular longhouse tourism destination. However, as Batang Ai opened up, visitation to the Lemanak declined. Nowadays very few tourists visit the Lemanak river. Those that visit do so on budget tours that don't generate much income for the local communities.

In addition to competition from Batang Ai, there were many reasons for the decline in tourism on the Lemanak. The Lemanak was been badly affected by upriver developments and is now heavily laden with silt, especially after heavy rainfall. Thus, the recreational opportunities associated with the river became more limited. As wealth increased as a result of expansion of cash crop farming and tourism there was a shift towards building new longhouses using modern materials. Foreign visitors were not so keen to pay to see concrete longhouses. Furthermore, the longhouses can now be reached by road.

It is difficult to see how tourism can be revived on the Lemanak (and Skrang) rivers. The natural environment is now degraded and other places offer a better experience.

3.4.6.13 Engkilili Town

Engkilili is a small town located in Lubok Antu district, approximately 35 km by road from Sri Aman. A bazaar first established in Engkilili in the late 19th Century by Chinese Hakka from Kalimantan. The town is located off the main highway and currently attracts very few tourists. Two sites near Engkilili are currently promoted as tourism attractions.

3.4.6.13.1 Batu Nabau



Batu Nabau (Python Rock) is located 3 km from Engkilili. The rock, shown in Figure 3-55, is accessed via a village path and is about 10 minutes' walk from the road. There is a small shelter and information panel near the rock. The cylinder-shaped rock is around 9 m long and 2 m wide. According to local villagers, about 25 years ago a Siamese man from West Malaysia came to the village asked if there was a snake-shaped rock nearby. The villagers showed the man the rock and he made some prayers and offerings. Today the rock is occasionally visited by residents of local towns and villages. Batu Nabau is a minor attraction with limited tourism potential.

Figure 3-55: The Moss Covered Batu Nabau

3.4.6.13.2 Wong Ajong

Wong Ajong is a recreational area located near Engkilili. It is a beautiful picnic spot and has the potential to attract more visitors. For example, it is a great location to expand into a proper camping site and promote to domestic tourists. There are also opportunities for greater involvement of the community in tourism.

Facilities were previously developed at Wong Ajong but these have not been maintained. There is a concrete pathway from the nearest longhouse to Wong Ajong but this needs maintenance work. A wooden shelter is in a state of disrepair.

The toilets have no running water and the steps to river are dangerous and falling apart. The whole area currently has a rundown feel to it and is strewn with rubbish. This is a shame as this location has excellent potential. With relatively small investment Wong Ajong could be transformed into a popular tourism attraction.



Figure 3-56: Wong Ajong has a Beautiful Setting but Facilities are in Despair

There are opportunities to increase community revenue from tourism. Currently, there is an ad-hoc fee structure with fees paid for parking and entry. However, this system is not formalised and no receipts are given. Different villagers also quote different fees. With proper and well-maintained facilities, a range of user fees could be introduced to generate income for local villagers.

3.4.6.14 Pantu Town

Pantu is a small town located approximately 135 km from Kuching. The town offers little of interest to tourists but is the nearest jumping off point for Gunung Lesong National Park. Currently plantation roads link Pantu to Gunung Lesong and surrounding villages. When a sealed road connects Pantu to Gunung Lesong, the town could benefit from tourists stopping off for lunch and provisions before proceeding to the park. It will therefore be similar to Lachau which serves as a lunch / rest stop for tourists travelling from Kuching to Batang Ai.

3.4.6.15 Lubok Antu Town

Lubok Antu is a small border and trading town located along the Sarawak-Kalimantan border. There is generally little of interest for tourists in the town itself. Lubok Antu has one budget hotel and a government rest house. Fort Arundell was built in 1946 on the site of the previous wooden Brooke era forts.

Previously tour operators in Kuching looked into using Sarawak as a jumping off point for the attractions and national parks in Kalimantan, including Danau Sentarum. The general idea was to combine tours of Batang Ai with trips into Kalimantan via the Lubok Antu border post. After touring sites in Indonesia, the tourists would return to Sarawak via Lubok Antu and then fly out of Kuching. In practice it proved difficult to implement these cross border eco-tours owing to visa issues, poor roads across the border and other factors. However, as infrastructure improves this idea could be worth exploring again. If lake tourism is developed at Batang Ai (see above), Lubok Antu could serve as the entry point for Indonesian tourists.

3.4.6.15.1 Wong Merah, Panjai Ruai

The entry point for Wong Merah waterfall is Panjai Ruai Atas, around 15 minutes' drive from Lubok Antu. The waterfall is accessed via a dirt track. It takes around one hour to walk to the waterfall. If the track is dry it is possible to use motorbikes and bicycles. Wong Merah is mostly visited by local villagers and residents of Lubok Antu. More recently it has attracted hikers and cyclists and visitors accessing it via 4WD vehicle.

3.4.6.16 Wilson Bana Homestay

Wilson Bana homestay is located at Po Ai Dau, approx. 27 km from Simanggang. The longhouse is accessed via a sealed road. According to the Resident's Office, this homestay is not active and rarely receives visitors. The homestay has limited linkages with the private sector and is not promoted by any inbound tour operators. There is nothing distinct about this homestay and the surrounding areas. There are similar longhouses located throughout Sarawak. It is difficult for homestays such as this to compete with longhouse tours at Batang Ai, which offer the combination of a longhouse visit, upriver travel and the chance to experience the rainforest.

3.4.6.17 Mount Hosanna Chapel

Mount Hosanna Chapel is located at 157 km on the Kuching-Sri Aman road. The distinctive architectural design of the chapel can be seen from the main road. The chapel is listed as a tourism attraction in the Sarawak Tourism Board's Sri Aman brochure. However, it is not always open. Special arrangements and pilgrimage visits can be arranged with the Catholic Church in Sri Aman.

3.4.6.18 Kemantan Lidi Waterfall

Kemantan Lidi (Figure 3-57 left) is a small waterfall located near Kampung Langgir Iban longhouse. The waterfall consists of series of tiers on a hillside. The first tier has a small swimming pool. A toilet block was built here and there is a small cleared area for camping. The waterfall is a recreational space for residents of Sri Aman, Engkilili and nearby villages. It attracts mostly day trippers and occasionally campers. Like many waterfalls in Sarawak, Kemantan Lidi suffers from litter problems (Figure 3-57 right). At present the community does not charge a fee for day trippers or campers.

Local trekking groups also visit the area and hike in the hills behind the waterfall. The site needs to be managed better and a proper refuse collection system is required. There is scope for the community to charge a small fee to enter the area and use the facilities. If local interest in camping and outdoor space continues there might be scope for developing a community-based tourism project in this area.



Figure 3-57: Kemantan Lidi Waterfall is a Local Picnic Spot Marred by Litter

3.4.6.19 Sungai Raya Recreation Area

Sungai Raya is small river that is promoted as a recreation and picnic spot. A toilet block and concrete steps have been built near the river. However, these have not been maintained. There is rubbish scattered everywhere and the toilets are in need of repair. Sungai Raya should not be promoted as a tourism attraction. If the toilet block cannot be maintained and a proper refuse collection system is introduced there is no point in promoting this place.



Figure 3-58: Facilities at Sungai Raya Recreational Area Have Not Been Maintained.

3.4.6.20 Wong Pupu

Wong Pupu (Figure 3-59) is a decently sized waterfall located near Batu Lintang, approximately 35 kilometres from Sri Aman. There is no signage on the main highway to indicate where the waterfall is. The waterfall is located close to the road so it is easily accessible. Currently there is no car parking space or facilities near the waterfall. The waterfall is visited by local villagers and people from Sri Aman. As the river can be fast flowing the waterfall it is not really a place for swimming. Nevertheless, it is a pleasant spot that attracts residents from nearby villages and towns. In view of this it would be appropriate to build a small car parking space and have an area with BBQ pits and picnic tables.



Figure 3-59: Wong Pupu Waterfall in Sri Aman

3.4.6.21 *Tapang Rumput Recreation Area*

The Tapang Rumput Recreation Area (Figure 3-60) features a small stream and rock pool located a short distance from the main highway. There are no signposts indicating where it is. This is probably a good thing as Tapang Rumput should not be promoted as a tourism attraction. Firstly, the river is nothing special. Secondly the whole area is filthy with piles of rubbish everywhere. Previously picnic facilities were built here but these have fallen into disrepair. There is little point in developing facilities at minor attractions such as this, especially if no budget is allocated for maintenance and upkeep.



Figure 3-60: Run-down facilities at Tapang Rumput recreation area

3.4.6.22 *Proposed Kelingkang Range National Park*

The Kelingkang Range runs along the Sarawak-Kalimantan border in the west of Sri Aman Division. Much of the hilly terrain has been previously logged. According to Sarawak Forestry, it will take some time to gazette the park as the various communities need to be consulted. As it may take several years before the Kelingkang Range is gazetted, priority should be given to developing facilities at Gunung Lesong National Park.

3.4.6.23 *Lanjak Entimau Wildlife Sanctuary*

Wildlife sanctuaries in Sarawak are not open to visitors and exist to conserve valuable ecosystems and endangered wildlife. As tourists are not allowed to visit wildlife sanctuaries an assessment of Lanjak Entimau was not conducted.

3.4.6.24 *Maludam National Park*

The vast majority of the 53,568 ha Maludam National Park is located in Betong Division. This includes Kampung Maludam which serves as the entry point for the park. As this park is essentially an asset of Betong Division it has not been assessed as part of the Sri Aman Master Plan.

3.4.6.25 Concluding Remarks

An evaluation of the Sri Aman Division's tourism resources indicates that it has a modest range of tourism attractions when compared to other divisions in Sarawak. On a positive note, the attractions that Sri Aman does have are high quality ecotourism assets. These include Batang Ai, the Ulu Sungai Menyang landscape and Gunung Lesong National Park.

New roads will improve access to smaller towns and villages (e.g. Lingga, Banting, etc.) in the coming years. This will open up further opportunities in 3-4 years' time. Access and basic infrastructure have to improve before these areas can be promoted as tourism destinations. The division also has some waterfalls and picnic spots that attract local residents and day trippers.

To conclude, there needs to be a realistic expectation of the tourism potential of the Sri Aman Division. With this understanding, the goal will be to maximise that potential and develop viable projects and tourism products that will attract both domestic and international demand; and therefore, create economic and employment opportunities for local communities.

3.4.7 Accommodation Supply

There is a limited choice of accommodation in Sri Aman Division. Most hotels are budget or mid-range shophouse properties. There are no international standard hotels or resorts in the Division. There is one official homestay programme, namely Wilson Bana homestay.

Table 3-33: Accommodation, Sri Aman Division

Name	Location	Type	Rooms	Capacity (guests)
Seri Simanggang Hotel	Simanggang	2-3* Hotel	158	
Mega Inn Hotel	Simanggang	Budget hotel	25	
Fortune Inn	Simanggang	Budget hotel	20	
Crystal Inn	Simanggang	Budget hotel	16	
Regent Inn	Simanggang	Budget hotel	24	
Champion Inn	Simanggang	Budget hotel	24	
Theatre Inn	Simanggang	Budget hotel	10	
Goodview Inn	Simanggang Town	Budget hotel	19	
Mei Xin Inn	Simanggang	Budget hotel	11	
Place 2 Stay	Simanggang	Budget hotel	45	
Viva Hotel	Simanggang	Budget hotel	44	
Kelingkang Inn	Lubok Antu	Budget hotel	13	
Wilson Bana Homestay	Po Ai, Melugu	Homestay	10	
Nanga Sumpa Lodge	Batang Ai	Lodge	8	25
Lubok Kasai Jungle Camp	Batang Ai	Jungle Camp	8	20
Mawang Rainforest Camp	Batang Ai	Camp Shelter	1	10
CPH Lodge (Ukom)	Batang Ai	Lodge	3	24
Jinggin Lodge	Batang Ai	Lodge	7	20
Other Accommodation	Batang Ai	Homestay	-	50
Total Room Supply			446	149
Aiman Resort (CLOSED)	Batang Ai	3* Hotel	100	

Notes:

- Aiman Batang Ai Resort & Retreat is currently closed. The property is seriously run down and will require substantial investment to refurbish it.
- Capacity for 'Other Accommodation' at Batang Ai is an estimate. Guests usually sleep on the ruai or family bilik at longhouse homestays rather than in purpose built guest rooms. As such capacity is flexible.

In addition to officially registered hotels there are a number of private homestays and guest houses, mostly located in Simanggang town. These homestays are marketed on Facebook, Air BnB and other channels. Homestays on Facebook are of varying quality and generally offer rooms in family houses rather than separate annexes of houses. Many appear to have stopped taking guests since the pandemic. Higher quality offerings are offered on AirBnB. At present there are 11 listings in Sri Aman on AirBnB with the majority in Simanggang. Prices range from RM 58-450. The majority of the listings are modern homes (terrace or semi-detached houses). Some offer well equipped and high quality accommodation. Very few of the AirBnB listings have guest reviews which suggest that visitation is somewhat limited

Batang Ai has a range of niche accommodation including longhouse guesthouses, lodges and jungle camps. The Aiman Batang Ai Resort & Retreat closed in April 2020. The following table shows room supply in the Sri Aman Division. Guest capacity is also listed for niche tourist accommodation at Batang Ai.

3.4.7.1 Batang Ai Longhouse Resort – Lessons Learned

The 100-room Hilton Batang Ai Longhouse Resort opened in 1994. The resort was hampered from the start by its bad design. The architectural design did not take into consideration the merits of the location or consider operational and maintenance issues. The developer built a series of featureless, longhouse-style blocks. The concept of a longhouse resort was given priority rather than the guest experience and designing rooms that took advantage of the lakeside views.

None of the rooms had private balcony areas overlooking the lake, a fundamental design error. Instead, rooms opened to a large corridor that was designed to resemble a longhouse *ruai*. However, the *ruai* areas were left empty and unused by guests. These and other design errors resulted in the resort having large areas of wasted space that was not utilised by guests. This unused built-up space did not generate revenue but still required maintenance.

The resort was also spread out over a very wide area. This added to the maintenance costs and made it difficult to operate as an efficient resort. The high ceiling of the lobby area was ill conceived and ended up a roost for bats and swiftlets. The constant mess from this required regular cleaning.

Access to the resort was via a small ferry. This was inconvenient for guests and added to staff and operating costs. The ferry schedule often resulted in guests having to wait around at the jetty after a long car journey from Kuching. During the construction phase there was an access road to the resort. This road should have been kept and upgraded so that guests could access the resort by car, anytime of the day.

The 3-star resort experienced low occupancy rates since it opened with annual occupancy rates in the 20-30% range. Low season occupancy rates were 5-10% and even in the peak season monthly occupancy was typically 30-40%. Although the resort was managed by Hilton it did not have the full range of facilities and services normally associated with the Hilton brand.

The longhouse resort received mixed reviews from guests on platforms such as TripAdvisor. Access constraints also contributed to the resort's failure. Journey time from Kuching to the resort was around 5-6 hours. Insufficient activities were offered at the resort itself.

In January 2016 Tradewinds Hotels & Resorts transferred ownership of the property to the Aiman Group. At the time of the change of ownership the resort needed major renovations or a total rebuild. The resort was falling apart and several accommodation blocks were unsellable owing to their run down

condition. The new owners only did minor repairs to the resort. As such the resort retained its tired and dated look and struggled to attract guests. The resort closed in 2020.

To summarise the resort failed due to the following factors:

- Poor architectural design that failed to put the guest experience first
- High maintenance and operational costs
- Limited activities and experiences offered at the resort itself
- No road access to the resort
- Access constraints - 5-6 hours from Kuching / an international airport
- Not utilizing the lakeside location for more tourism activities (e.g. sunset cruises, water sports, fishing, etc.)

3.4.8 Community-Based Ecotourism (CBET)

“Community Based Tourism (CBT) is tourism activity, community owned and operated, and managed or coordinated at the community level that contributes to the well-being of communities through supporting sustainable livelihoods and protecting valued socio-cultural traditions and natural and cultural heritage resources.” (ASEAN Community-Based Tourism Standard, 2016)

In Malaysia, the most common form of CBT is the homestay (Ministry of Tourism & Culture, 2016). This government-led programme was first launched in 1995 and involves tourists staying with a host family in a village.

Local communities often lack the capacity, knowledge and skills to develop community-based tourism projects (Ministry of Tourism & Culture, 2017). Product development assistance can come from the private sector, government agencies and NGOs.

However, one of the greatest challenges facing CBT projects is over reliance on external aid from the government or donors such as NGOs. Many CBT projects fail when external financial assistance is withdrawn or project budgets are depleted. CBT is hard to do and can take years before results are seen by the community.

According to the National Ecotourism Plan, “the long-term success of a CBT project depends on its integration with the mainstream tourism industry, especially through partnerships with the private sector.” Such private sector partnerships help move CBTs up the value chain and attract more demand.

In Sarawak there are two main types of community-based tourism projects. Private sector tourism initiatives that offer accommodation, tours and activities and government-led homestay programmes that mostly focus on providing accommodation, with guests staying in the host’s house. These two models have developed totally separate from one another. Government led homestay projects often have poor linkages with the private sector. In Sarawak, there has been an emphasis on the quantity of homestays rather than their quality and marketability.

3.4.8.1 *Government-Led Homestay Programmes*

The traditional homestay model promoted by government agencies in Malaysia has had mixed success. Whilst some programmes have been very successful, many homestays have failed to attract many guests.

There are currently 44 registered homestays in Sarawak offering 895 rooms. Both the Federal and State government are involved with these homestays. The Federal government via MOTAC provides funding for house upgrades and minor village infrastructure and MTCP Sarawak assists with capacity building.

In 2019 Sarawak's homestays hosted 58,722 visitors (85% of domestic, 15% foreign) and generated RM4,704,600. Average spend per visitor was RM80. This is a significantly lower spend than privately run guest houses and homestays in Sarawak.

The Federal Government has highlighted a need to move away from the traditional homestay programme promoted in Malaysia. A study (MOTAC, 2018) on upscaling the Malaysian homestay experience recommended the kampung stay model where guests stay in separate annex buildings or chalets rather than staying in a room in the family home.

Sarawak already has a number of successful private sector guesthouses or kampung stays (e.g. Kura Kura, Peraya and Saloma's). More recently, private individuals have developed standalone tourist accommodation and village stays at beach destinations such as Telok Melano.

Where possible Sri Aman should encourage variations of the traditional homestay model. For example, it could focus on developing kampung stays and pioneering other community managed tourism products and services (e.g. transport, guided activities, camping sites, etc.).

Alternative forms of community-based tourism are likely to generate more revenue than the traditional homestay model. The upscaling Malaysian homestays report outlines some useful recommendations in this respect.

Additionally, community-based tourism initiatives should only be developed in areas that have good tourism potential. A proper assessment of an area's tourism potential needs to be conducted before committing financial resources to a community-based tourism program. The division level tourism task forces could conduct future assessments using a simple attraction rating model to prioritise locations for development.

3.4.8.2 *Private Sector Initiatives*

There is substantial community involvement in the tourism sector at Batang Ai with some longhouses earning significant income from the provision of tourism services. For example, transportation services are provided by various longhouses and a number of tour operators work closely with longhouse communities. Tourism revenues received by individual longhouses vary widely, with popular longhouses receiving hundreds of thousands of Ringgits each year (UNDP Malaysia, 2007).

Community involvement has generally been in the form of a longhouse committee dealing with an individual tour operator (Sarawak Tourism Board, 2006). The committee manages certain operational aspects of tourism and ensures a fair division of work amongst residents of the longhouse. Most longhouses have little or no involvement in business planning, sales and marketing, which are all handled by tour operators (Yea, 2002).

Some tour operators have established more extensive relationships with longhouses. For example, Project Orangutan at Jinggin, Borneo Transverse at Mengiling and CPH Travel at Ukom. These partnerships extend beyond payments for tourism services and often involve financial assistance (e.g. grants and loans) and community projects. The most significant community-based tourism initiative at Batang Ai is Borneo Adventure's Ulu Ai Project.

3.4.8.2.1 *The Ulu Ai Project*

The Ulu Ai Tourism Project is a partnership between tour operator Borneo Adventure and the Iban community of the upper Delok River. Three longhouses are involved in the project - Nanga Sumpa, Jambu and Ta'ong. The project commenced in 1987 and is longest partnership between a tour operator and a community in Malaysia. From the beginning tourism has been carried out with the agreement and cooperation of the community.

The project is centred on Nanga Sumpa Lodge and offers tourists a chance to experience the Iban lifestyle on the host's own terms. Tourism activities focus on the society and environment, rather than cultural performances and demonstrations. The community is fully involved in tourism operations. A longhouse tourism committee serves to coordinate the provision of a range of tourism services.

Table 3-34: Tourism Payments to Ulu Ai Longhouse Community

Year	Provision of Services*	Facilities, Repairs & Maintenance**	Others (allowances, donations)	Total
2010	197,557	7,128	13,200	217,885
2011	263,774	5,214	13,200	282,188
2012	299,809	8,898	75,364	384,071
2013	404,238	30,306	24,237	458,781
2014	359,992	288,591	119,675	768,258
2015	232,838	88,333	86,737	407,908
2016	207,270	34,118	73,886	315,274
2017	207,343	38,451	42,540	288,334
2018	244,101	81,331	42,610	368,042
2019	245,262	18,034	43,940	307,236

Source: Borneo Adventure

*Amount paid by Borneo Adventure to the community for boat charges, head tax, tuai rumah (or headman) tax, helpers, cleaners, guides, porters, etc.

**Amount paid by Borneo Adventure to the community for building lodges, trekking huts, repairs & maintenance, clearing jungle trails, etc. The vast majority of this would be for labour costs.

Apart from direct payments from Borneo Adventure, the community derives revenue from handicraft sales, tips and gratuities. The company estimates this amount to be around RM 70,000 per annum. The average revenue from tourism to the community is estimated at around RM450,000 per annum; a substantial sum for a rural community in Sarawak (Ministry of Tourism and Culture, 2016).

Borneo Adventure also provides financial support for development projects, community initiatives and medical treatment. Examples include micro-credit loans for villagers to buy outboard engines and a welfare fund to help families pay for medical or educational expenses.

According to the National Ecotourism Plan, the Ulu Ai Project "demonstrates that CBET can be successful even without government intervention, when private sector-local community partnerships are cultivated based on trust, with emphasis on community ownership and development, as well as providing tangible, substantial benefits to the community (Ministry of Tourism and Culture, 2016).

3.4.8.2.2 *Local CBT Business Arrangements & Partnerships*

There is no one-size-fits-all with private sector CBT initiatives. Business models, arrangements and partnerships between tour companies and communities differ depending on the type of tourism activity (accommodation, tours only, transport services, F&B, etc.). Agreements need to be negotiated between the operator and the community and often take time so that there is buy-in across the community.

The most comprehensive partnership in Sarawak is the Ulu Ai Project described above. This partnership features a range of business agreements including rental agreements for land, monthly allowances for key personal (e.g. headmen, tourism coordinators, etc.), maintenance contracts and an agreed schedule of fees for a range of work and services. This includes fees for boat transfers, local guiding, construction work, trail maintenance, housekeeping, cooking, headman and tourist taxes, etc. The fees are periodically reviewed.

A longhouse tourism committee presents the community and negotiates with the company. Regular meetings are held between the company and community elders in Batang Ai and Kuching. The community is actively involved in all aspects of tourism operations at Batang Ai. Most of the work is allocated on a rotation system by the tourism committee so that everyone who is interested can obtain some income from tourism. Borneo Adventure handles sales and marketing and administrative matters such as compliance with overseas agents' requirements on health and safety.

Other tour companies in Sarawak also have partnerships with longhouse communities at Batang Ai. Some of these agreements are with the whole community whilst others are just with the headman. Most companies agree a schedule of fees for services with the community or the headman. One of the largest sources of income for members of the community is boat transportation.

Some companies will rent *bilik* in the longhouse to utilise as a lodge. Borneo Transverse does this at Mengiling Longhouse at Batang Ai. CPH has built an additional *bilik* at the end of Ukom longhouse that it uses as a lodge for its guests. Other tour companies also visit Ukom but their guests stay with the headman or other residents or sleep on the *ruai*.

Project Orangutan took a different approach with its partnership at Jinggin. It financed the building of the lodge and then transferred ownership to the community after a certain volume of guests had stayed at the lodge. Like other companies, Project Orangutan negotiates a schedule of fees with the community.

3.4.8.3 *CBT Projects Need to Be Mindful of Tourism's Vulnerability to External Shocks*

External events can result in reduced tourism revenue for rural communities. Successful CBT initiatives in Sarawak rely more on long-haul tourism markets which often see drastic drops in arrivals following a crisis or event.

When planning and developing tourism in rural areas, it is vital to emphasise to the community that tourism should be seen as a source of extra income. Traditional economic activities should be prioritised so that rural communities do not rely too heavily on tourism. It is risky for communities to rely on tourism too much owing to the cyclical nature of the industry and the fact that tourism is frequently impacted by external events.

Covid-19 has resulted in substantially reduced revenue for longhouse communities at Batang Ai that host tourists. The 2020 peak season has been lost. However, as these communities still pursue traditional economic activities, they have the resilience to sustain themselves.

Developing new community-based tourism projects in Sri Aman Division in the next few years will be challenging. International arrivals to Sarawak will be drastically reduced over the next few years. However, domestic demand is increasing and there are opportunities to develop a different type of community-based tourism, targeting local travellers.

3.4.9 Scientific, Academic, Volunteer & Education (SAVE) Tourism

SAVE is a tourism concept encompassing four niche markets: Scientific, Academic, Volunteer and Education travel. SAVE travellers generally place greater emphasis on natural and cultural heritage, getting to know local people and enhancing knowledge. Mainstream tourists often require extensive infrastructure and facilities. Developing such infrastructure can be expensive, especially in remote rural areas. According to the SAVE Travel Alliance, attracting SAVE travellers can be beneficial for developing tourism destinations as these visitors have many qualities that can assist with tourism growth.

- They require less sophisticated facilities than the typical leisure traveller.
- They stay for extended periods at a destination
- They engage the local population and the private sector
- They contribute to improvement of the area

Table 3-35: Benefits for Destinations from SAVE Tourism

Type	Profile	Benefits for Destinations
SCIENTIFIC	Travel to enhance science and help with acquisition of knowledge	Extended stay Hires local workers Researcher lives in community, eats local food, uses local transport, etc. Positive economic benefits Scientists gather information about culture, natural environment which helps raise profile of destination.
ACADEMIC	Travellers seeking to participate in experiential learning activities leading to credit for formal degree programs or courses offered by higher education institutions	Academic groups visit more remote places Greater interaction Simple facilities/services Travel in groups Higher economic benefits Ability to raise awareness of destination
VOLUNTEER	Travel to participate in activities that will contribute to the betterment of society.	Stay longer Diversified economic benefits Share experience Increase word of mouth Simpler products/services
EDUCATION	Travel to enhance knowledge, for personal experience rather than academic credit	Extended stay Increased economic benefits Increased interaction with local community Fosters importance of local cultures/traditions

Source: George Washington University

Sarawak has had reasonable success at targeting niche markets such as a SAVE. Batang Ai already plays host to volunteer tourists. NGO Project Orangutan, Sarawak's most successful volunteer tourism programme, operates orangutan treks in an area outside of Batang Ai National Park. The Project helped

to build a lodge a Jinggin Longhouse and works closely with the community to operate the treks. Before the pandemic, 300-400 volunteers per year visited Batang Ai with Project Orangutan.

Batang Ai also attracts school and university groups. Kuching-based tour operators often arrange trips to various areas of Batang Ai. Some of these trips focus on community projects whilst others feature soft adventure activities.

The best opportunities for developing edu-tourism are leveraging the environment & the natural assets of the Division. Batang Ai is unique and has the potential to attract international and local researchers and school groups. Appropriate facilities will be needed for researchers as outlined in the initial recommendations. Existing set-ups are adequate for school groups.

Destinations elsewhere in the Division that have a combination of nature and culture-based attractions should also be able to attract niche edu-tourism segments such as school groups. The Lingga-Gunung Lesong Cluster should be able to attract school groups when park infrastructure, facilities and accommodation are developed.

Whilst Sarawak has achieved some success with SAVE tourism, Sabah is in a different league in comparison. Sabah has successfully targeted the general volunteer tourism market with programs at Sepilok orangutan and sun bear centres. It has also gained a reputation as a destination for school groups and has activity centres that focus heavily on the school trip market.

Sabah has also developed a reputation as a location for academic research. It has done this by establishing partnerships with foreign universities and developing well-equipped field studies centres. These include Danum Valley Field Centre, Danau Girang Field Centre and the recently completed Imbak Canyon Studies Centre. Some of these centres are jointly managed with overseas partners. They attract both international researchers and volunteers and lead to strong collaborations between local and foreign researchers.



Figure 3-61: Researchers at Danau Girang Field Centre, Sabah

These field centres can generate substantial economic activity for rural communities. Each researcher pays for their trip and requires local research assistants and guides, lodge accommodation and meals. Researchers and volunteers also stay for long periods of time. A key driver to successfully developing

this niche is having a strong relationship with an overseas university. This guarantees a steady flow of academic researchers and volunteers and therefore regular income for the project.

The Sri Aman Division has some high value protected areas and there are opportunities to expand SAVE tourism. For example, establishing a rainforest field studies centre in partnership with local and international universities would be a first for Sarawak. Locating the field studies centre within Batang Ai National Park is a viable option. Currently, the park receives just 100-200 visitors per year, one of the lowest of all parks in Sarawak. A rainforest field studies centre would attract local and international researchers and create employment opportunities for local communities. Unlike tourism, which is seasonal, research activities would take place all year round. Research activities would therefore complement the ecotourism activities that currently mostly take place outside of the national park.

3.4.10 Location Filming

The Sri Aman Division, or more specifically, Batang Ai is one of the most popular locations in Sarawak for international film production companies. The clean rivers, rainforest scenery, wildlife and longhouses have proved to be a popular choice for filming movies, documentaries and reality TV shows.

This is largely due to the work of Kuching-based film location fixers and the efforts of the Sarawak Tourism Board. For example, Sarawakian film producer Edgar Ong was instrumental in selecting Batang Ai as one of the locations for the movie *The Sleeping Dictionary*. Tour company Borneo Adventure has acted as film fixer for a range of documentaries and reality TV shows that have been filmed at Batang Ai. These programmes have appeared on CNN, BBC, National Geographic and other major channels.



Figure 3-62: Anthony Bourdain takes a break whilst his crew continue filming, Skrang River

Location filming can generate significant income for rural communities. For example, Batang Ai has been used as a location for a number of reality TV shows with filming taking place over 6-8 weeks. Whilst the total budgets for these programmes can run to several million US dollars, the amount spent within Sarawak is typically around RM 1 to 2 million, with a substantial amount of this channeled to local communities. For example, a BBC reality TV show filmed at Batang Ai resulted over RM350,000 being paid to the longhouse community over a 2-month period.

According to location fixers in Sarawak, the current State film permit system often discourages international film companies from selecting Sarawak. Permit approvals are often given a few days before arrival and many production companies will not take this risk. A more streamlined and efficient process is needed. If this happens, the Sri Aman Division is well positioned to leverage its natural assets and promote itself as a film location.

3.4.11 Digital Tourism Presence

A key source of online information for Sarawak is STB's main website. This site ranks highly in Google and has extensive backlinks. Content on Sri Aman's attractions is fairly limited on STB's website. This is understandable as currently there is only one popular destination in the division (i.e. Batang Ai). Under the 'Plan' section, there is a location filter to search attractions which includes Sri Aman. Six attractions are listed (Batang Ai, Sri Aman Town, Rattan, Maludam, and Fort Alice). The information on Batang Ai is comprehensive but some details (e.g. the recent closure of the Aiman Resort) have not been updated. The write-ups on the other attractions could be improved. The tidal bore is also well featured in the Blog section of the website.

A Sarawak Travel App was launched in early 2020. The app was accompanied by a 'More to Discover' web portal (Figure 3-63). There are plans to merge the Sarawak Travel App and STB's website.

Divisional brochures in PDF format are listed on STB website, including one on Sri Aman. The brochure provides a good overview of attractions, is well designed and has some good photos. One area for improvement is the 'how to get there' information which has insufficient practical details to help visitors find these attractions. Listing GPS locations of attractions would be helpful for travelers.

The tidal bore is one of Sri Aman's defining features and yet it is difficult to find information on tidal bore times. Other destinations that have tidal bores have dedicated websites that list wave times at various locations on the river. This allows tourists to plan a visit to coincide with the tidal bore.

Some attractions in Sri Aman have incorrect location markings in Google Maps (e.g. Wong Ajong) and some are not listed at all. This makes it hard for tourists to find the attractions, especially as there are no physical roadside signs to help self-drive tourists.

STB's YouTube channel includes some excellent videos of the benak. Other attractions in Sri Aman Division are not well featured. There is a video on a cycling tour to Sri Aman, Banting and Lingga. There is some good user generated content on YouTube featuring attractions in the division. Some high-quality videos of Batang Ai have been produced by tour companies and drone operators. Post lockdown more videos of waterfalls and recreational sites (e.g. Wong Merah, Gunung Lesong, Batang Ai.) from day trippers and excursionists have been uploaded to YouTube and other channels.

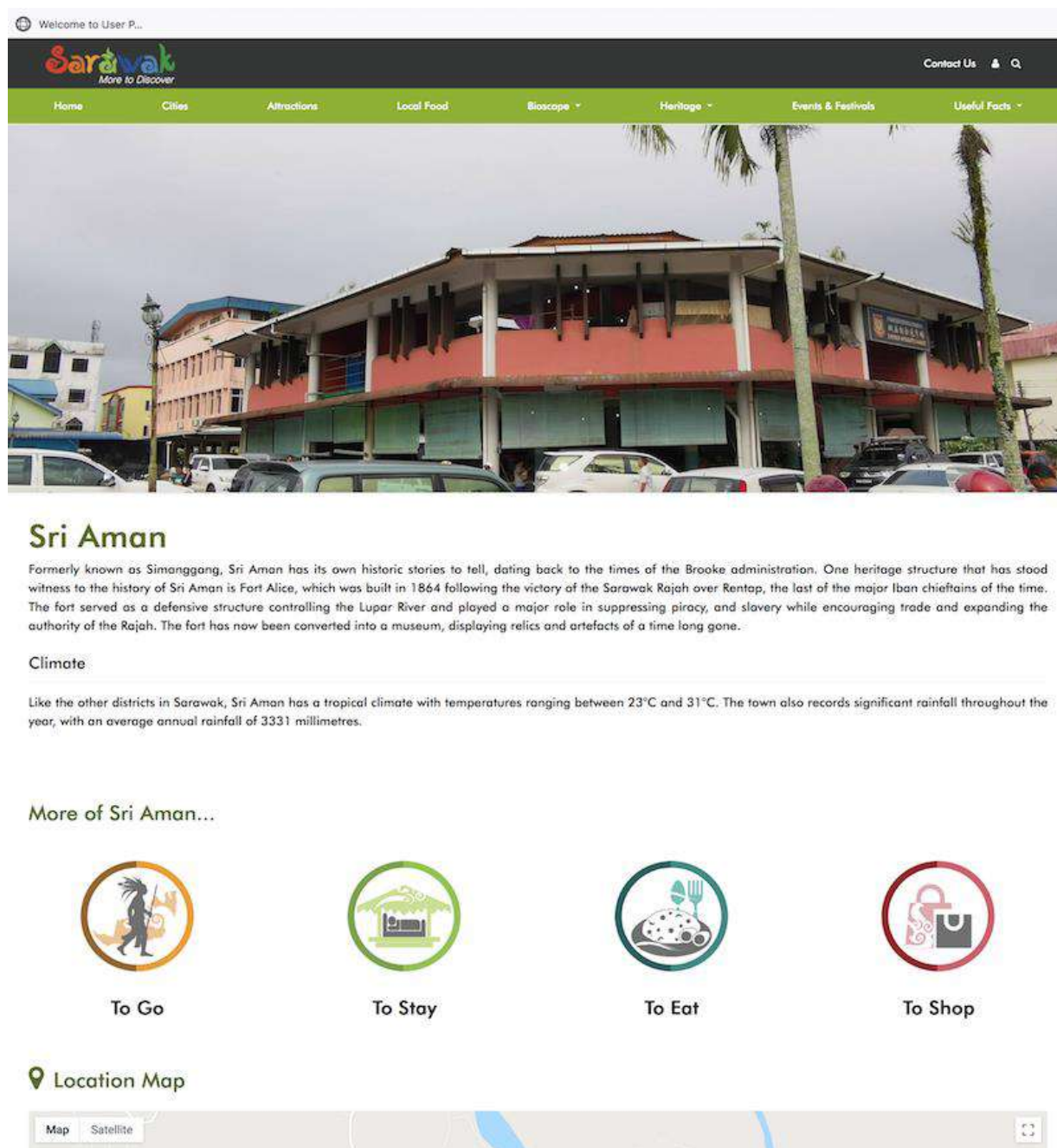


Figure 3-63: Sarawak More to Discover web portal

Key attractions such as Batang Ai are well featured on Trip Advisor either as an individual attraction listings or reviews under tour companies. Other attractions in the division are less well represented on TripAdvisor. This is not surprising as they do not receive many visitors. There is a wide range of user generated content on social media (Facebook, Instagram, etc.) that features Sri Aman.

To conclude, there is a reasonable amount of digital content on the Sri Aman division's attractions. It would be useful to have some better-quality videos on attractions in Sri Aman. A destination video on the Sri Aman Division plus shorter videos on individual attractions is needed. A mix of professionally filmed content and more personal video blogs would help to showcase a wider range of attractions and experiences.

3.4.12 Issues, Challenges & Opportunities

The following table summarises the issues and opportunities for tourism in the Sri Aman Division.

Table 3-36: Sri Aman Division Tourism SWOT

Strengths	Weaknesses
Division has a number of high value protected areas offering a mix of habitats (rainforest, rivers, lake) which provide variety and scope for a range of leisure activities Home to Sarawak's wild orangutan population Batang Ai is Sarawak's main destination for 'longhouse tourism' and orangutan treks, both flagship products. Long established, successful partnerships between communities and private sector tourism businesses History & heritage The tidal bore, a rare natural phenomenon Planned infrastructure set to improve access and open up new areas (e.g. G. Lesong) Strong government support for tourism	Access constraints – most attractions are 3-5 hours from Kuching (limits interest in the destination) Limited accommodation choices (mostly budget and mid-range, no international standard hotel or resort) Only one established destination (Batang Ai) and no real tourism clusters Wildlife (except orangutans) in protected areas is difficult to see Inadequate infrastructure & facilities (e.g. need better boat jetties, toilets, improvements in cleanliness, etc.). Lack of private sector tourism players based in the division Previously popular tourism attractions (Skrang & Lemanak) have gone into serious product decline No effective mechanism to channel funds to the maintenance of attractions Poor internet connectivity
Opportunities	Threats
To develop camping sites throughout the division to tap into growing domestic demand. To develop a Gunung Lesong-Lingga tourism cluster To leverage Batang Ai reservoir as a tourism asset and develop it into a lake tourism destination To offer low-impact water sports and water-based activities at Batang Ai (e.g. angling, water ski-ing, windsurfing, kayaking) and train local community members as guides/instructors. To re-develop the Batang Ai Resort with better designed rooms and improved levels of service To promote sport and adventure races / events To develop a rainforest research centre for international & local researchers To improve facilities at local recreation spots To improve signage to make it easy to find tourism attractions and local recreation areas To develop new community-based tourism products that do not follow the traditional homestay model To better manage attractions and beauty spots and improve waste disposal To launch a 'Keep Sarawak Clean' campaign to educate the public on littering at natural sites To gazette the Sungai Ulu Menyang landscape as a national park or other form of protected forest to safeguard prime orangutan habitat To create positive publicity for Sarawak by gazetting more protected areas. To better protect the Sarawak Langur (<i>Bijit</i>) and make it an icon of the Sri Aman Division.	Hunting threatens wildlife resources in protected areas and the ability to develop new wildlife watching tours Illegal logging (e.g. Ulu Sungai Menyang) Transboundary haze events Global economic recession Weak post-Covid-19 global tourism demand with recovery to 2019 levels expected to take 3-5 years New roads (whilst bringing development benefits) often degrade tourism resources Increased domestic tourism demand is resulting in more litter and rubbish at attractions and beauty spots Similar tourism attractions in other parts of Sarawak are more accessible and often offer better experiences

Source: UNIMAS Holdings

3.4.13 Hazards, Effects and Resilience Planning

The tourism sector is vulnerable to external shocks. War, terrorism, disease, natural disasters and global recessions can all impact tourism in a negative way with arrivals and revenues plummeting in a short period of time.

According to a World Travel & Tourism Council (WTTC) study of 69 events, recovery times for the tourism sector vary depending on the type of event or crisis. Recovery time for natural disasters averages 16.2 months whilst recovery from disease averages 19.2 months. The recovery time for disease events ranges from 10-35 months.

Table 3-37: Tourism Recovery Times in Months by Type of Crisis

Type of Crisis	Minimum	Average	Maximum
Disease	10.0	19.4	34.9
Environmental Disaster	1.0	16.2	92.8
Political Turmoil	10.0	22.2	44.9
Terrorism	2.0	11.5	42.0
Total	1.0	17.7	92.8

Source: World Travel & Tourism Council, 2020.

The WTTC recommends destinations implement the following measures to improve crisis preparedness, management and recovery.

- Build trust-based coalitions between key stakeholders before a crisis hits in order to respond in a coordinated and effective manner when needed.
- Enable scenario-based planning, assess readiness and maintain emergency action plans.
- Educate to reduce fear by implementing comprehensive training programmes which engage stakeholders.

WTTC also stresses the need for communication and effective media management during the crisis.

Over recent decades Sarawak has suffered downturns in tourism as a result of external events. These events include the Gulf War (1991), the September 11 attacks (2001), Transboundary Haze (multiple years including 1997/8, 2015 & 2019), the Global Financial Crisis (2007/8), the MH370 (2014) & MH17 (2015) crashes and Covid-19. The impact of the current pandemic is on a vastly greater scale than any of the other events.

As many international tourists visit both Sarawak and Sabah, Sarawak's tourism industry can be negatively impacted by events in Sabah. For example, the Sabah kidnappings (2013, 2014, 2015 & 2016) and earthquake (2015) resulted in cancellations and postponement of tours in Sarawak. Events can impact source countries to different degrees. For example, the spate of kidnappings in Eastern Sabah caused tour cancellations from Western countries but demand from Asian countries was not impacted so severely.

The coronavirus pandemic has shown the fragility of international tourism. At present the State government and the private sector are focusing on promoting domestic tourism. In essence there are two components of this demand. Firstly, local leisure demand from residents of Sarawak and secondly travellers from West Malaysia and Sabah. The pandemic has hit the second component of domestic demand with border controls and health measures discouraging travel between West and East Malaysia.

Even when borders reopen and foreign arrivals recover, Sarawak will need to continue to place emphasis on domestic demand so that the tourism sector is more resilient to external shocks and periodic downturns in arrivals. This will require substantial investment in visitor facilities to cater for local recreation. Parks and green space, beach esplanades, riverfront developments, boat ramps, picnic areas, public toilets, shower blocks, bike racks, etc., are the types of basic infrastructure and amenities that Sarawak needs to cater to local recreation and domestic tourism demand.

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PART 4

INFRASTRUCTURE AND UTILITIES

SECTION 4.1 TRANSPORTATION AND ROADS

In brief this section focuses on:

- Regional connectivity namely road, air transport and their transits
- Sub-regional state-wide connectivity
- Urban transportation
- Rural public transport and its connectivity to urban areas

The ultimate objective is to plan and design a multi-modal transport system, which is well coordinated, reliable, comfortable, cost-effective and user-friendly to support the social economic plan of the Study Area.

4.1.1 Sri Aman's Place Within Sarawak's Infrastructure

4.1.1.1 Roads

The only arterial road in the Sri Aman Division is the Pan Borneo Highway which, at the time of writing this report, is currently being upgraded. A second arterial road (Second Trunk Road) is being planned which will link Sebuyau with Betong via Lingga and Simanggang. All other roads in the Sri Aman Division can be classified as collector and access roads. That is, they terminate at their intended destination or link to arterial road. The principal roads in this category are:

- Simanggang – The main town in Sri Aman is accessed by a 13 km branch road off the Pan Borneo Highway. The road terminates at Batang Lupar. However, there is an extension along the River to Lingga.
- Lingga – Connects from Simanggang and follows the Batang Lupar to Lingga, where it terminates
- Pantu – connects from Pan Borneo Highway and terminates at Pantu
- Lubok Antu – From Pan Borneo Highway the road connects to Lubok Antu. From there it extends to the Indonesian Border (approximately 6 km) where a border control post is situated
- Batang Ai – The road to Lubok Antu has a left branch before reaching Lubok Antu. This road extends to Batang Ai Dam and terminates there.
- Engkilili – From Pan Borneo Highway there is a road into Engkilili. More recently a narrow, winding sealed road allows travel through to Lubok Antu.
- Batu Lintang – The access road extends from the Pan Borneo Highway to the Indonesian Border. There is Border Control provided at this location.



Figure 4-1: Existing Road Network of Sri Aman Division

Source: JKR Sarawak

4.1.1.2 Air Linkages

The Sarawak Government has identified a site for a short take-off and landing airport (STOL) at Bebuling, Spaoh in the neighbouring Betong Town. Targeted to be in operation by 2023, it is aimed to improve air connectivity, which in turn can assist in transportation of passenger and perishable high value

agricultural products for export from the area. With such facility in place, the study area will be included air transport network of the state.

4.1.1.3 River

The Batang Lupar ferry service links Sebuyau in the neighbouring Samarahan Division to Triso, which is located west of Maludam National Park in Betong. This will become redundant once the new bridge is completed at this location.

Within Sri Aman, river transport along Batang Lupar is mainly consisted of small to medium fishing vessels. The Lupar River downstream of Simanggang is considered unsuitable for larger scale boat activities for the following reasons:

- The River has a high tidal range and is very shallow in parts at low tide. This means that larger draft vessels will only have safe access during high tide periods. Since these vary each day and throughout the day, transport times becomes erratic, with narrow windows of opportunity.
- The River is a high energy system as evidenced by the Tidal Bore phenomenon. The strong currents make navigation difficult, and often dangerous, for smaller vessels.
- Because the River is a high energy system the bathymetry of the river is constantly changing, with sediment bars being actively eroded and deposited with tidal flux. This means that sand bars are unpredictable and can be a hazard to navigation.
- The design clearance at the new Sebuyau bridge across the Batang Lupar is unsuitable for large cargo vessels. This is important as the only real advantage for River transport is the prospect of shipping product directly to West Malaysia or beyond. However, this will require a large ocean-going vessel that will not be able to pass the bridge nor navigate the River.

In addition, there is little demand for transportation services on the River as:

- There is no development or settlements on the north bank, thus no need for anyone to cross the River
- Settlements on the southern side of the River are serviced by a sealed road. The Second Trunk Road will also be aligned on the southern side of the River. Thus, road access is good, and will improve under the SAMP.
- The River is a highly turbid system and its muddy appearance is not an attractive feature for potential tourists
- The prospect of observing crocodiles from the River is one of the few attractions that is envisaged. However, the dangers associated with navigation offset this, and the presence of the crocodiles only upgrades the safety issue.

River transport is commonly used along the Batang Seterap from Lingga to Banting, as Banting has no formal road access.

River transport is still used on the Batang Skrang, but has reduced dramatically since the road was constructed along the Skrang Valley. The people in those settlements are no longer reliant on the river for transportation.

4.1.1.4 Remote Villages in Batang Ai

In Ulu Batang Ai (upstream of the Dam) many of the settlements are within the Totally Protected Area. Thus, it may not be feasible, or advisable, to provide road connections to these remote communities where the traditional water-based transportation is being utilized. Currently small native boats are utilised for transportation between settlements, for accessing schools and clinics, and for travelling to

the Batang Ai Dam site where a road connection exists for transit to the external areas. Generally jetty facilities are poor and refuelling is problematic as fuel has to be sourced from Lubok Antu.

There are some remote settlements on the Sg. Engkari that are able to be accessed by logging roads.

4.1.2 Issues, Challenges & Potential

The main challenge is to design and coordinate transport resources to sustain the economic growth of the Study Area. It should be in line with its planned land use, economic base and the wish list of future green and smart city. It is also desirable to aim for full utilization of existing transport resources and to achieve optimization performance towards its future transport system. The system moves in line with the relevant economic sectors. In accepting this, challenges and potential in capitalizing the opportunities can be summarised as follows:

4.1.2.1 Land-based Transportation

The current external passengers as well as freight movements are anticipated to grow in line with regional road development, especially in the implementation of Pan Borneo Highway. Relevant facilities and amenities for passenger and freights need to be improved to balance with the expected growth.

4.1.2.2 Riverine Transport

The navigable river is a valuable natural transportation resources especially along the settlements and agricultural/aquaculture developments. For instance, residents from longhouses located along the tributaries of Batang Lupar are depending heavily on riverine transport.

The SAMP proposes that new or upgraded road access should be developed for many of these settlements (e.g in Banting, Pantu area, along Skrang valley, etc). Where road access is not recommended (largely for environmental reasons) focus will be on improving water based transportation services. This applies to the settlements upstream of the Batang Ai Dam.

Some of the strategies being proposed are:

- Jetties with adequate facilities and amenities.
- Subsidized/free water taxi for school children and transportation of local products.
- Promote safety measures in riverine transport and encourage safety culture among the locals.
- Provide for convenient refueling facilities for boats.

Suitable crafts shall be considered for the specialised purpose of Lake ferry which combines eco- tourism activities and goods transport. The fundamental elements include comfort, reliability and well-equipped facilities that are supported with effective communication system. In addition, other fundamental elements include:

- Good and adequate facilities and amenities at and around the jetty. This is to ensure that the water-based related activities are extended towards a larger land-side catchment.
- Effectively connected by land transport to the City and neighboring town. This is to ensure a successful inter-modal transport.
- Boarding/alighting, ticketing and all activities at the terminal shall be simplified and user friendly.

4.1.2.3 Urban Centre Mobility

The urban centre commercial operations are anticipated to expand physically and increased in activities. The current conventional mobility mode and its physical connectivity are facing a great challenge in the development towards a Green and Smart City.

In the long run, it is equally vital to promote non-motorized travel mode within the new commercial centre and new developments. This can be achieved by providing safe and user-friendly cycle track as well as comfortable and safe pedestrian walkway.

4.1.2.4 Rural and Urban Connectivity

Lack of good rural and urban connectivity create resistance of balance and sustainable growth. Thus, good physical transport linkage and public transport system are vital.

4.1.3 Vehicle Ownership, Travelling Modes, Purpose and Frequencies

The vehicle ownership, travelling pattern by purposes (in co-relation to modal choice), trip length and other usage frequencies are established based on the household survey carried out in 2020. The findings that show useful base information for modal switch planning are summarized in Table 4-1 and Table 4-2 as follows:

4.1.3.1 Transport Vehicle Ownership

Table 4-1: Distribution of Household Vehicle Ownership by Type

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Car/Van	47.6%	35.2%	28.4%	36.5%	38.3%
Motorcycle	47.0%	54.0%	49.2%	52.2%	46.7%
Bicycle	4.8%	7.8%	7.0%	10.4%	9.4%
Boat	0.3%	3.0% (1)	15.4%	0.9%	5.6%
Others	0.3%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat ownership figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Source: Sri Aman Masterplan Study - Household Survey (2020)

4.1.3.2 School Transport

Table 4-2: School Trip Travel Mode Distribution

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Public transport (van/bus etc)	11.6%	16.3%	4.2%	0.0%	N/A
Car	52.6%	31.9%	8.5%	25.0%	N/A
Motorcycle	18.9%	34.8%	47.9%	50.0%	N/A
Bicycle	1.1%	0.0%	5.6%	0.0%	N/A
Boat /sampan	0.0%	0.0% (1)	1.4%	0.0%	N/A
Walking	15.8%	17.0%	32.4%	25.0%	N/A
Total	100.0%	100.0%	100.0%	100.0%	N/A

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat transport figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Source: Sri Aman Masterplan Study - Household Survey (2020)

Table 4-3: One Way Travel Distance for School Trip (km)

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Public transport	3.8	6.6	4.0	0.0	N/A
Car	2.6	5.1	3.8	5.0	N/A
Motorcycle	2.4	2.6	1.3	2.0	N/A
Bicycle	1.0	0.0	0.7	0.0	N/A
Boat /sampan	0.0	0.0	40.0	0.0	N/A
Walking	0.8	0.9	0.8	1.3	N/A

N/A – Not Available

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat transport figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Table 4-4: One Way Travel Time for School Trip (minutes)

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Public transport	15.1	16.7	19.0	0.0	N/A
Car	8.8	13.2	14.2	11.7	N/A
Motorcycle	9.3	9.4	7.3	9.2	N/A
Bicycle	15.0	0.0	8.3	0.0	N/A
Boat /sampan	0.0	0.0 (1)	45.0	0.0	N/A
Walking	7.4	8.0	12.2	4.3	N/A

N/A – Not Available

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat transport figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Source: Sri Aman Masterplan Study - Household Survey (2020)

4.1.3.3 Travel for Work

Table 4-5: Work Trip Travel Mode Distribution

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Public transport	4.9%	5.1%	2.4%	4.5%	N/A
Car	47.6%	27.7%	8.9%	20.5%	N/A
Motorcycle	29.1%	39.5%	34.7%	36.4%	N/A
Bicycle	0.0%	0.0%	0.8%	6.8%	N/A
Boat /sampan	0.0%	0.5% (1)	13.7%	0.0%	N/A
Walking	18.4%	27.2%	39.5%	31.8%	N/A
Total	100.0%	100.0%	100.0%	100.0%	N/A

N/A – Not Available

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat transport figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Source: Sri Aman Masterplan Study - Household Survey (2020)

Table 4-6: One Way Travel Distance for Work Trip (Km)

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Public transport	3.6	8.1	7.5	2.0	N/A
Car	3.5	5.1	5.1	5.6	N/A
Motorcycle	2.9	3.8	1.8	2.8	N/A
Bicycle	0.0	0.0	2.5	6.5	N/A
Boat /sampan	0.0	0.5 (1)	9.1	0.0	N/A
Walking	1.1	1.3	0.8	1.3	N/A

N/A – Not Available

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat transport figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Source: Household Survey - Sri Aman Masterplan Study

Table 4-7: One Way Travel Time for Work Trip (Minutes)

Transport Mode	Sri Aman	Lubok Antu	Lingga	Pantu	Engkilili
Public transport	14.8	35.0	30.0	5.0	N/A
Car	11.2	13.3	13.5	7.3	N/A
Motorcycle	10.8	13.5	10.2	7.8	N/A
Bicycle	0.0	0.0	30.0	15.0	N/A
Boat /sampan	1.0	1.0 (1)	30.9	0.0	N/A
Walking	11.0	9.4	9.9	18.5	N/A

N/A – Not Available

NOTE (1) The survey did not include the settlements upstream of Batang Ai Dam, where all of the households will use boats. Thus the boat transport figure shown for Lubok Antu sub-district can be expected to be lower than actual.

Source: Sri Aman Masterplan Study - Household Survey (2020)

4.1.3.4 Summary of Findings

The findings related to transport utilization from the household surveys are summarized as follows: -

- The majority of vehicles owned by households in primary and secondary towns are car/van and motorcycle. These vehicular types represent 28% to 48% and 47% to 54%, respectively.
- Public transport is not a preferred choice for work and school trips. The highest usage of public transport for school trips is 11.6% in Sri Aman and 5.1% for working trips in Lubok Antu.
- Although not well covered in the survey, it is apparent that utilization of boat is higher around the settlements where transportation mode choice is not available and there is no accessible road.

The continuation in improvements of road linkages and networks will lead to further dependency on private vehicle unless the improvement and re-shaping of public transport system takes place concurrently.

SECTION 4.2 DRAINAGE AND IRRIGATION

4.2.1 Introduction

This chapter reviews the current situation in regards to drainage and irrigation in Sri Aman Division.

This situational assessment sets out to assess:

- the current situation and existing status of drainage and irrigation;
- plans and proposals that are in existence; and
- the expectations for improving drainage and irrigation.

In order to undertake effective infrastructure master planning, development and maintenance, it is necessary to understand and recognise that infrastructure planning is:

- a strategic place-shaping tool to achieve community benefits and a means of delivering service efficiencies and improvements;
- a means of delivering strategic objectives for localities;
- a corporate process which must be undertaken in partnership between the local authority/municipal authority and other public service delivery organisations; and

The assessment of demographic data produced from this Masterplan and other studies is used to provide a steer on the priority ranking of recommendations for infrastructure improvement.

The infrastructure objective of the SAMP masterplan is to make recommendations on infrastructure and utilities in an efficient and coordinated manner which will realise the full economic potential in Sri Aman. Also, to ensure that the needs and welfare of the people and of businesses both in the urban and rural areas of Sri Aman's Districts are met through sustainable and balanced infrastructure improvements.

4.2.2 The Wider Picture

4.2.2.1 Drainage and Flooding

The Sri Aman Division receives an annual average rainfall of more than 2500mm, making it rich in water resources.

In the pre-development environment flooding can be considered a natural process involving periodic inundation of the floodplain, during which the soil nutrients are replenished with flood-borne sediment.

To facilitate development, engineering infrastructure is often used to constrain and control the extent and level of flood events. The drainage and flood control infrastructure are normally not designed to preclude all flood events, just the more frequent, less extreme, events. As such it should not be expected that flood control will eliminate damaging flood inundation completely.

Poorly designed, or poorly maintained, drainage infrastructure can contribute to more frequent flooding events. In many cases, the existing drainage system has not been designed to cater for new and expanding residential and commercial developments, which have much higher rates of runoff than undeveloped land.

Sarawak has invested in flood relief and mitigation programs, including a series of major river improvement projects. The Sarawak Urban Stormwater Management (SUStoM) is now a planning standard for development control to incorporate stormwater management into design to ensure that drainage objectives and standards are achieved.

Current 'Best Practice' approaches have been adopted, including "control-at-source" techniques, which include controlling water quantity and quality as well as erosion and sediment management.

4.2.2.2 *Irrigation*

The main idea behind irrigation systems is that target vegetation is maintained with the minimum amount of water required. The implementation of an irrigation system will help conserve water, while saving time, money, preventing weed growth and increasing the growth rate of plants and crops. In paddy irrigation schemes, the flooding type of irrigation is generally practised where the water depth can be controlled individually by the farmers.

Generally, there are many types of irrigation implemented for agriculture sectors. They cover from traditional-low scale methods to modern high-tech approaches. The traditional paddy irrigation system is diverting flow from an existing stream through a cascading series of paddy plots, each at a slightly lower level than the previous one. No ditches or siphon tubes required. Less traditional is the ditch Irrigation, where ditches are dug out, and seedlings are planted in rows. The plantings are watered by placing furrows in between the rows of plants. Siphon tubes are used to move the water from the main ditch to the furrows.

4.2.3 **Infrastructure Resource Inventory Review**

4.2.3.1 *Community Perceptions*

Given the high, and reliable, rainfall, drainage is the more urgent issue in Sri Aman. Irrigation requirements will be crop specific with significant irrigation being needed for padi crops only. Tree crops may benefit from drip irrigation systems, which will not require provision of public infrastructure.

An associated issue is erosion and landslips. Riverbank erosion is an ongoing mechanism that is accelerated during flood events when stream power is high. It is also accelerated by vegetation of the riparian zone and floodplain.

Landslips mainly occur in steep landscapes in the mountainous part of the Division. However large-scale riverbank erosion may also be described by some as landslips.

The socio-economic survey undertaken for this Masterplan obtained feedback on community perceptions on flooding and erosion and the extent of the impacts. Table 4-8 reports on the impacts of flooding and erosion/ landslides to residents across the different Districts.

Flooding in Lingga, Simanggang and Engkilili affects more people compared to the other sub-divisions. Erosion and/or landslides occur more frequently in Lingga, Engkilili and Lubok Antu.

Based on the socio-economic survey, in Simanggang flooding has resulted in losses for households of generally less than RM1,000 but, but in some cases, can be up to RM10k. It is rare for them to above

this value. While these numbers are indicative only (based on household responses) it does indicate that flooding events, for the most part, cause minor damage, but significant inconvenience.

Table 4-8: Flooding and Erosion / Landslide Impacts (% residents affected)

Indicator	Sri Aman			Lubok Antu	
	Simanggang	Pantu	Lingga	Lubok Antu	Engkilili
Flooding Frequency	27%	1%	40%	5%	16%
Landslide Frequency	1%	1%	12%	7%	9%
Loss of Infrastructure	95% < RM10k 4% RM10k to 40k	NA	NA	99% < RM10k	NA
Loss of asset	99% < RM1k	NA	NA	99% < RM500	NA

Source: Sri Aman Masterplan Study - Household Survey, 2020

Based on the socio-economic survey, in Simanggang flooding has resulted in losses for households of generally less than RM1,000 but, but in some cases, can be up to RM10k. It is rare for them to above this value. While these numbers are indicative only (based on household responses) it does indicate that flooding events, for the most part, cause minor damage, but significant inconvenience.

4.2.3.2 Drainage and Flooding

The flood-prone areas are generally well known to the authorities and have been a continuing challenge for urban and rural drainage improvement works. For the most part flooding issues are localised and in areas with inadequate or poorly maintained drainage infrastructure.

Within the urban environment, multiple short, medium and long-term solutions have been introduced. For instance, culverts crossing the road would either be replaced by larger culverts or by additional culverts adjoining the present culverts to increase the water carrying capacity. Within the semi-rural and rural environment, improvement actions are identified from the drainage and flood mitigation studies and site observations for the area. The Simanggang Town Drainage Study is currently underway and the interim results are expected to be produced in mid-2021.

A key contributor to flooding is the extensive tidal range, typically around 6m, between high and low water. The occurrence and extent of this high tide is predictable but has proven to be a challenge for the authorities to manage. It is also the cause of the incoming tidal bore or 'Benak' creating an additional wave front at the head of the incoming tide.

The coincidence of a flood flow from upstream and a king tide at the Batang Lupar mouth is one of the main causes of overbank flooding on the Batang Lupar. From an asset and infrastructure perspective these floods can be quite damaging. From an agricultural perspective it can also lead to loss of perennial crops. However, it also can deposit fresh sediment on the floodplain that can lead to improved agricultural productivity in subsequent years. Thus, for farmers, it can be both a curse and a blessing.

Pengairan Saliran Bahagian Sri Aman between the years 2017-2020, key flooding locations in the study area were at:

- Batang Lupar (20 flooding incidents);
- Batang Seterap (flooding incidents);
- Batang Lemanak, Sungai Kerepok, Sungai Skrang, Sungai San (1 incident each).

These incidents are classified by incident type with the number of occurrences in brackets as follows:

Flash Flood (52); High Tide (1); and Monsoon rains (1)

Table 4-9: Location of Flood Events (2017 -2020)

Year	Location/ River	Flood Type
2017	Sg. Kerepok	Flash Flood
2018	Jalan Semawa, Pantu	Batang Seterap
	Rh. Buma, Entalun	Sg. Skrang
	Jalan Bayu & Taman Tiara	Batang Lupar
	Rg. Grain, San Munggur	Sg. San & Sg. Udop
	Jalan Bayu & Taman Tiara	Batang Lupar
	Taman Tiara	Batang Lupar
	Jalan Berjaya	Batang Lupar
	Jalan Batang Lupar	Batang Lupar
	Taman Tiara	Batang Lupar
	Nanga Kesit	Batang Lemanak
	Kpg. Panggil Baru	Batang Lupar
	Jalan Berjaya	Batang Lupar
	Taman Tiara	Batang Lupar
	Jalan Kpg Ubah- Kpg Isu	Batang Seterap
	Taman Tiara	Batang Lupar
	Taman Tiara	Batang Lupar
	Light Industrial Estate	Batang Lupar
	Jalan Pasir Panas	Batang Lupar
	Jalan Hospital	Batang Lupar
	Taman Tiara	Batang Lupar
	Jalan Berjaya	Batang Lupar
	Jalan Batang Lupar	Batang Lupar
	Jalan Market	Batang Lupar
	Jalan Hospital	Batang Lupar
	Jalan Brayun	Batang Lupar
	Kpg Resak	Batang Lupar
	Taman Tiara	Batang Lupar
	Taman Gamang	Batang Lupar
	Jalan Bayu	Batang Lupar
	Jalan Berjaya	Batang Lupar
	Jalan Batang Lupar	Batang Lupar
	Taman Pasir Panas	Batang Lupar
	Taman Tiara	Batang Lupar
	Taman Pasir Panas	Batang Lupar
	Jalan Munggu	TB
	Rh. Tr Hillary	Batang Lupar
	Rh. Tr Jilum	Batang Lupar
	Rh. Tr Mos	Batang Lupar
2020	Jalan Berjaya	Batang Lupar
	Jalan Berjaya	Batang Lupar
	Jalan Batang Lupar	Batang Lupar
	Taman Pasir Panas	Batang Lupar
	Taman Tiara	Batang Lupar
	Kpg Siantan Lingga	Batang Lupar
	Jalan Berjaya	Batang Lupar
	Jalan Batang Lupar	Batang Lupar
	Taman Siang	Batang Lupar
	Taman Tiara	Batang Lupar
	Taman Alamanda	Batang Lupar
	Taman Siang	Batang Lupar
	Taman Nanang	Batang Lupar

Source: Jabatan Pengairan Saliran Bahagian Sri Aman, Laporan Banjir Semasa 2017 – 2020

The actions to address flooding have been data-led based on flooding inventory data collated by Jabatan Pengairan Saliran Bahagian Sri Aman.

The flooding locations in the study area are described in Table 4-9 and are shown in Figure 4-3, Figure 4-4 and Figure 4-5.



Figure 4-2: Simanggang town - Location of Flooding (2017 – 2020)

Source: Jabatan Pengairan Saliran Bahagian Sri Aman, Laporan Banjir Semasa 2017 – 2020



Figure 4-3: Location of Flooding - Batang Lupar

Source: Jabatan Pengairan Saliran Bahagian Sri Aman, Laporan Banjir Semasa 2017 – 2020

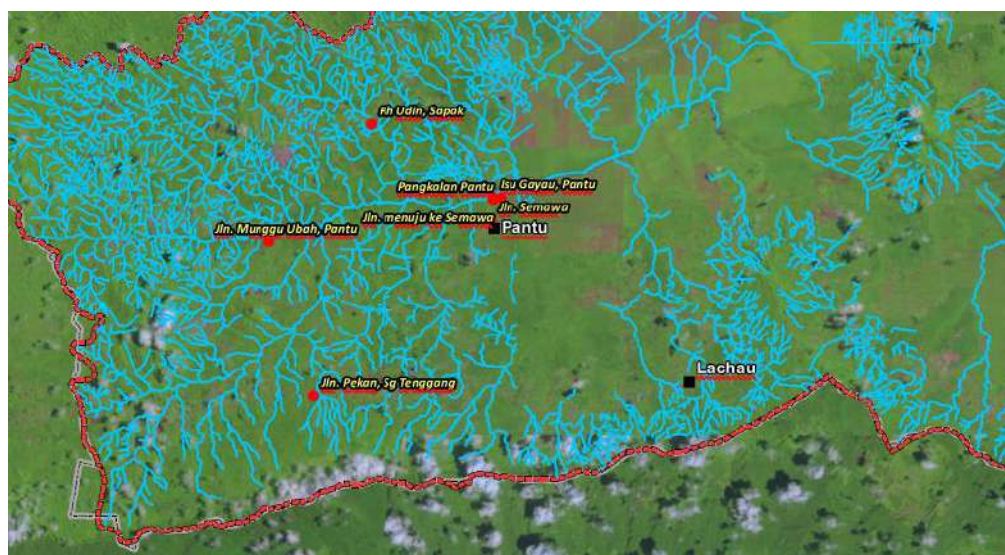


Figure 4-4: Location of Flooding - Pantu

Source: Jabatan Pengairan Saliran Bahagian Sri Aman, Laporan Banjir Semasa 2017 – 2020



Figure 4-5: Location of Flooding – South Simanggang

Source: Jabatan Pengairan Saliran Bahagian Sri Aman, Laporan Banjir Semasa 2017 – 2020

In terms of impacts, although flooding is an all-year-round occurrence, the more frequent flooding incidences are reported in Table 4-10.

Table 4-10: Frequent Flooding Locations (2017 -2020)

Month	Location	River Affected
February	Taman Tiara	Batang Lupar
December	Jalan Berjaya	Batang Seterap
April	Jalan Batang Lupar	Sg. Skrang

Source: Jabatan Pengairan Saliran Bahagian Sri Aman, Laporan Banjir Semasa 2017 - 2020

The data shows that action has been taken to address some of the flooding occurrences. There is also on-going monitoring of implemented flood remedial actions to assess the effectiveness of these measures.

The list of existing JPS drainage schemes to support agricultural activity are listed in Table 4-11.

Table 4-11: Existing Agriculture Drainage Schemes

Scheme	District	Area (ha)	Purpose
Tanjung Bijat Controlled Drainage Scheme	Sri Aman	1,224	To drain the peat area to enable more utilisation of land for farming
Sungai Gran Controlled Drainage Scheme	Sri Aman	306	To drain area to enable more utilisation of land for paddy farming
Sungai Entulang Controlled Drainage Scheme	Sri Aman	134	To improve the existing paddy area. The drainage will provide a favourable condition for off-season cultivation

Source: Jabatan Pengairan Saliran, Bahagian Sri Aman

4.2.3.3 Irrigation

Current irrigation schemes support agricultural activities along the gley and organic soils of riverine areas and sedentary soils along the hillsides. The list of existing drainage and irrigation schemes which cover a total area of 2,008 ha is shown in Table 4-12.

Table 4-12: Existing Agriculture Irrigation Schemes

Scheme	Sub-District	Coverage Area (ha)	Status & Purpose
Banting Irrigation	Lingga	344	Currently in use for the planting of paddy
Sg. Ensurai	Engkilili	431	Will require agricultural activity rehabilitation to maximise use
Sebubok Engkala	Sri Aman	265	Will require agricultural activity rehabilitation to maximise use
Sebrang	Sri Aman	230	Will require agricultural activity rehabilitation to maximise use
Tanjung Seduru	Engkilili	198	Will require agricultural activity rehabilitation to maximise use

Source: Jabatan Pengairan Saliran, Bahagian Sri Aman

4.2.3.4 Riverbank Erosion

Riverbank erosion has been identified in the locations listed in Table 4-13.

Table 4-13: Riverbank Erosion Sites

Riverbank erosion sites	
Antik to Sg Pendam	Sg Pendam Batu, Sg Seduku, Sg Susur, Sg Lekok, Sg Empelanjau, Sg Sunga, Sg Bakong, Sg Antik, Sg Stirau
Batang Skrang –	Sg Temelang, Sg Tisak, Sg Lidong, Sg Lipat
Batang Seterap –	Sg Selantik, Sg Gayau, Sg Semawa, Sg Sebembau, Sg Kerangsa, Sg Kubau, Sg Isu, Sg Sapat, Sg Merah, Sg Bakong
Batang Klauh	Sg Dor, Sg Selepong, Sg Klauh, Sg Engkeramut, Sg Balau, Sg Jungkong
Pasar Lingga	Batang Lingga - Pasar Lingga to Kampung Hilir Lingga (Approx 700m) & Pasar Lingga to Kampung Hulu Lingga (Approx 1.3km),
Pasir Panas area	Pasir Panas (Approx 1.0 km)
Kpg Hulu Lingga to Tanjung Jaya	from Kpg Hulu Lingga to Tanjung Jaya (Approx 1.5 km)
Kampung Hilir Lingga to Sg. Pendam Batu	from Kampung Hilir Lingga to Sg. Pendam Batu (Approx 4.5 km)
Batang Klauh	Banting, Sri Aman, (Approx 1 km)

Source: Daya Rancang

Assessment of the severity and impacts from the erosion are not available and probably are yet to be done. Based on the socio-economic survey, the impacts are likely economically minor but represent a major nuisance for social and community purposes.

4.2.4 Committed Plans & Project Proposals

The database of committed plans and project proposals are in the compilation stage for this study. The data set out below has been extracted from various sources but has yet to be verified with Jabatan Kerja Raya or with the Jabatan Pengairan Saliran (JPS) Bahagian Sri Aman.

4.2.4.1 Drainage and Flood Improvements

JPS Bahagian Sri Aman has provided information on proposed Non-Catalytic Drainage and Flood Improvements under RMK 12 costing RM 60M, and these are reported in Table 4-14.

Table 4-14: Proposed Non-Catalytic Drainage and Flood Improvements under RMK 12

Location	Comments	Cost Estimate RM
Riverbank Protection Works At Batang Lupar		
a) Construction of riverbank protection works (1.78km)	Potential problems caused by riverbank erosion	40M
i. Section A – Outlet Sungai Jambu ke Kampung Hulu Outlet 3: 480m	1. Endangering the safety of the lives and property of the residents living nearby	
ii. Section B – Kampung Hulu Outlet 3 ke Outlet Sungai Stawang: 400m	2. Causes damage to public infrastructures such as roads, electric poles and others	
iii. Section C - Kampung Datuk ke Tanjung Engkabang: 900 meter	3. The implementation of this project is important to provide protection to the residents around the village (approximately 400 houses) from the problem of riverbank erosion and flooding.	
Drainage Improvement Works		
Taman Tiara, Kampung Teratai, Kampung Ningkan and Jalan Brayun	Existing drainage systems are mostly not fully functioning, damaged, shallow and unable to function efficiently, causing frequent flash flood problems when it rains heavily. This situation endangers the safety of the public and damage to public property & infrastructure. Apart from that, it also affects the daily activities of the residents in the area. The implementation of this project is important to avoid the problem of flash floods and stagnant water in the area, which in turn will ensure the comfort and safety of local residents (approximately 180 houses).	10M
Kampung Resak, Jalan Batang Lupar, Jalan Tawi Sli and Jalan Berjaya	Existing drainage systems are mostly not fully functioning, damaged, shallow and unable to function efficiently, causing frequent flash flood problems when it rains heavily. This situation endangers the safety of life and damage to public property & infrastructure. Apart from that, it also affects the daily activities of the residents in the area. The implementation of this project is important to avoid the problem of flash floods and stagnant water in the area, which in turn will ensure the comfort and safety of local residents (approximately 350 houses).	10M

Source: Jabatan Pengairan Saliran, Bahagian Sri Aman

4.2.4.2 Irrigation

The list of irrigation schemes that JPS have identified for the rehabilitation of agricultural schemes are listed in Table 4-15.

Table 4-15: Proposed Drainage and Irrigation Schemes for Agriculture

Drainage and Irrigation Schemes	District	Area (ha)
Tanjung Seduru	Engkilili	198
Sebrang	Engkilili	230
Sg. Ensurai	Engkilili	431
Sebubuk Engkala	Sri Aman	265
	Total	1,124

Source: DID Sarawak

4.2.5 Issues, Challenges & Opportunities

4.2.5.1 Drainage Issues

Drainage in this region, as in Sarawak generally, has the challenge of dealing with high-intensity rainfall events (often associated with monsoon conditions), steep catchment headwaters that deliver high flows to the coastal areas, and poor natural drainage in the flat coastal lands.

The low-lying areas and settlements along riverbanks are consistently at risk of flooding. Whilst this has always been the case, and buildings and development infrastructure are adapted for this, the situation is now exacerbated by:

- Clearing of riparian areas for development, thereby accelerating the run-off rate and flood frequency the
- Expansion of developed areas with hard surfaces that drain greater quantities of runoff into the natural drainage systems
- Drainage of low-lying swamp areas that has led to ground subsidence in those locations

Additionally, the high tidal range in the estuarine reaches of the rivers can contribute to river based flooding, especially when a king tide is associated with a high rainfall/runoff event.

Much of the flooding experienced in Sri Aman is attributed to inadequate drainage systems. Often this is a result of incremental urban expansion which adds to the drainage catchment and eventually makes the original drainage capacity insufficient. The drains are also subject to the accumulation of litter and debris, further reducing their design capacity.

This is a particular issue at road culverts where the accumulation of debris can reduce the culvert capacity to less than half. Accordingly, it is recommended that road culverts be designed to allow for 50% blockage and regular clearing and maintenance is undertaken.

4.2.5.2 Drainage Opportunities and Strategies

As a flood mitigating measure, retaining water on the natural/biological media should be given priority over swift water runoff. The storage effect of vegetation, soil, ground and wetlands has a mitigating effect over a short period, to alleviate minor or medium-scale flooding. Retaining existing intact peat swamp areas will be a critical component of this approach.

The strategy to manage floods ecologically should be based on improving river basin land-use, prevent rapid runoff in both rural and urban areas, and an area-wide effort to restore rivers' natural flood zones.

Such measures include the discharge of excess water into natural and artificial flood retention areas (which will be used temporarily) in a controlled manner rather than to allow surface water runoff directly to the river systems. This is very effective in mitigating short, high intensity rain events but, In the event of heavy and lasting rainfall, storage is less relevant.

Action to address flooding would generally be addressed through either structural or non-structural measures, as shown in Figure 4-6 and Figure 4-7 below. Many of these measures have been implemented in the study area, and there is a need to reconcile and to review their effectiveness and returns on investment.

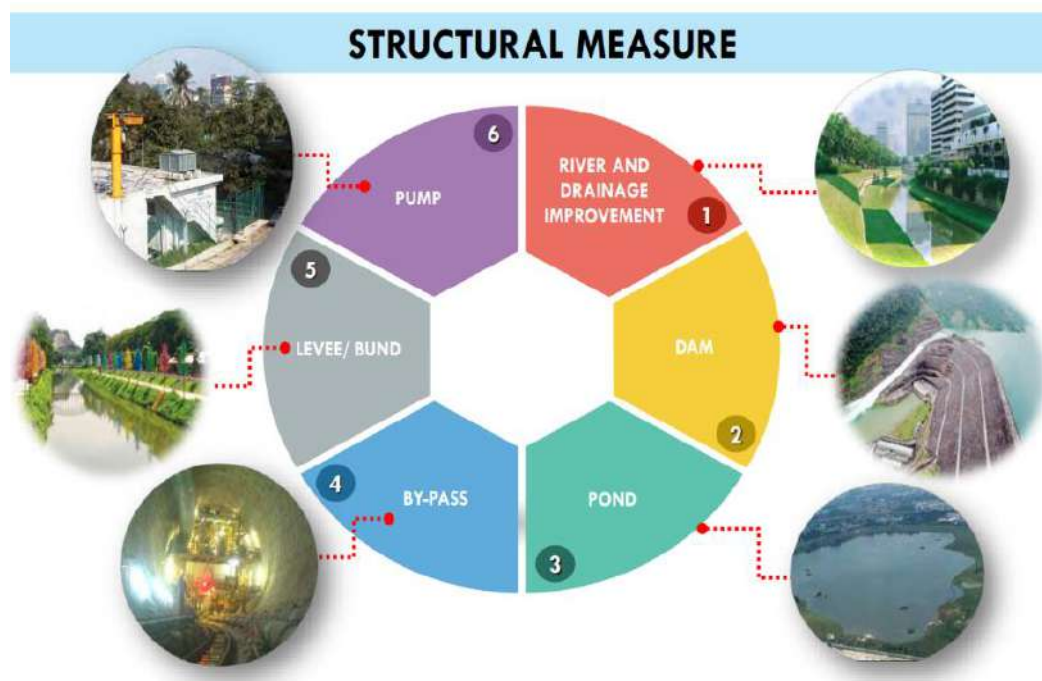


Figure 4-6: Structural Measures to Address Flooding

Source: Integrated Flood Management in Malaysia, JPS, July 2019

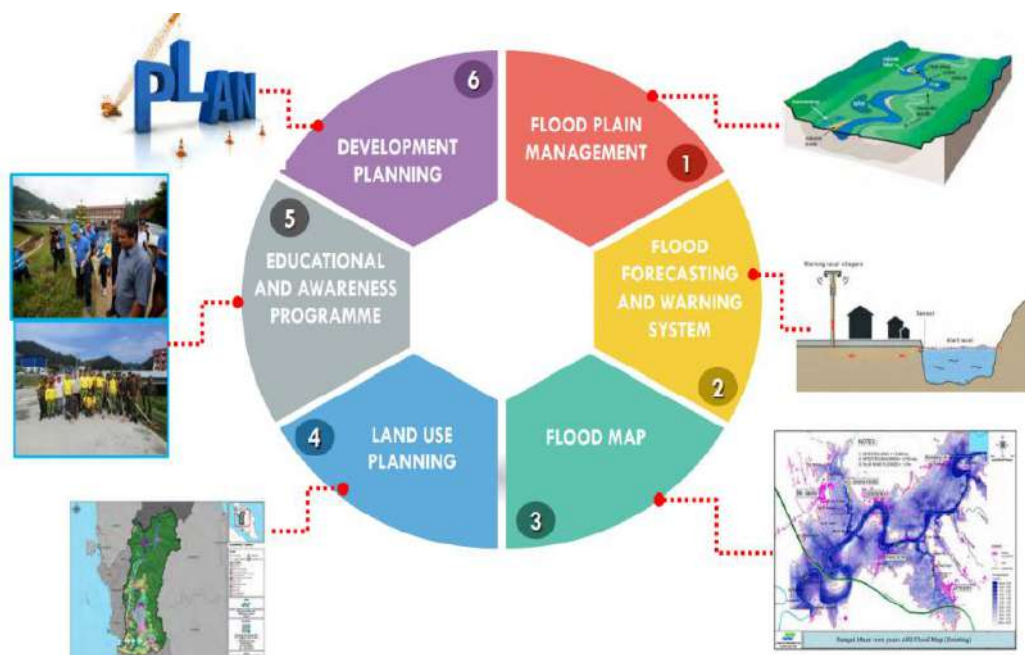


Figure 4-7: Non-Structural Measures to Address Flooding

Source: Integrated Flood Management in Malaysia, JPS, July 2019

The public should be encouraged to make their own flood prevention measures and keep themselves informed on how to act during flood events to protect themselves and their belongings. In areas that are particularly threatened by flooding, a specific preparedness to alert, rescue and safety measures should be planned and implemented at all levels by maintaining regular necessary and continuous on-going training actions and information strategy.

In recent years, there is a greater attempt to intercept a range of non-point source pollutants including general litter, sediment and nutrients, etc. This can be achieved using stormwater best management practices (BMPs), including pollutant traps and grass swales. There is also an increasing awareness of the ecological values of watercourses and the need to maintain and enhance them.

4.2.5.2.1 Integrated Flood Management

The current strategies and options for integrated flood management will require a review, and these could be assessed against Figure 4-8.

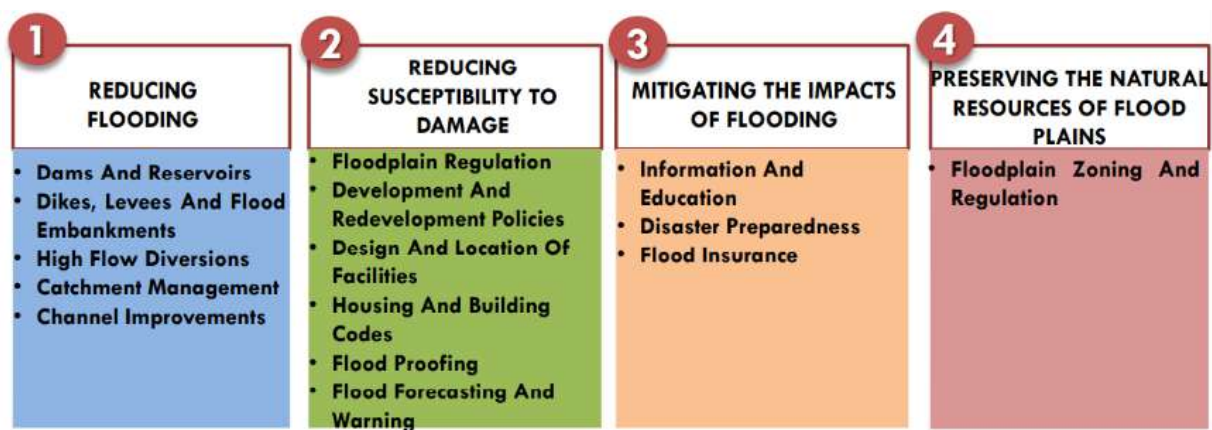


Figure 4-8: Strategies for Integrated Flood Management

Source: Integrated Flood Management in Malaysia, JPS, July 2019

4.2.5.3 Irrigation Issues

The high rainfall and availability of tributaries and other water bodies provide an excellent environment to support farming and plantation activity in the study area. As such irrigation is mainly required for padi schemes based on flood irrigation.

In Sri Aman the challenges for irrigation includes:

- The irrigation areas are generally on the river floodplains. In the downstream, lowland reaches of the rivers, the rivers are generally estuarine, and the water, therefore, is often brackish, and not suitable for agricultural use.
- The alternative water resource in these lowland areas is groundwater. This is also a resource for potable supply and its use would require careful management to ensure that the groundwater level is not lowered to the degree that salt water infiltration results.

It is necessary to promote integrated water resources management at the basin level to ensure that water resources will not become a constraint to the sustainability of future socio-economic development activities in terms of both quantity and quality.

4.2.5.4 Irrigation - Opportunities

Irrigation management and monitoring is required in order to increase crop yield, to conserve water, prevent soil salinisation and waterlogging, and to protect the environment. Improved irrigation operational performance and efficient agricultural water use should be adopted.

Irrigation Operational Performance - To ensure continuous water supply, dry months (May-August) where water use can be dropped creating an “agriculture drought” enabling all irrigation schemes to continue operating. The planting of different crops within an area means that planting and harvesting dates are less uniform, so that neighbouring farmers no longer demand water at the same time as one another. It is technically impractical to meet the increasingly individualised water demands of mechanised farms through gravity-based, surface flow during this period.

Efficient agricultural water use - Increased competition for water between sectors affects agriculture, mainly through the rapid growth of the domestic and industrial sectors requiring more water per hectare than necessary. Agriculture uses about 68% of total water consumption, but irrigation efficiency is 50% at best in the larger irrigation schemes and less than 40% in the smaller ones. There is also the opportunity of recycling of irrigated water.

Smart farming and precision agriculture involve the integration of advanced technologies into existing farming practices to increase production efficiency and the quality of agricultural products.

Non-padi crops

Irrigation of crops other than padi requires relatively little irrigation, and is considered minor in terms of demand on water resources. This includes irrigation for commercial selected fruit and vegetables. Nevertheless, efficiency in these irrigation systems is also important.

Subsurface Drip Irrigation (SDI) is already a prevalent irrigation method that allows farmers to control when and how much water their crops receive. This irrigation system supplies the water either onto the soil surface or directly onto the root zone through a network of valves, pipes, tubing and emitters. By pairing these SDI systems with increasingly sophisticated IoT-enabled sensors to continuously monitor moisture levels and plant health, farmers will be able to intervene only when necessary, otherwise

allowing the system to operate autonomously. Drip irrigation is a popular irrigation system for commercial selected fruit and vegetable production.

Digital strategies

Investment into water control and regulation equipment, remote sensing and geographic information systems will enable:

- integrated planning and management of irrigation systems;
- analysis to identify causes and effects constraining irrigation system performance;
- better estimation of crop water requirements;
- improved design, construction and modernisation of irrigation systems;
- strategies to improve irrigation system efficiency; and
- institutional strengthening, capacity building, training and education.

4.2.5.5 *Riverbank Erosion - Issues*

Riverbank erosion is a serious issue that can impact the productivity of agricultural land as well as existing dwellings and infrastructure.

To address riverbank erosion issues, it is important to understand the mechanisms by which the erosion is occurring. This normally requires a geomorphological assessment covering the hydrology, hydraulics and sediment characteristics of the fluvial system. In the absence of understanding these dynamics riverbank protection works can be self-defeating with erosion activity transferred to adjacent, downstream riverbanks. This creates a cycle of difficult and expensive engineering projects that will only be effective when the entire riverbank is protected with rock, concrete or similar protection works. This latter approach is not sustainable and is a poor outcome for the river in terms of its ecological communities, the riparian environment, and the aesthetics for the community.

The provision of a healthy riparian zone and vegetated buffer strip is a very effective way of protecting the riverbank. However, this comes at the cost of productive land (the riparian zone typically has the best agricultural soils due to the alluvial deposits from flood events).

4.2.5.6 *Riverbank Erosion - Opportunities*

Riverbank protection needs to be targeted, strategic and based on an understanding of the dynamics of the river system. It is possible to identify the locations that will be more prone to erosion than others. These locations can be identified for protection from clearing activities, keeping the riverbank, riparian zone and an adequate buffer strip intact.

Riverbank protection works can be very expensive and it is therefore important that appropriate protection works be adopted for each site. These should be based around the value of the land being protected vs the cost of the works.

SECTION 4.3 UTILITY SERVICES – WATER SUPPLY

4.3.1 Introduction

Water supply ranks amongst one of the most important public utilities and is largely driven by supply considerations. In terms of planning for a reliable treated water supply system, the main components to consider are the source development, treatment, storage, and transmission and distribution of the potable water.

4.3.2 The Wider Picture – Water Supply in Sri Aman

Population growth and economic expansion results in growing demand and pressure on water supply, as well as increasing levels of water pollution. Safe drinking water and adequate sanitation facilities have still yet to be made available to some communities in the State. There are many communities that still depend on rivers to wash and bathe in. The Sarawak Government is looking to address these issues through effective water resource management, increased water supply and system capability, and improved operating efficiency.

4.3.2.1 Water resource

Water catchment areas in Sri Aman are shown in the following figure.

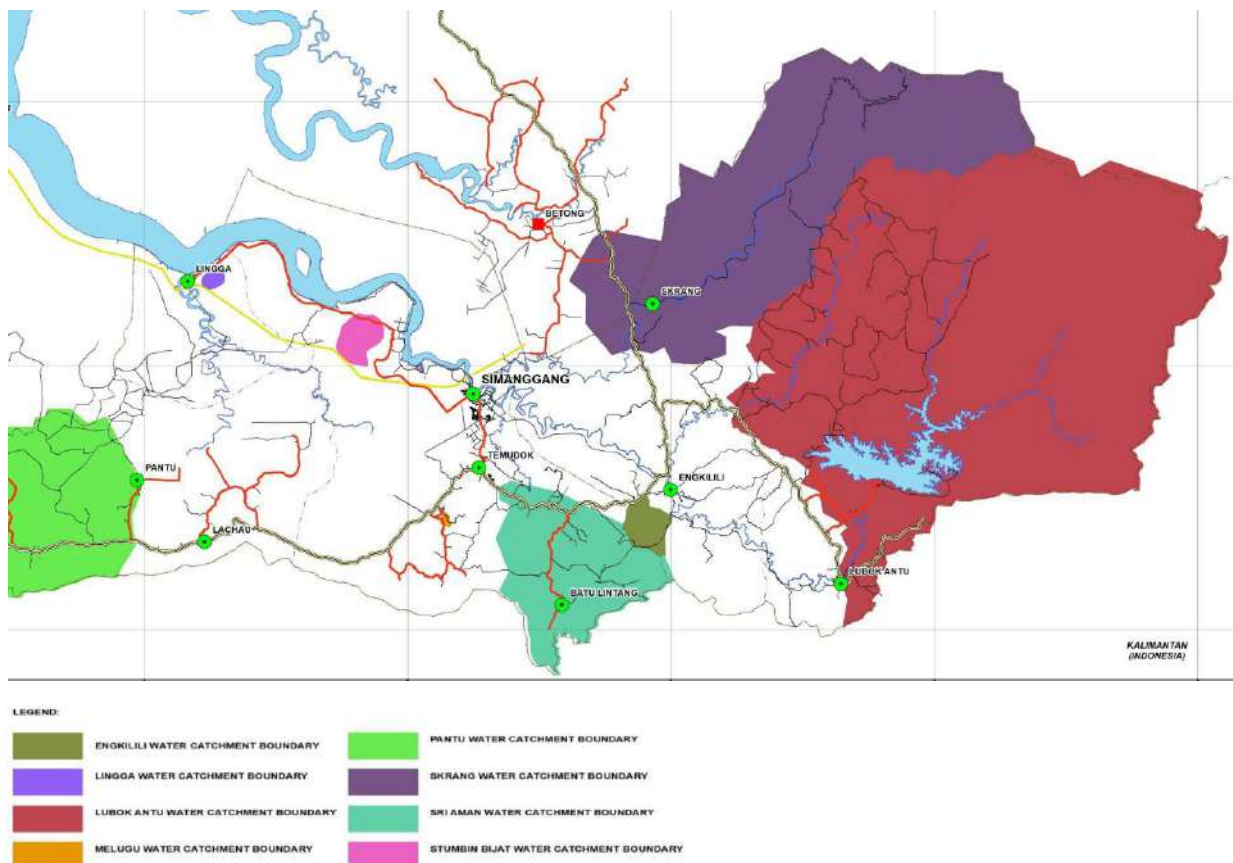


Figure 4-9: Water Resource Catchment Areas in Sri Aman

Source: JBALB Sarawak

4.3.2.1.1 *Mains water supply*

Generally, the water supply system is predominantly reliant on surface water systems for resource. Run-of-River systems are common, with, or without, a small weir to divert flow to the treatment plant.

In Sri Aman this reliance on catchment flow has been a limitation during longer dry periods. While these periods may be rare, this can be a serious issue. JBALB is currently undertaking a pipeline project to divert water from the upper part of the Batang Lupar to enhance supply at the main treatment plant for Simanggang – Bayai WTP.

It is noted that Lingga has a small water resource catchment and will be subject to limitations in dry periods. However, Lingga is now connected to Sri Aman supply so has a good level of water security.

4.3.2.1.2 *Remote communities*

Remote communities beyond the reach of the mains water grid are serviced under the SAWAS scheme (Sarawak Alternative Water Supply). These rely on gravity fed water from nearby springs or creeks. Additionally, when there is no available rainwater, tanks are usually adopted. The final option would be to rely on the River water that is found adjacent to most longhouses. The latter option is not preferred as it will result in the lowest quality water of all the options listed.

Other water resource opportunities that may exist in Sri Aman are:

4.3.2.1.3 *Groundwater*

There have been no significant attempts to access groundwater in the Division. However, this may be a resource worth investigating in the future. It may be particularly applicable to towns in the brackish reach of River systems. In these cases, readily available surface water may be too saline to be suitable. However, provided that the water table is positively charged (i.e. flowing out to the River) the water will be fresh. Provided that the rate of extraction does not lower the water table level to make it negatively charged (i.e. flow from river into water table, especially during high tide), this would prove a useful resource.

Risks are that nutrient and metal levels in the water may be high and require treatment. And if the brackish water is able to penetrate the groundwater zone there could be serious impacts on vegetation.

4.3.2.1.4 *Batang Ai Dam*

It has frequently been suggested that Batang Ai Lake would make an excellent resource for water supply. While the water quality is very good the water resource is fully committed to power production, and no water is available for diversion to other purposes. SEB has indicated that it has no objection to diverting water from the river after it has passed through the power station turbines, but would not allow any diversion from the Lake itself.

4.3.2.2 *Water treatment plants*

Sarawak has 87 water treatment plants (WTPs) which were operated by the water supply authorities as shown in Table 4-16.

Based on Table 4-16, it can be observed that most of the WTPs are operated by Jabatan Bekalan Air Luar Bandar Sarawak (JBALB). However, these are mainly small WTPs which cater for the rural areas of

Sarawak. KWB and SWB each operate 2 WTPs only, but the combined water production accounts for more than 50% of the water produced in Sarawak.

Table 4-16: Water Treatment Plants and Average Daily Water Production (2018)

Water Supply Authority	No. Of WTPs	Water Production (MLD) In 2018
Kuching Water Board (KWB)	2	391
Sibu Water Board (SWB)	2	96
LAKU Management Sdn. Bhd.	4	218
Jabatan Bekalan Air Luar Bandar (JBALB)	79	251
Total	87	956

Source: Study on Sarawak Water Supply Master Plan and Water Grid (Dec 2019)

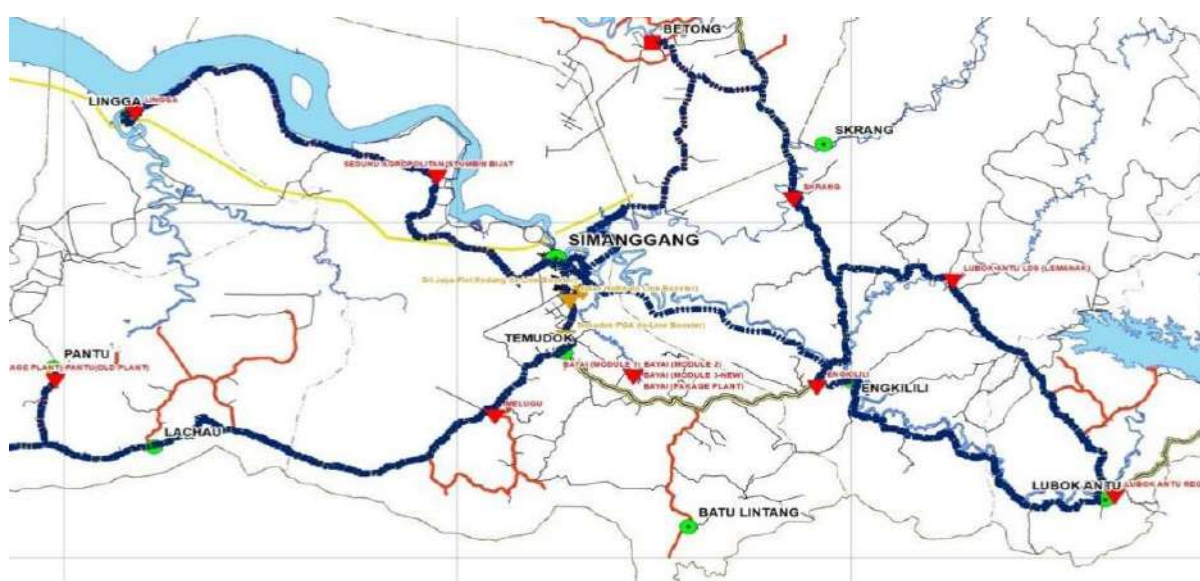


Figure 4-10: Location of Water Treatment Plants in Sri Aman

Source: JBALB Sarawak

Presently, the water supply sector in Sarawak faces a number of challenges, especially in rural areas. According to the Ministry of Utilities and Telecommunication, during the drought of 2018/2019 Mukah and Sri Aman District experienced massive water shortages (Bernama, 2019). Eighteen (18) water treatment plants in Sarawak were reported to have a critical level due to the dry weather with Sri Aman, Samarahan, Serian, Betong, Kuching and Mukah being among the most critical.

4.3.2.3 Sarawak Alternative Water Supply (SAWAS) Program

The Sarawak Government initiated the Sarawak Alternative Water Supply (SAWAS) Program in 2018 through the Ministry of Utilities and Telecommunication Sarawak under the 11th Malaysia Plan. SAWAS aims to provide clean and safe water to remote rural communities using the most strategic water supply system based on resource availability, remoteness of location, and technology available. This approach is in line with achieving Sarawak's vision of 100% water supply coverage by 2025. By the end of 2019, JBALB had completed SAWAS Project Phase 1 with 5 packages (Table 4-17).

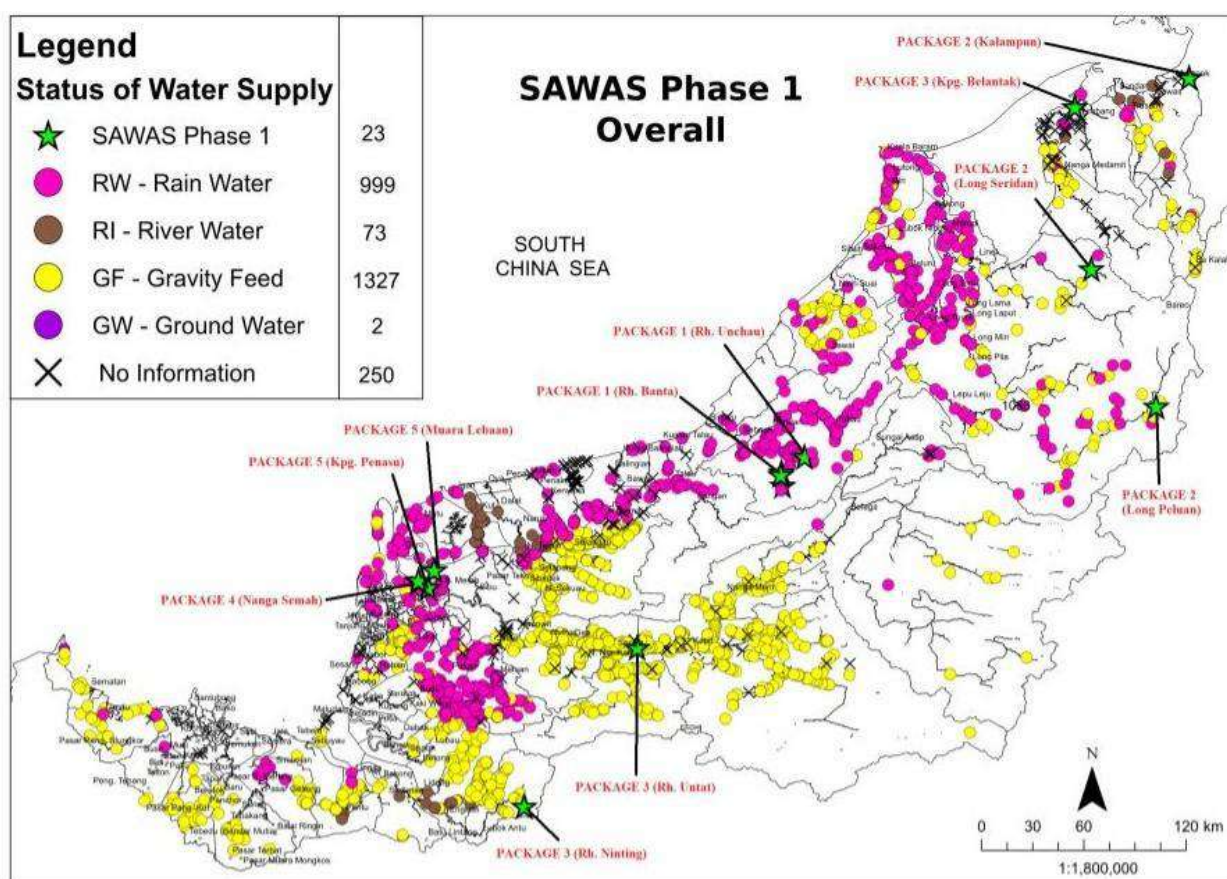
Table 4-17: JBALB Packages

Package 1	Ulu Pandan covering Rh. Unchau, Rh. Banta, Rh. Sunam Ak Una, Rh. Kaya Ak Paji and Rh. Renang
Package 2	Long Seridan and Long Peluan, Miri; Kalampun, Limbang
Package 3	Rh. Untat, Sg. Melipis, Kapit; Rh. Ninting, Ng. Jambu, Lubok Antu, Sri Aman; Kpg. Belantak, Limbang
Package 4	Nanga Semah
Package 5	Kpg. Penasu, Muara Lebaan, Rh. Chochok, Rh. Manggong, Rh. Amoi, Rh. Minang

Source: JBALB Sarawak

The components of these projects involve a combination of one or more of the following:

- developing raw water sources (river, spring, rain, groundwater, etc)
- installing raw water pipeline and/or storage systems,
- setting up simple treatment system, if applicable
- installing a piped distribution network system, where required
- water quality testing equipment
- control & monitoring system
- power supply, where required.

**Figure 4-11: SAWAS Project Phase 1 in Sarawak**

Source: JBALB Sarawak

4.3.2.4 Sarawak Water Supply Grid Program – Stressed Areas

The Sarawak Water Supply Grid Program focuses on the laying and replacement of water mains, construction of booster stations, upgrading and improvement of water treatment plants, digitalization of water supply systems and improvement works to existing water supply systems.

This program is aimed at solving issues of low water pressure, or frequent supply interruption, experienced by existing consumers.

4.3.3 Sri Aman's Place within Sarawak's water supply

In 2008, WTPs within the Sri Aman Division supplied 12.1MLD (1.1% of total Sarawak supply) of potable water via pipelines from 9 water treatment plants (WTPs) provided by JBALB. Supply details are shown in Table 4-18.

In the span of 10 years from 2008 to 2018, there has been some notable improvement in Sri Aman's water treatment plants' capacity. In 2014 the Seduku Agropolitan Water Treatment Plant was constructed to cater for the agriculture sector in Stumbin-Bijat area and also for supplying domestic users at Bakong Melayu, Skirau Ai and Seduku Areas. Besides this the Bayai WTP, Pantu WTP and Lubok Antu Regional WTP have upgraded their capacity to 42.8 MLD. In 2018, Sri Aman received 2.5% (50.91 MLD) treated water supply within Sarawak (2,077.38MLD). All the WTPs operated at Sri Aman Division in 2008 and 2018 are summarized in Table 4-18.

Table 4-18: Water Treatment Plants in Sri Aman Division at Year 2008 and 2018

Districts	Water Treatment Plant (WTPs)	WTP Capacity (MLD) at Year 2008 ¹	WTP Capacity (MLD) at Year 2018 ²	Supply Area
Sri Aman	Bayai WTP	3.4	33.3	Simanggang
	Melugu WTP	0.65	0.65	Melugu
	Stumbin-Bijat WTP	0.65	0.65	Stumbin-Bijat
	Seduku Agropolitan WTP	-	2.0	
	Lingga WTP	0.65	0.65	Lingga
	Pantu WTP	1.3	2.0	Pantu Bazaar
	Total Sri Aman Districts	6.65	39.25	
Lubok Antu	Lubok Antu Regional WTP	0.65	7.5	Lubok Antu
	Lubok Antu LDS WTP	2.27	2.2	Lubok Antu, Salcra Sawmill, Btg. Ai Resettlement Scheme
	Engkelili WTP	1.95	1.31	Engkelili
	Skrang WTP	0.65	0.65	Skrang
Total Lubok Antu Districts		5.52	11.66	
Total Sri Aman Division		12.17	50.91	
Total Sarawak		1151.23	2,077.38	

Source:

¹Review of National Water Resource (2000 - 2050) and Formulation of National Water Resources Policy - Volume 5 Water Supply sector (Immediate Works), Final Report, 2011

²Rural Water Supply Department, Sri Aman (2018), SADA Development Plan

4.3.3.1 Water Supply Facilities in Sri Aman Division

The water supply facilities at the hierarchical level for settlements of Sri Aman Division are shown in Table 4-19. Water treatment plants are provided at the principal towns of Simanggang, Lubok Antu, Lingga, Pantu, Melugu, and Engkilili, while water supply in other settlements such as Lachau and Sg. Tenggang town is provided by elevated water tank and gravity feed system fed from regional WTPs (e.g. Bayai WTP).

Based on the water supply facilities of the Sri Aman Division provided by JBALB, 665 settlements of the division received water supply in 2018. As shown in Table 4-20, 53% or 355 of the settlements received treated water supply through Water Treatment Plants, while 47% or 310 of the settlements received water supply through alternative supply systems (water tanks, SAWAS and Gravity Feed).

Table 4-19: Hierarchy Level of Water Supply Facilities at Year 2018

Hierarchy Level	Sri Aman Division Town	Water Supply Facilities
Divisional Town	❖ Simanggang	❖ Regional Water Treatment Plant
		❖ Reservoirs
District Town	❖ Lubok Antu	❖ District Water Treatment Plant
		❖ Reservoirs
Sub-District	❖ Lingga	❖ Sub District Water Treatment Plant
	❖ Pantu	❖ Elevated Water Tank
	❖ Engkilili	❖ Gravity Feed Water Supply
Other Settlement	❖ Melugu	❖ Elevated Water Tank
	❖ Lachau	❖ Gravity Feed Water Supply
	❖ Sg. Tenggang	

Source: JBALB Sri Aman (2018), SADA Development Plan

Table 4-20: Water Supply in Sri Aman Division in 2018

Districts	No of Settlements	Treated Water Supply from WTP (No. of Settlements)	Alternative Water Supply (No. of Settlements)
Sri Aman District	387	256 (66%)	131 (34%)
Lubok Antu District	278	99 (36%)	179 (64%)
Sri Aman Division	665	355 (53%)	310 (47%)

Source: SADA Lab 1, JBALB Sri Aman, Sri Aman Resident Office (2018)

It can be seen that the majority of the settlements in Sri Aman District rely on Water Treatment Plants to supply clean water, while 34% receive alternative water supply, especially in the areas around Lingga and Pantu. However, in Lubok Antu District the majority of residents rely on water tank, SAWAS and

Gravity Feed as alternative water supply. This is due to the geographical location of many settlements which are more remote and have difficult access.

In 2018, the Bayai and Engkilili WTP in the Sri Aman Division had higher water demand than water production capacity (Table 4-21). Treatment capacity in these areas needs to be increased to cater for current and future demand.

The Government allocated RM90 million to Sri Aman in 2018 for the construction and upgrading of water supply facilities in water treatment plants. Out of that, RM50 million was used to increase the capacity of Bayai Treatment Plant from 33MLD to 53.3MLD and to upgrade the treatment plants in Lingga and Pantu. Meanwhile, the balance of RM40 million was used for water supply in Undup area especially in Batu Lintang which give benefits to 1500 residents from 43 longhouses.

JBALB are planning to construct a pipeline line from a new intake on the Batang Lupar (between Lubok Antu & Engkilili) to transfer water to the Bayai Undup Treatment Plant.

Table 4-21: Performance of Water Treatment Plants in Sri Aman Division, 2018

Districts	Water Treatment Plant (WTPs)	WTP Capacity (MLD)	% of Capacity Utilization	No. of Consumers	Population
Sri Aman	Bayai WTP	33.3	105.11	10816	64896
	Melugu WTP	0.65	100	352	2112
	Stumbin-Bijat WTP	0.65	100	1243	7458
	Seduku Agropolitan WTP	2.0	75		
	Lingga WTP	0.65	100	428	2568
	Pantu WTP	2.0	95	985	5910
	Total Sri Aman Districts	39.25			
Lubok Antu	Lubok Antu Regional WTP	7.5	93.33	1180	7080
	Lubok Antu LDS WTP	2.2	91	1782	10692
	Engkilili WTP	1.31	148.55	1472	2944
	Skrang WTP	0.65	100	451	2706
Total Lubok Antu Districts		11.66			
Sri Aman Division		50.91			

Source: JBALB Sri Aman (2018), SADA Lab

4.3.3.2 Drought conditions and critical Water Treatment Plants in Sri Aman Division

In 2019, eight (8) water treatment plants in the Sri Aman Division were operating at minimum capacity due to low water level of water resources during the drought (The Star, 2019). The capacity of water treatment plants in Bayai, Pantu, Melugu, Stumbin, Seduku, Lingga, Lemanak Development Scheme and Engkilili were all affected (Borneo Post, 2019).

People in Simanggang raised their concern during the drought (2019) on the issue of water supply disruption and low water pressure during the drought since it affected many households. Water supply was also a major issue in many longhouses. The issues here are not treatment plant capacity, but water resource availability and development.

4.3.4 Water Supply Resource Inventory

Sri Aman has a number of types of water supply resource;

- JBALB mains water which includes
 - Water intakes
 - water treatment plants
 - booster stations
 - reservoirs
 - water tanks
 - pipelines and distribution networks
- Alternative water supplies (SAWAS)
 - river,
 - rain water harvesting,
 - gravity feed,
 - groundwater.

Table 4-22 shows the water supply resource for urban, suburban, rural villages and remote interior villages in the Sri Aman Division. Table 4-23 shows nine water supply resource rivers for ten water treatment plants in the Sri Aman Division.

Table 4-22: Water Supply Resource for Settlement Pattern in Sri Aman Division

Settlement	Water Supply Resources
Urban Residential	JBALB water supply system
Suburban	JBALB water supply system
Rural Villages	JBALB water supply system Rain water harvesting River
Remote Interior Village	Rain water harvesting Gravity Feed River

Source: JBALB Sri Aman (2018), SADA Lab

Table 4-23: Water Supply Resource in Sri Aman Division

Districts	WTP	Water Supply Resource	Supply Area
Sri Aman	Bayai	Btg. Undup River	Simanggang
	Melugu	Dor River	Melugu
	Stumbin-Bijat	Stumbin River	Stumbin-Bijat
	Seduku- Agropolitan		
	Lingga	Stugok River	Lingga
Lubok Antu	Pantu	Btg. Seterap	Pantu Bazaar
	Lubok Antu	Btg. Ai	Lubok Antu
	Lemanak Development Scheme	Btg. Lemanak	Lubok Antu Salcra Sawmill Btg. Ai Resettlement Scheme
	Engkilili	Marup River	Engkilili
	Skrang	Btg. Skrang	Skrang

Source: JBALB Sri Aman (2018), SADA Lab

JBALB is working towards an integrated water supply network for the Sri Aman Division. The system relies on the existing Lubok Antu WTP, a WTP at Engkilili with capacity increased to 75 MLD, an upgraded Bayai WTP (to 53.3MLD) and a raw water transfer pipe to supplement the intake at Bayai WTP. Pantu is to be upgraded to a capacity of 5 ML/d. The settlements are all connected with mains supply from these WTPs, via intermediate storages and header tanks where required. The future arrangement is shown in Figure 4-12.

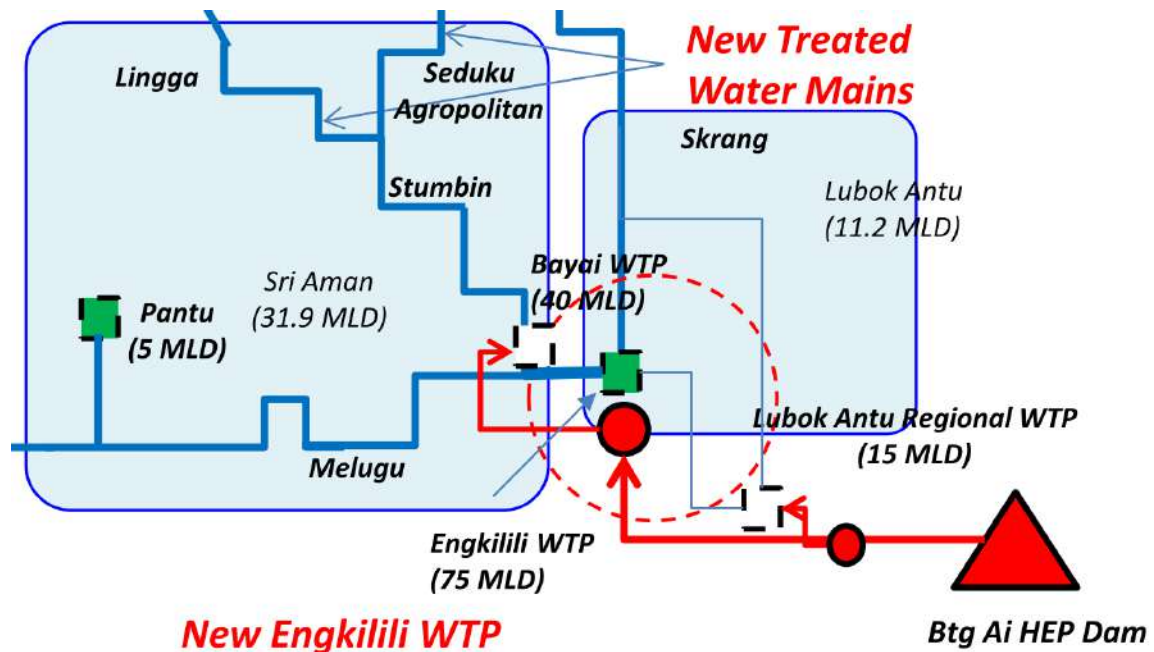


Figure 4-12: Long-Term layout of water supply system in Sri Aman

Source: Study on Sarawak Water Supply Master Plan and Water Grid, Dec 2019

4.3.4.1 Batang Undup River

Early in 2020, a major raw water transfer project was approved to transfer water from Batang Lupar to Batang Undup. The capacity of the Batang Undup River is too small to reliably meet the upgraded capacity of the Bayai Water Treatment Plant. The project includes constructing a new raw water intake at Batang Lupar (near Engkilili), installing a connecting pipeline to Batang Undup, constructing a new pump station and associated M&E (mechanical and electrical) works. The project is complementary to the Bayai Water Treatment Plant upgrading project which will increase capacity from 33MLD to 53.3MLD.



Figure 4-13: Bayai Water Treatment Plant

Source: JBALB Sri Aman (2018), SADA Lab

4.3.4.2 Batang Ai Dam

In 1985, the Batang Ai River was dammed to form the first hydroelectric plant in Sarawak. It created a 24 sq. km reservoir fed by tributaries of the Ai River.

The State Government announced in 2018 that the usage of Hydroelectric Power (HEP) dam reservoirs can be considered as a potential source of water for a solution to water supply shortages. The idea is that water from the reservoirs of HEP dams of Batang Ai, Balleh and Bakun can be used to supply water treatment plants.

However, Batang Ai is principally a hydroelectric facility and relies entirely on the water stored in the dam for electricity production. Alternative uses of the stored water may compromise the storage volume, and thus gravity head, required for the turbines, effectively reducing the power production potential.

Whilst this would only be an issue during times of lower storage levels, it would coincide with higher demands on the stored water for water supply purposes. For these reasons SEB has effectively ruled out the use of the stored water for alternative use. However, SEB has no objection to the extraction of water on the downstream side of the power station.

4.3.4.3 Alternative Water Supply Options

4.3.4.3.1 Gravity Feed

In 2011, 8 Rural Water Supply and Sanitation projects (Bakas) of gravity-feed water supply were implemented in Sri Aman under the Blue Ocean Strategy in Sarawak. The quality of water supplied from existing gravity feed water supply systems in Sarawak was upgraded in 2012 by the State Health Department by integrating appropriate water treatment filtration systems (Borneo Post, 2012). Approximately 4,605 households in Sri Aman Division received Gravity Feed System as shown in Table 4-24.

4.3.4.3.2 Rainwater Harvesting System

Rainwater Harvesting System (SPAH) refers to the direct collection of rainwater from roof areas. Based on NAHRIM report (2011), the system of rainwater harvesting is compatible with a mechanism of 'first

flush' which prevents the rain runoff washing dust and dirt from the roof into the rainwater tanks. It also requires a tightly closed tank to avoid entry of mosquitos. An example from Bair Longhouse in Betong is shown in Figure 4-14. DID Sri Aman Division implemented the rainwater harvesting system in Sri Aman, supplying the systems to 409 households in rural areas as shown in Table 4-24.

Table 4-24: Household and Population with Alternative Water Source

No.	Zone	No of Household	Populations
1	Gravity Feed System	4,605	23,025
2	Rain Harvesting System	409	2,045
Total		5,014	25,070

Source: JBALB Sri Aman (Feb 2018)



Figure 4-14: Rainwater Harvesting System at Bair Longhouse, Betong

Source: JBALB Sri Aman (Feb 2018)

4.3.4.3.3 Sarawak Alternative Water Supply (SAWAS) Program

In 2019, the Government initiated the Sarawak Alternative Water Supply (SAWAS) program to ensure that isolated settlements received safe and clean water. This is part of Sarawak's vision of achieving 100% water supply coverage by 2025 (JBALB). The SAWAS programme is basically an alternative water supply system that provides safe and reliable water for remote or isolated rural communities that cannot be connected to the existing water supply systems. SAWAS will remain as a stand-alone and independent micro water supply systems in the foreseeable future until such times when it is economically feasible to connect these areas to the water grid.

The raw water under SAWAS program may be sourced from

- a mountain stream with mini dam structure (normally known as Gravity Feed System),
- river water,
- groundwater or
- rainwater harvesting.

The SAWAS project is community-based where it places the responsibility for operating and maintaining the system on the local community. As an alternative to the conventional way of supplying water from

a water main grid which is costly and time-consuming for remote rural areas, SAWAS provides treated water that can be easily installed and operated by the local communities. The cost of operations is relatively lower and maintenance of the system is monitored by JBALB.

In Sri Aman, there are 310 settlements that have been supplied alternative clean water under Package 3 of SAWAS Project Phase 1.

4.3.5 Issues, Challenges & Opportunities

4.3.5.1 Issues and Challenges

4.3.5.1.1 Scattered settlements

The scattered settlements in the Study Area makes the provision of treated water supply difficult and uneconomical. A significant proportion of the population in Sri Aman Division live in rural areas that are scattered, hilly, rugged and distant. Laying of water mains is uneconomic or impractical for many of these areas.

4.3.5.1.2 Accessibility

Some longhouses in rural Sri Aman are still not accessible by roads for the laying of reticulation networks.

4.3.5.1.3 Low Water Pressure

Several water-stressed areas that were recently connected to the water grid supply system received inconsistent and inadequate treated water supply due to low water pressure.

4.3.5.1.4 Catchment Management

Disruption of water catchment areas which are the source of raw water for the WTPs as well as those for the alternative supply system (gravity feed) can cause inconsistent and inadequate water supply. Timber harvesting or other development activities are the main forms of impacts on catchments.

4.3.5.1.5 Drought

In 2019, the water supply disruption affected a few areas including Simanggang, Pantu, Melugu, Stumbin, Seduku, Lingga, Lemanak and Engkilili due to the extended period of drought in the state. Eight of the water treatment plants in the Sri Aman Division were operating at minimum capacity due to the worst water levels during the drought.

The critical water level of water source of Btg Undup River, Seterap River, Dor River, Stumbin River, Stugok River, Lemanak River and Marup River during drought period causes low water pressure and disruption from the water treatment plants.

4.3.5.1.6 Growing Demand vs Capacity

The water demand in the division has been increasing due to the increase in population and activities. Hence, meeting the growing water supply demand in the Sri Aman Division whether the activities are

domestic, agricultural or commercial, is a challenge that needs numerous short and long-term solutions to be considered.

The capacity of existing water treatment plants is subject to growing consumer demand from domestic, commercial and agricultural activities. This can lead to low water pressure or supply interruptions.

4.3.5.1.7 Towns on estuarine river systems

One of the big challenges is supplying potable water in the coastal regions and towns is that, generally, the available water in the river systems is saline to some degree.

4.3.5.2 Opportunities

4.3.5.2.1 Restricting potable water use

Given supply limitations in the face of growing demand, an obvious strategy will be to limit the use of potable water to appropriate uses only. In the first instance this would involve not using treated water for agricultural irrigation purposes.

4.3.5.2.2 Water for agriculture / irrigation

The treatment of water for agricultural irrigation can generally be set to a lower standard. Recycled water may also be considered for this purpose.

4.3.5.2.3 Groundwater

Groundwater may be a suitable option for some purposes, especially irrigation supply.

4.3.6 Hazards, Effects and Resilience Planning

4.3.6.1 Deep Peat Soil Areas

Peat areas have a role in storing fresh water and mitigating flood events. The implications of draining these areas for agriculture or other development purposes can have severe impacts on this role. This is a major issue in the Division, and one of the most appropriate water resource strategies in the coastal areas may be to retain the existing deep peat areas and prevent future impacts on them. It will be critical to establish, from a water resource perspective, the conditions under which these areas might be developed, the infrastructure that will be required, and the impacts that will not be able to be mitigated.

4.3.6.2 Maintaining intact catchment conditions

4.3.6.2.1 Raw Water Quality

Development within water supply catchments can result in excessive sediment runoff into the waterway, elevating sediment levels, and potentially affecting the capacity of the treatment plant to remove these sediments.

4.3.6.2.2 *Raw Water in Coastal Areas*

Rising sea levels, and drainage of peat areas, can result in saline migration further upstream than is currently experienced. In coastal areas this can impact water intakes. The removal of salinity in water treatment is a specialised and costly process for which existing plants are not equipped.

4.3.6.3 *Impact of drought*

The drought in 2019 reduced the water level of water resources to a critical level which affected the intake of water treatment plants and reduced the available supply to consumers.

4.3.6.4 *Resilience Planning*

Highly decentralized water supply and sanitation options are now feasible; they provide resilience and complement centralized systems.

Water conservation and green infrastructure options for stormwater management such as rainwater harvesting systems will be an important strategy for reducing risks.

SECTION 4.4 UTILITY SERVICES – ELECTRICITY

4.4.1 Introduction

Sarawak Energy Berhad (SEB) is the fully integrated electricity utility responsible for the generation, transmission and distribution of electricity throughout the state, achieving sustainable growth and prosperity throughout Sarawak.

This chapter reviews the state of electricity supply in Sarawak with particular focus on Sri Aman region.

4.4.2 The Wider Picture – Electricity Supply in Sarawak

In 2019, Sarawak achieved 96.4% overall electrification with 92% of rural areas provided with 24-hour reliable power supply. Sarawak has the lowest average unsubsidised tariffs in Malaysia and amongst the lowest average tariff in ASEAN.

4.4.2.1 Power Generation

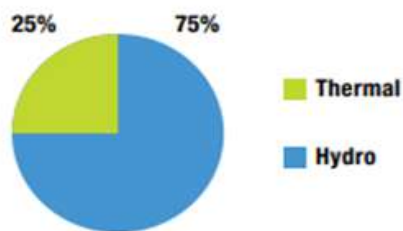
Sarawak had 4,701MW of power generation capacity as of 2018 which was largely afforded by harnessing renewable energy through hydropower (75%). This sustainable energy source is derived from the Murum, Bakun and Batang Ai Hydroelectric power plants. The construction of the Baleh hydroelectric project (HEP) is currently underway and expected to be completed in 2025. The power generation mix in Sarawak is shown in Figure 4-15, and the power generation capacity of the hydro projects is shown in Figure 4-16.

The balance of Sarawak's power needs are supplied by thermal plants, gas-powered plants (13%) coal-fired plants (10%) and Diesel (2%). These are still an essential part of the generation mix to maintain Sarawak's energy diversity and security.

As seen in Figure 4-17, SEB owns and operates three gas generation plants in Bintulu and Miri which supply less than 1500 MW, while three coal-fired plants in Sarawak operate in Mukah, Balingian and Sejingkat. There is only one diesel power station which is operates in Kuching with a capacity 64MW, making up around 1.5% of energy for Sarawak.

SARAWAK'S GENERATION MIX

Predominantly Renewable, Sustainable Hydropower



Generation capacity: **4,701MW**

Hydropower: **75%**

Thermal: **25%**

Coal: **10%**

Gas: **13%**

Diesel: **1.5%**

Alternative Energy: **0.5% and growing**

Figure 4-15: Energy Sources for Sarawak

Source: Sarawak Energy Berhad (SEB)



ADVANCING HYDROPOWER

Batang Ai Hydroelectric Plant

108_{MW}

Murum Hydroelectric Plant

944_{MW}

Bakun Hydroelectric Plant

2,400_{MW}

Baleh Hydroelectric Plant

1,285_{MW}

UNDER CONSTRUCTION

Figure 4-16: Generation Capacity of Hydropower in Sarawak

Source: Sarawak Energy Berhad (SEB)



The 317MW Bintulu Combined Cycle Power Station.

SECURITY OF SUPPLY

GAS

- Bintulu Power Station (Combined Cycle) **317MW**
 - Bintulu Power Station (Open Cycle) **165MW**
 - Miri Power Station **102MW**
 - Tanjung Kidurong CCGT **421MW x 2**
- commissioning date : 2021

COAL

- Mukah Power Station **270MW**
 - Sejingkat Power Station **210MW**
 - Balingian Power Station **624MW**
- commissioning date : 2019

DIESEL

- Kuching Power Station **64MW**

Figure 4-17: Power Plants in Sarawak

Source: Sarawak Energy Berhad (SEB)



Figure 4-18: Balingian Coal-Fired Power Plant in Mukah, Sarawak

Source: Sarawak Energy Berhad (SEB)

4.4.2.2 Transmission Systems

4.4.2.2.1 State Grid

The State Grid's transmission system in Sarawak consists of 1,235 km of 275kV and around 373 km of 132kV transmission lines. This includes the underground cable owned or operated by SEB Transmission Department used to transfer electricity from one power station to a substation or another power station. The Sarawak State Grid distributes electricity to 680,000 consumers in Sarawak, from West to North region as well as the energy intensive SCORE area in Bintulu.

4.4.2.2.2 New Transmission Projects

The construction of Sarawak's 500kV Backbone Transmission Line Project will strengthen the network system. It includes three 500 kV double circuit lines totalling 511 km.

Besides this, there is also a 275kV transmission line interconnection project from Mambong in Sarawak to Bengkayang in West Kalimantan. Through a power exchange agreement this can be built for cross border power connectivity by sharing energy security and reliability.

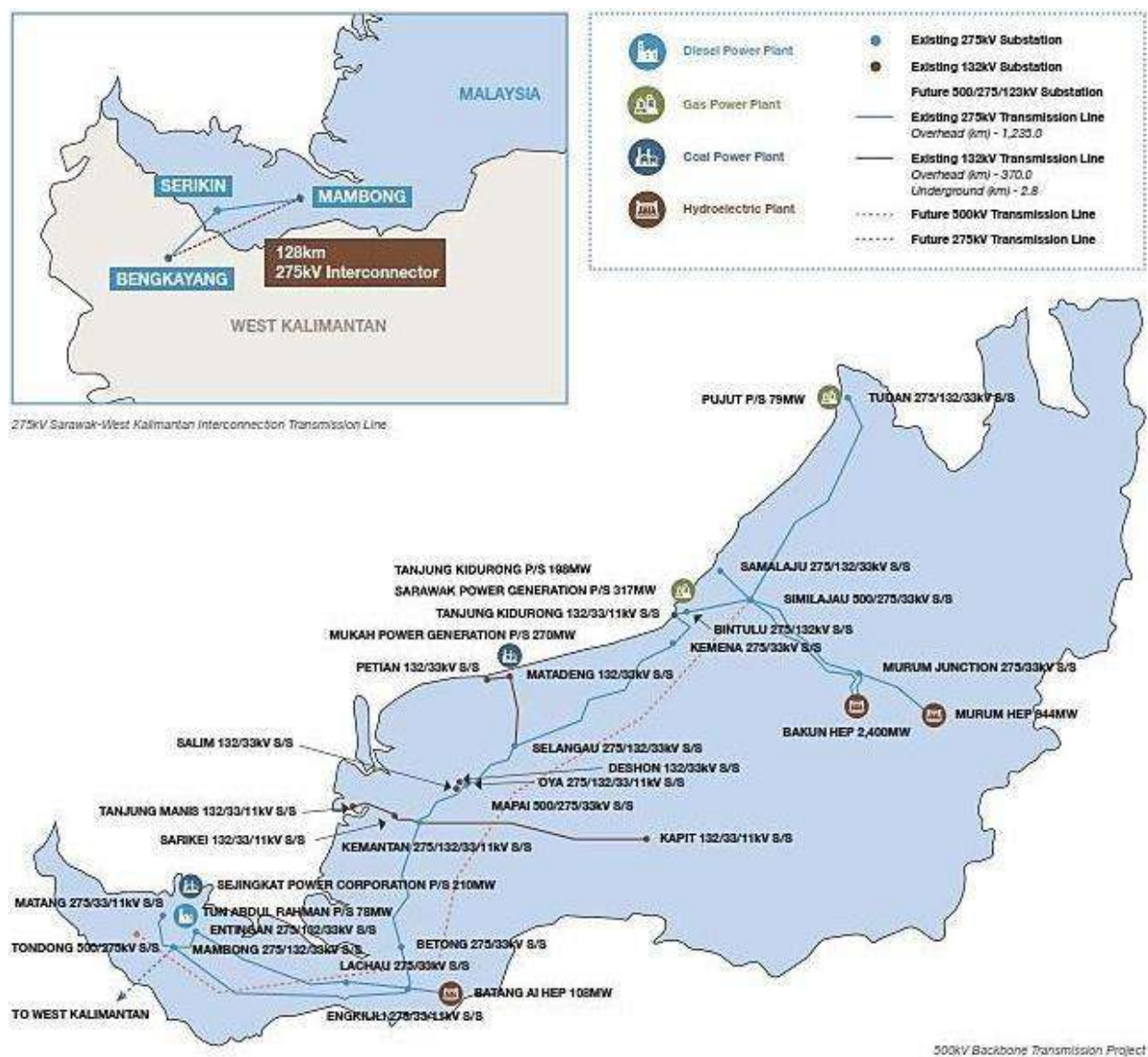


Figure 4-19: 500kV Backbone Transmission Project in Sarawak

Source: Sarawak Energy Berhad (SEB)

4.4.2.3 Rural Electrification

This section focuses on Sarawak's Accelerated Rural Electrification or Rural Power Master Plan. The SEB aims to achieve 100% electricity supply to the whole state by 2025. The plan involves accelerating rural electrification through a variety of programs with government funding under the Rural Electrification Scheme (RES), Sarawak Alternative Rural Electrification Scheme (SARES), and Hybrid and Rural Power Supply Scheme (RPSS). These are summarised in Figure 4-20.

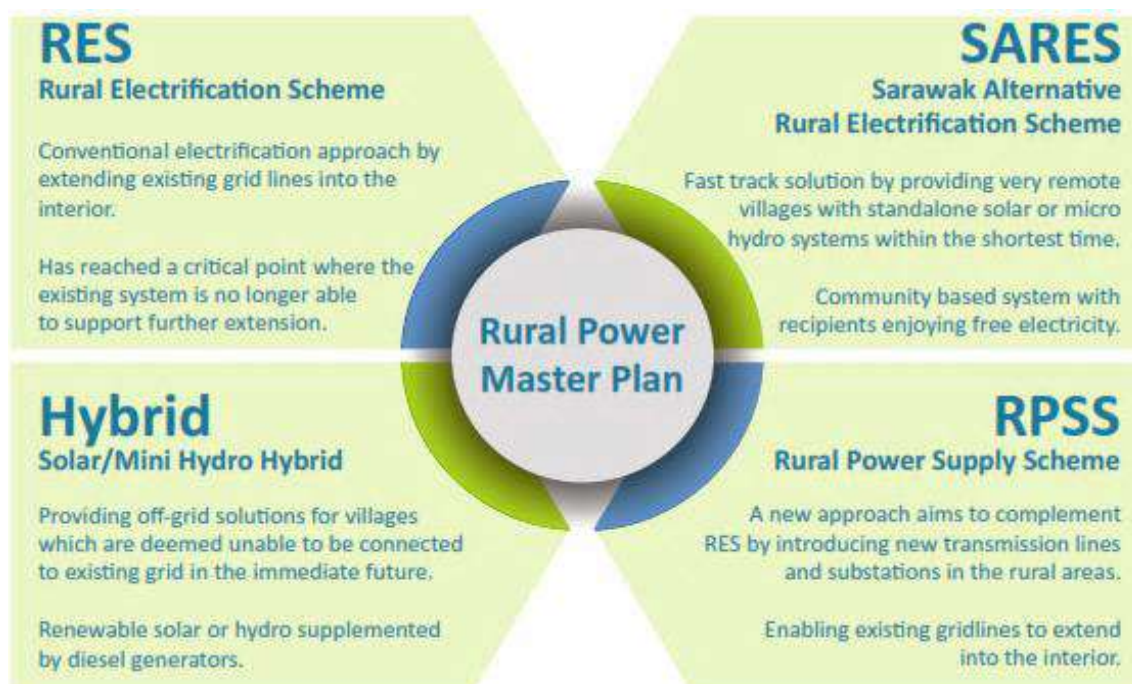


Figure 4-20: Rural Electrification of Rural Power Master Plan

Source: Sarawak Energy Berhad (SEB)

SARES has completed four phases and is currently committed with SARES Project Phase 5 which covers 10 villages in the Sri Aman Division. The Sarawak Alternative Rural Electrification Schemes (SARES) at the Sri Aman Division is the provision of solar PV systems to remote settlements. In 2014, 9 villages in Ulu Skrang have been provided with alternative electricity supply under SARES Phase 1.

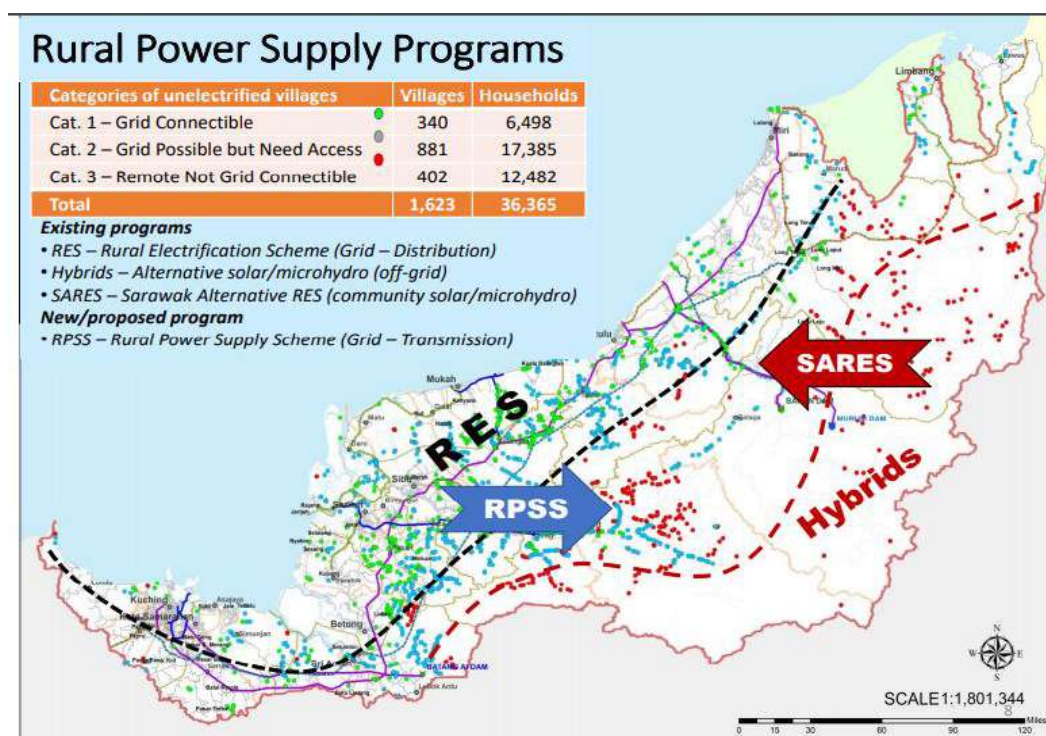


Figure 4-21: Rural Electrification of Rural Power Master Plan

Source: Sarawak Energy Berhad (SEB)

In 2018, electricity coverage has increased up to 95% of the entirety of Sarawak, covering 91% of rural communities, where 110,000 new rural households have been connected through grid expansion or community-based generation projects since 2009. In 2019, it increased to 96.4% overall electrification with 92% of rural areas in Sarawak being provided with 24-hour reliable power supply.

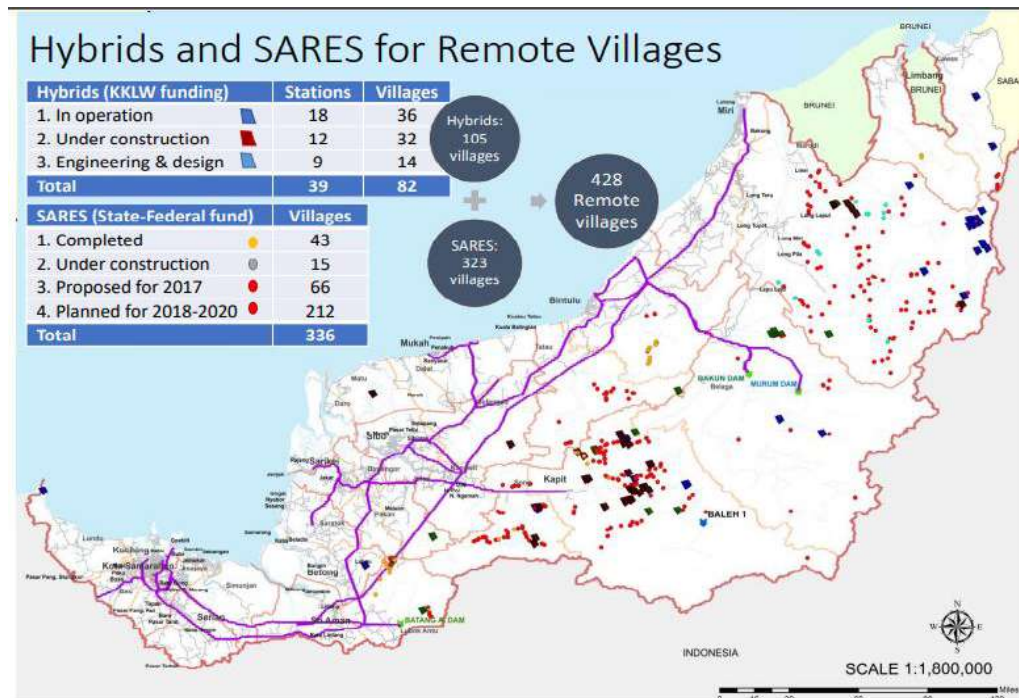


Figure 4-22: Rural Electrification of Rural Power Master Plan

Source: Sarawak Energy Berhad (SEB)

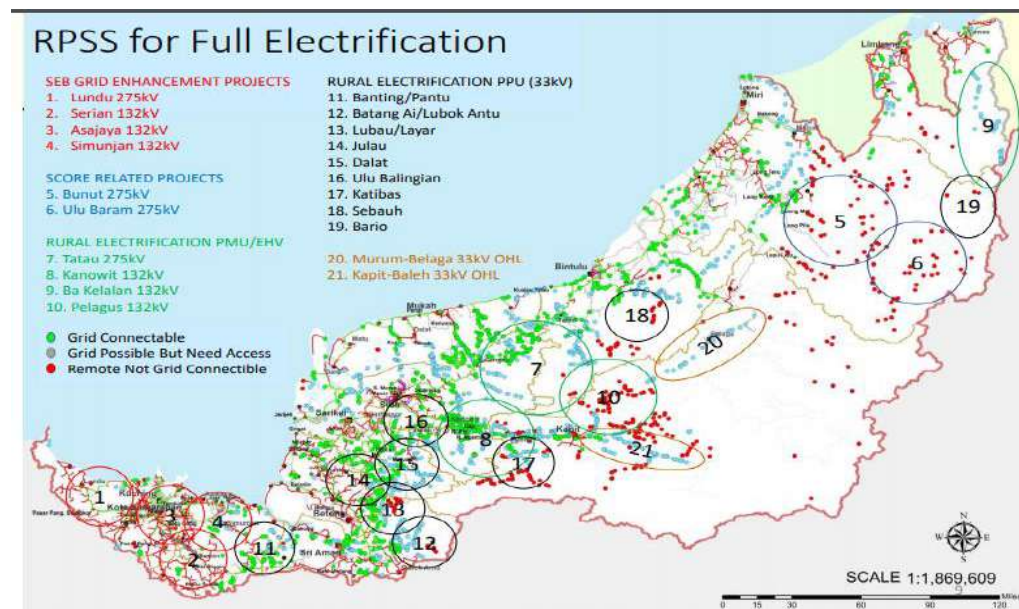


Figure 4-23: Rural Electrification of Rural Power Master Plan

Source: Sarawak Energy Berhad (SEB)

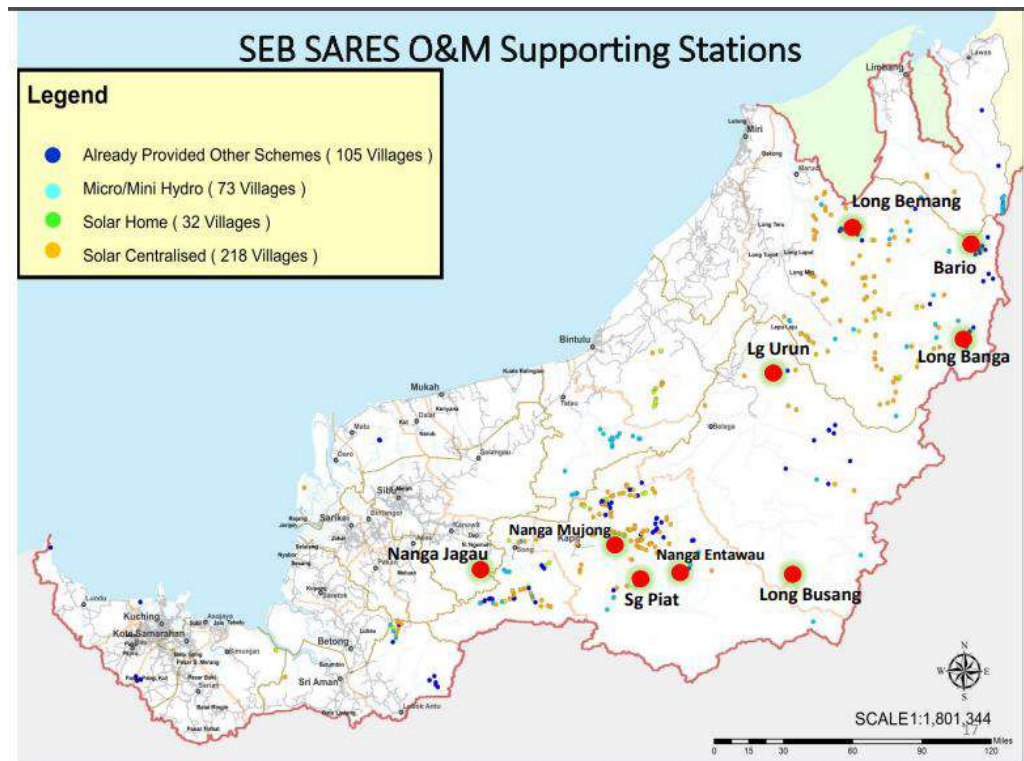


Figure 4-24: Rural Electrification of Rural Power Master Plan

Source: Sarawak Energy Berhad (SEB)

4.4.3 Sri Aman's Electricity Supply

The Sri Aman Division has the Batang Ai Dam and hydroelectricity project located in Lubok Antu District. The power station generates 2.3% or 108MW of the total 4,701MW power supply in Sarawak. This power is fed directly to the State grid and is thus available throughout the State. In this way Sri Aman is harnessing sustainable renewable energy for the benefit of the entire State.



Figure 4-25: Batang Ai Dam

Source: Sarawak Energy Berhad (SEB)

4.4.3.1 Existing Electricity Supply in Sri Aman

The Sarawak Electricity Supply Corporation (SESCO) is the only licensed utility company under SEB which supplies electricity to Sri Aman and all other areas in Sarawak.

The main source of electricity supply in Sri Aman Division is the SEB Power Grid network.

Minor sources supplement this in areas where the grid is not available:

- Generator sets under the ownership of SESCO or Government sponsored
- SARES - installation of solar panels
- Micro Hydro

4.4.3.2 SESCO Power Grid Network Supply

The SESCO Power Grid network connects consumers in Sri Aman urban areas and most areas in Lingga, Pantu and Engkilili sub-districts.

The state grid supplies Sri Aman via 275kV transmission lines from Betong, with connection at 30MVA 33/275kV to Engkilili substation. The main source of SEB power supply to Sri Aman Division is from this substation. shows the current and power carried by the main power lines to and through Engkilili substation as of 2014.

Table 4-25: Current and Power Carried by Engkilili Substation (2014)

275kV Transmission Lines	MVA per circuit	Total MVA with two circuits	Total Current Carried by Two Circuits
Batang Ai-Engkilili	294	500	88
Engkilili-Mambong	587	980	190
Engkilili-Kemantan	600	1020	113

Source: SESCO Sri Aman (2018), SADA Lab

4.4.3.2.1 New high voltage transmission line

A new 500kV transmission line from Similajau to Tondong will help to reinforce the existing 33kV distribution systems in the Betong-Debak-Pusa areas and will also provide power for the Lachau-Sri Aman-Serudit-Saratok-Sarikei 132kV Regional Grid.

4.4.3.2.2 Main Substations in Sri Aman

To cater for the overall load there are presently five (5) existing 33/11kV substations including Nanga Kesit which is expected to be completed in 2021, and one 275/33kV substation in Lachau. These substations are shown in Figure 4-26 below and used as the main distribution of power to Sri Aman Division. Power is further distributed by these main substations to small capacity 33kV and 11kV substations (less than 3MVA) through 33kV and 11kV overhead lines.

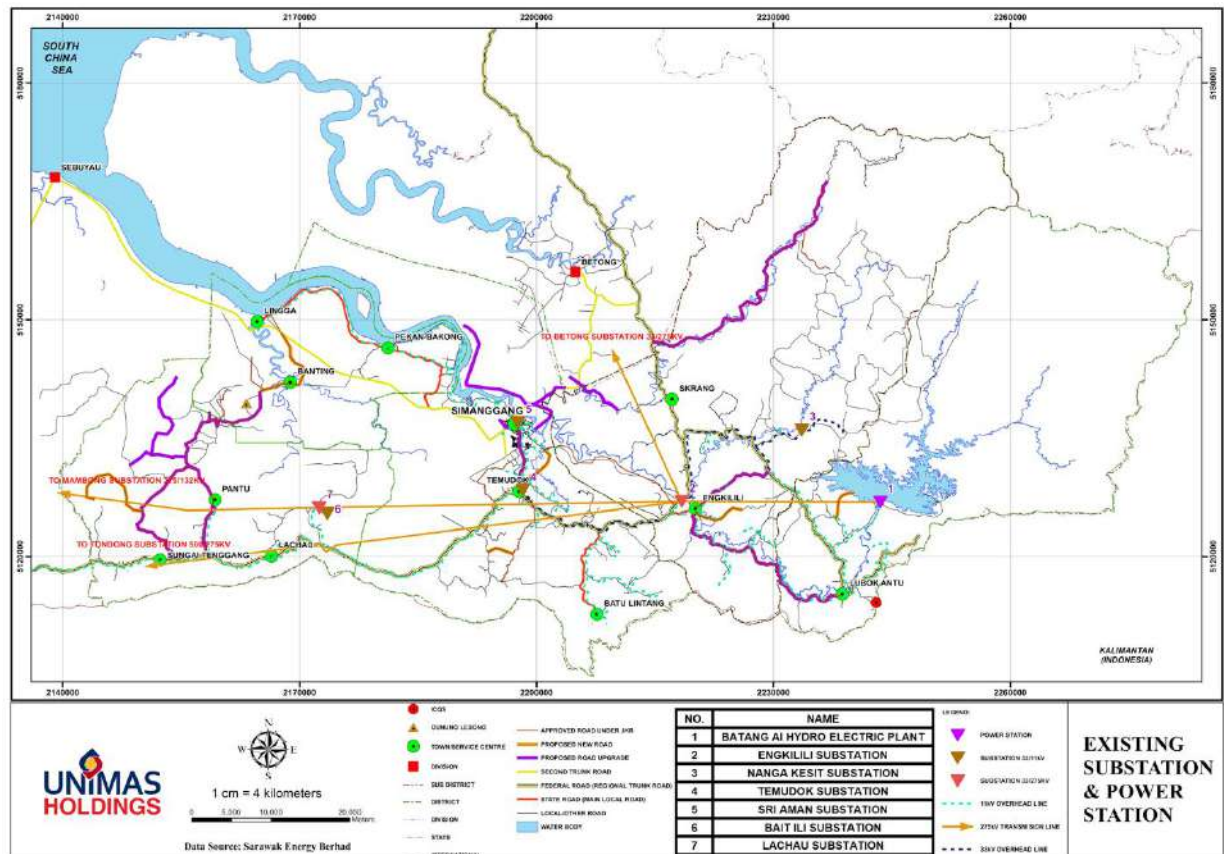


Figure 4-26: Location of Substations in Sri Aman Division

Source: Sarawak Energy Berhad (SEB)

4.4.3.3 Present Load

For Sri Aman Division the total maximum demand in 2020 was 41.3MW. Figure 4-27 shows the historical peak loadings of Sri Aman from years 2010 to 2019.

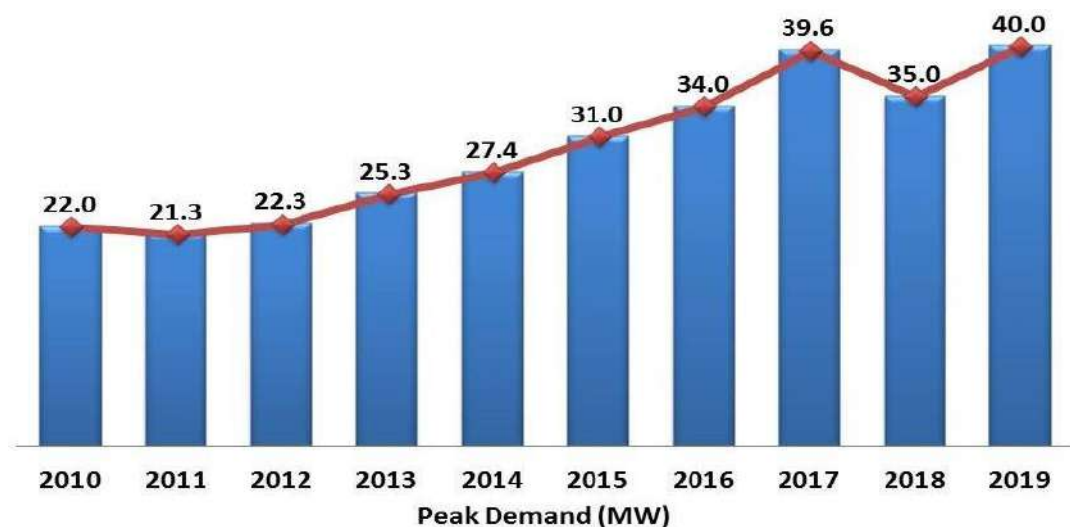


Figure 4-27: Historical Peak Demand of Electricity in Sri Aman Division (2010 - 2019)

Source: Sarawak Energy Berhad (SEB)

Table 4-26: Peak Demand of Electricity in Sri Aman Division in 2015 - 2020

Year	Total Population	Maximum Demand (MW)
2015	100,600	31.0
2016	105,000	34.0
2017	106,600	39.6
2018	108,100	35.0
2019	109,800	40.0
2020	111,400	41.3 ^e

Source: Sarawak Energy Berhad (SEB)

4.4.4 Electricity Supply in Settlements in Sri Aman

The electricity supply facilities at hierarchy level settlements of the Sri Aman Division are shown in Table 4-27. Transmission offices, distributors and substations have been provided at the settlements at divisional, district and sub-district towns of Simanggang, Lubok Antu, Lingga, Pantu and Engkilili, while the other settlements of Melugu, Lachau and Sg. Tenggang towns were provided electricity by substations.

Table 4-27: Hierarchy Level of Electricity Supply Facilities at Year 2018

Hierarchy Level	Sri Aman Division Town	Electricity Supply Facilities
Divisional Town	❖ Simanggang	❖ Regional Transmission Office
		❖ Main Distributor (PMJ)
		❖ Local Distributor (PPU)
		❖ Substation (PE)
District Town	❖ Lubok Antu	❖ Regional Transmission Office
		❖ Main Distributor (PMJ)
		❖ Local Distributor (PPU)
		❖ Substation (PE)
Sub-District	❖ Lingga	❖ Local Transmission Office
	❖ Pantu	❖ Local Distributor (PPU)
	❖ Engkilili	❖ Substation (PE)
Other Settlement	❖ Melugu	❖ Substation (PE)
	❖ Lachau	
	❖ Sg. Tenggang	

Source: SESCO Sri Aman (2018), SADA Lab

Based on the electricity supply facilities provided by SESCO, 665 settlements of Sri Aman Division received electricity supply as shown in Table 4-28. Sixty-nine percent (69%) (456) of the settlements received electricity supply through the National Main Power Grid System, while the other 31% or 209 settlements received alternative electricity supply through rural supply programme or mini hydro, generator sets and SARES programs.

Table 4-28: Electricity Supply in Sri Aman Division in 2020

Districts	No of Settlements	Electricity Supply (No. of Settlements)	*Alternative Electricity Supply
Sri Aman	387	328 (85%)	59 (15%)
Lubok Antu	278	128 (46%)	150 (54%)
Sri Aman Division	665	456 (69%)	209 (31%)

Note: *Alternative Electricity Supply (Mini hydro, Generator set and SARES)

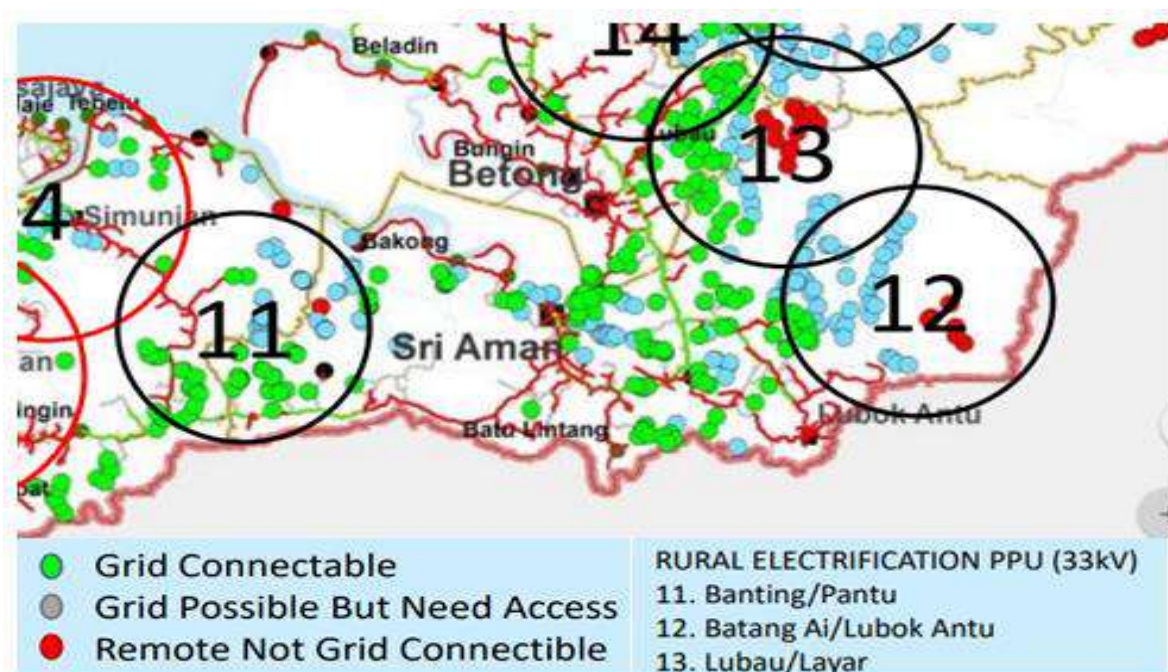
Source: SADA Lab 1, SESCo Sri Aman, Resident Office Sri Aman (2020)

It can be seen that the majority (> 2/3) of the settlements in Sri Aman District rely on the State Grid System for electricity supply, while 31% receive alternative electricity supply; the latter mainly in remote areas.

However, in the Lubok Antu District the majority of the residents rely on mini hydro, generator sets and SARES as alternative electricity supply. These settlements are facing problems with power interruptions and inadequate 24 hours supply of electricity due to the reliance on these alternative sources.

4.4.4.1 Rural Electrification Scheme (RES) & Rural Power Supply Scheme (RPSS)

RES and RPSS are the schemes for expansion of existing grid network to rural areas. It focuses on transmission and distribution of electricity to the villages near to the grid and accessible by roads. There are two new 33kV medium voltage substations to be constructed as main distribution sub-stations (PPU) in Sri Aman Division which are Banting/Pantu, and Batang Ai/Lubok Antu, as shown in Figure 4-28. The new substations will be connected to the main grid by 33kV medium voltage conductor line.

**Figure 4-28: Electricity Supply in Sri Aman Division**

Source: Sarawak Energy Berhad (SEB)

4.4.4.2 Power Supply from Power Stations and Isolated Generators

Some settlements which are accessible by roads or rivers but located in the remote areas from SESCO grid network has been supplied by power supply from generators. Generators are either owned by SESCO or under sponsorship by Government.

4.4.4.3 Off-Grid Renewable Energy System

There are two major off-grid renewable energy systems being implemented in Sri Aman for the rural electrification programs; namely the solar energy system and micro hydroelectric power.

4.4.4.3.1 Solar Photovoltaic (PV) Supply

The Government through Sarawak Alternative Rural Electrification Schemes (SARES) sponsors the provision of solar PV system to remote settlements. Priority is given to remote settlements without road access; without suitable water source for hydro power, not feasible to be connected to the main electricity grid in the next five years, and where a school is in existence.

In 2014, Rumah Manggat in Batang Ai comprising 17 households (population 40) has implemented the solar home system under SEB's CSR Project to generate up to the total PV capacity of 5.44kW (320W per household). As shown in Figure 4-29, It is provided with new internal wiring including 8 lighting point and 4 socket outlets to cater basic rural household electricity needs with lighting, fans, television, radio, video player, satellite decoder, computer and phone charger.



Figure 4-29: Rumah Manggat – solar power system

Source: Sarawak Energy Berhad (SEB)

Three solar hybrid systems are also located at Rumah Dau, Nanga Menjuau and Nanga Delok in Sri Aman Division with locations shown in Figure 4-30). A 129.6kW solar hybrid system has been provided at Rumah Dau in 2014 (Figure 4-31) to cater for a population of 114. The power is complemented by two 58kW diesel generators and a bank of AC batteries to supply electricity to the villagers.



Figure 4-30: Location of Solar Hybrid in Sri Aman Division

Source: Sarawak Energy Berhad (SEB)



Figure 4-31: Solar Hybrid at Rumah Dau

Source: Sarawak Energy Berhad (SEB)

In 2016, a solar home system and solar centralised system was provided in Ulu Skrang covering 9 villages under SARES Phase 1 Programme including Rh Juan and Rh Remong as shown in Figure 4-32 and Figure 4-33.



Figure 4-32: SARES Phase 1 at Ulu Skrang comprise 9 villages

Source: Sarawak Energy Berhad (SEB)



Figure 4-33: Two of Nine Villages at Ulu Skrang provided with Solar Centralised System

Source: Sarawak Energy Berhad (SEB)

4.4.4.3.2 Micro Hydro Stations

As of the time of writing, there are currently only four micro hydro-electric stations at Abok Mawang, Semulong Ulu, Sri Tamang 2 and Nanga Jambu.

Micro hydro provides alternative renewable energy sources in the range of 5kW to 100kW for remote areas away from the grid using the flow of a river. It is estimated that some streams in Betong and Lubok Antu could generate between 50kW and 200kW of power. These four micro hydro dams are summarized below.

Abok Mawang

In 2007, UNIMAS, JKR and the Community built a 30kW micro hydro located in Abok Mawang as shown in Figure 4-34.



Figure 4-34: Micro Hydro at Abok Mawang

Source: UNIMAS and JKR Sarawak

Abok Mawang is a Malay village located in Pantu sub-district. The power generated from the pelton turbine is used to run a conventional AC generator and supply electricity for 10 to 20 households for common household electrical appliances.

Semulong Ulu

In 2009, UNIMAS, JKR and the Community built a 12kW micro hydro system located in Semulong Ulu, Lingga Sub-District, to supply around 700 watts of electricity per house for 25 households in Rh Tapang Pungga. The villagers maintain the dam as it is a community-based project.



Figure 4-35: Community Project in Semulong Ulu

Source: UNIMAS and JKR Sarawak

Sri Stamang 2

A micro hydro dam and generating system has been built at Kampung Sri Tamang 2, Lubok Antu District in 2012. It provides 18.3kW of power for 240 consumers in longhouses and for the *Klinik Desa*. The system uses stream flow of Ubo River as the source.



Figure 4-36: Micro Hydro Dam at Kampung Sri Tamang 2

Source: Micro Hydro Project for Rural Electrification by Smart Village (Link: <https://www.slideshare.net/e4sv/kuching-24-micro-hydro-sarawak-mohd-fauzi-ismail>)

Nanga Jambu

A micro hydro dam at Nanga Jambu has been constructed in 2016 with a generating system that can generate 15kW of power for the village.



Figure 4-37: Micro Hydro Dam at Nanga Jambu

Source: Daya Rancang

4.4.5 Covid-19 & Its Impact on the Electricity Supply

Due to the COVID-19 pandemic overall electricity demand in the ASEAN region has been reported to have dropped following the slowdown of activities in various industries and commercial sector.

Malaysia reported a 23 per cent increase in residential electricity consumption in Peninsular Malaysia while at the same time, overall electricity usage decreased in Sarawak by 20 per cent following the move by the government to close all business premises and halt economic activities due to the imposition of the MCO. Though impacted sectors will take some time to recover, household's consumption is predicted to remain high in the short to medium term.

Sarawak Energy implemented special discounts under both the Economic Stimulus Package (PRIHATIN) of the Federal Government and Sarawakku Sayang Special Assistance Package of the Sarawak Government. Eligible customers of Sarawak Energy's 700,000 account holders from the domestic, commercial and industrial categories will have their electricity bills discounted accordingly to ease the financial burden faced as a result of the COVID-19 situation.

The discount package in Figure 4-38 was provided over a period of six months for electricity consumption from 1 April 2020 till 30 September 2020, and is expected to total over RM166 million.

From a utility's standpoint, the simple act of 'keeping the lights on' is vital to ensure the continuity of key critical infrastructure to provide reassurance and stability to a nation. Keeping the lights on in this context represents an imperative global necessity, as entire economies shift to remote working practice. Stable electricity supply is not only important for powering remote workers, or meeting the surge in demand for home energy usage. That same electricity illuminates our hospitals, powers our healthcare equipment, and ensures that even in the face of medical uncertainty, healthcare workers can be confident in receiving the power they need.



Figure 4-38: Economic Stimulus Package Sarawak Electricity Bill Discount

Source: Sarawak Energy Berhad (SEB)

Electricity is considered an essential service and as its primary provider in the State, Sarawak Energy's critical functions teams are continuing to work from their base locations and plants during the pandemic.

The milestone projects for electricity in Sarawak such as construction of the Baleh HEP project still continue apace.

4.4.6 Electricity Supply Resource Inventory

Table 4-29 shows the various electricity supply resources for various settlement patterns in Sri Aman Division.

Table 4-29: Electricity Supply Resource for Settlement Pattern in Sri Aman Division

Settlement	Electricity Supply Resources
Urban Residential	SEB Power Grid
Suburb	SEB Power Grid
Rural Villages	SEB Power Grid SARES Micro Hydro
Remote Interior Village	SARES Micro Hydro Generator set

Source: JBALB Sri Aman (2018), SADA Lab

4.4.6.1 SESCO Power Grid

The SESCO Power Grid in Sri Aman has been supplying electricity from 275kV National Grid and 500kV Backbone Transmission Line. There is one hydroelectric power plant - the Batang Ai HEP. There are five (5) 33/11kV substations and one 275/33kV substation in Sri Aman Division. These substations distribute the power to smaller capacity 33kV and 11kV substations (less than 3MVA) through 33kV and 11kV overhead lines.

4.4.6.2 SARES

The Sarawak Alternative Rural Electrification Schemes (SARES) in the Sri Aman Division provides solar PV system to remote settlements. In SARES Phase 1, 9 villages in Ulu Skrang have been included. Currently SEB is executing centralised solar power system in 10 rural villages in Sri Aman under SARES Phase 5 Programme as shown in Table 4-30.

Table 4-30: 10 Villages in Sri Aman Division Under SARES Phase 5 Program

No	Village	Household	System
1	Rh Jacob Anak Bedindang (Tanjung Perin, Banting)	4	Solar Home System
2	Rh Mamut Anak Emparu (Langgir Ili)	28	Centralised Solar System
3	Rh Agusti Ak Blassan (Engkerepok Ili)	18	Centralised Solar System
4	Rh Jack Anak Ade (Engkerepok Ulu)	19	Centralised Solar System
5	Rh Mathew Anak Kota, Langgir Ulu	7	Centralised Solar System
6	Rh Pridu anak Logah, Kampung Sg Pisang	14	Centralised Solar System
7	Rh Sambau, Ng Mengkak, Engkari	37	Centralised Solar System
8	Kpg Sg Merah	9	Centralised Solar System
9	Kampong Sinjor	4	Solar Home System
10	Rh Tujoh, Sg. Anak Balingian	12	Centralised Solar System

Source: Sarawak Energy Berhad (SEB)

4.4.6.3 Generator Sets

The settlements which are accessible by roads or rivers but located in the remote areas from SESCO grid network have been supplied with generators. Generators are either owned by SESCO or under sponsorship by Government.

4.4.7 Digital Electricity Presence

In-line with Sarawak Digital Economy Strategy, Sarawak Energy (SEB) targeted a digital utility by 2025 in Sarawak. Currently, SEB is transitioning to online platforms for operations and customer interface. Figure 4-39 shows the digital management of distributed energy resources adapted from McKinsey & Company (2016). It enhances customer experience and caters diverse preferences at key touch-points from technology innovations and digitalisation efforts.

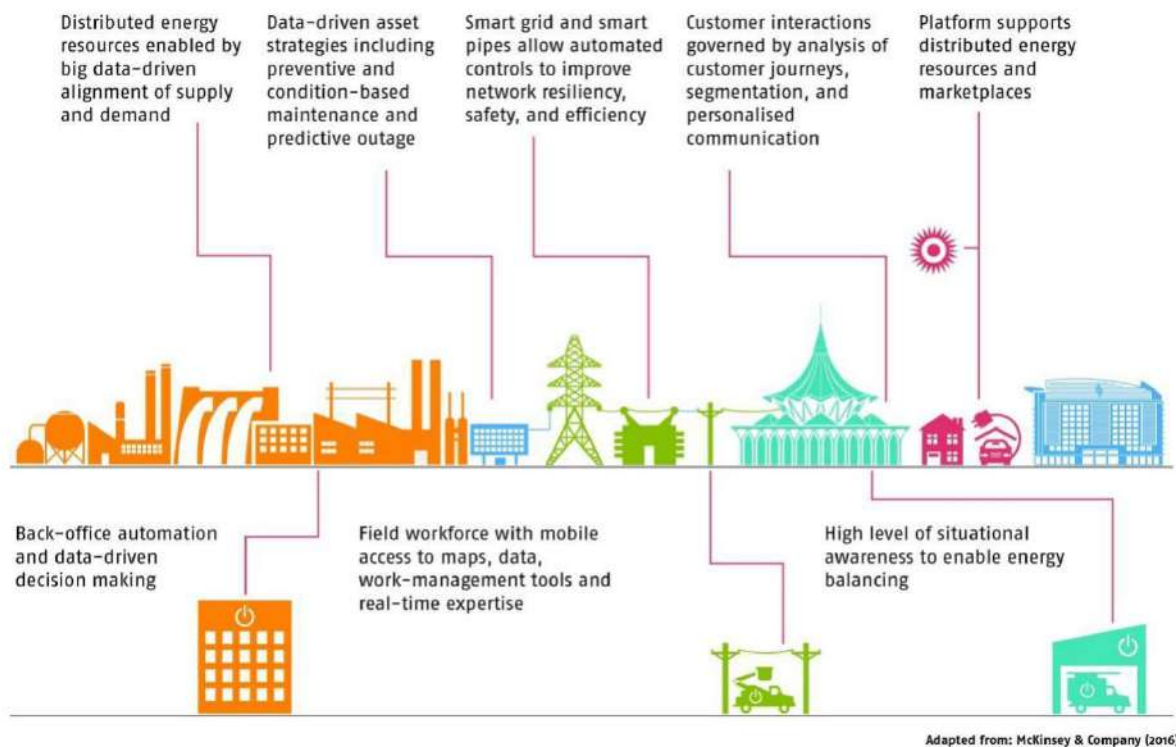


Figure 4-39: Full Electrification Plan in Sarawak

Source: Sarawak Energy Berhad

SEB encourages all customers to use online platforms to perform transactions through mobile applications of 'SEB cares' to limit movement and minimise face-to-face transaction at customer service counters. This application can be used for bill payment, view bill or to report any technical issue and enquiries, besides paying the utilities bill through other platforms such as Sarawak Pay, Boost or JomPay.

4.4.8 Policy and Strategy Drivers

4.4.8.1 Sarawak Socio-Economic Transformation Plan (SETP) 2030

Sarawak's power system was designed and implemented sustainably with an optimal capacity mix that predominantly utilises renewable hydropower in conjunction with coal and gas for energy security. New hydro, coal and gas plants are implemented when there is a need to meet planned or forecast demand of domestic, commercial and industrial local organic loads, from Sarawak Corridor of Renewable Energy (SCORE) bulk-energy industries, and to support Sarawak's digital economy initiatives.

The Ministry of Utilities and Telecommunication through Sarawak Energy has a mission to provide all the rakyat with reliable, affordable 24-hour electricity. Sarawak's power development also includes strategies to electrify rural areas. Infrastructure development such as associated roads required for accessibility to hydropower sites such as Bakun, Murum and Baleh has brought connectivity to these remote areas, providing opportunities to bring these once inaccessible rural areas into the mainstream of socioeconomic growth and development.

4.4.8.2 Rural Power Master Plan 2025

Strategy for full rural electrification coverage by 2025 was initially formulated in 2015 under the Rural Power Master Plan. The plan aims to accelerate rural electrification through a variety of programmes with government funding programs which are; Rural Electrification Scheme (RES), Sarawak Alternative Rural Electrification Scheme (SARES), Hybrid and Rural Power Supply Scheme (RPSS). The simultaneous implementation of these programs will speed up the government's electrification plan, catalysing rural development to close the gap between rural and urban communities, enabling the State's digital economy agenda to reach our rural communities to help realise Sarawak's vision to become a developed state by 2030.

4.4.8.3 Rural Electrification Scheme (RES)

Under the Rural Electrification Scheme (RES) the overall state domestic electricity coverage has increased to about 95% with 90% of rural population electricity coverage as shown in Figure 4-40.

The Sarawak Government, in collaboration with Sarawak Energy Berhad (SEB), is aiming to connect more than 30,000 remaining rural households as it works towards achieving full electrification by 2025. The vision is to ensure all rural communities including the most remote and inaccessible upriver communities are connected to constant 24-hour electricity supply. The focus of rural electrification is to extend the grid to reachable areas while standalone systems employing alternative electricity sources are used for regions too remote for grid connection.



Figure 4-40: Percentage Coverage RES in Sarawak at (2009-2025)

Source: Sarawak Energy Berhad (SEB)

4.4.8.4 Sarawak Alternative Rural Electrification Scheme (SARES)

Sarawak Alternative Rural Electrification Scheme (SARES) is a community-based system that provides standalone solar or micro hydro systems for the most remote, inaccessible areas. SARES has completed four phases and currently SARES Project Phase 5 is under way covering 10 villages in Sri Aman Division.

4.4.8.5 Sarawak Digital Economy Strategy 2018-2022

The Sarawak Digital Economy Strategy 2018-2022 is one of Sarawak's approaches in harnessing the digital economy. It will accomplish this through seven focus areas which include Digital Infrastructure, Cyber Security, Talent Development, E-commerce, R&D in digital technology, Digital Innovation Entrepreneurship and Digital Government. The Strategy's vision, mission and benefit are shown in Figure 4-41.



Figure 4-41: Vision and Mission in Sarawak Digital Economy Strategy

Source: EPU Sarawak

4.4.9 Issues, Challenges & Opportunities

4.4.9.1 Issues and Challenges

- **Accessibility** - Some longhouses in rural and interior areas are still not accessible by roads for the installation of electricity transmission lines.
- **Scattered settlements** - Many longhouses were located far apart from each other making connection to the grid economically and physically impractical.
- **Alternative supply systems** rely on operation and maintenance from the local community. Some of the skills required for this are in limited supply amongst villagers. This not only impacts the reliability of supply, but also safety issues when working with electricity.

4.4.9.2 Opportunities

- Sarawak Government committed with **SARES, Hybrid and RES programme** to ensure 100% of electricity supply coverage for the state by the year 2025.
- Sarawak has excellent resources of power generation. Supply does not appear to be a major constraint – just the practicality of connecting remote settlements to the available supply.

4.4.9.2.1 Adding solar farms to the power generation mix

SEB is looking at developing floating solar farms on their hydro lakes as a way of supplementing the power production. This will be particularly useful during times of extended low rainfall, as it will reduce the rate that the hydrolakes are drawn down, allowing production capacity to be maintained at a higher level for a longer period.

SEB will soon commence with a pilot project at Batang Ai lake, in Sri Aman Division.

4.4.10 Potential Hazards

The principal hazards for electricity supply in the Division are:

- Micro hydro stations will have reduced capacity during periods of drought
- Small scale solar, hydro and hybrid systems are not able to easily respond to increased demand, or peaks in demand
- Management, maintenance, and regulation of community based systems can create a range of issues, especially in regard to safety.

SECTION 4.5 UTILITY SERVICES - TELECOMMUNICATION

4.5.1 Introduction

The Malaysian Communications and Multimedia Commission (MCMC) announced that, in populated areas nationwide, Malaysians have been able to benefit from an impressive 91.8 percent of 4G LTE mobile coverage. The regulator wants to eventually achieve 100 percent 4G LTE mobile coverage over the course of multiple phases and over 100Mbps mobile broadband speeds via 5G by the end of 2025 as part of its Jalinan Digital Negara Plan (JENDELA). (*MalaysiaWireless (September, 2020)*)

4.5.2 The Wider Picture – Telecommunications in Sarawak

SMA and the Malaysian Communications and Multimedia Commission (MCMC) are working together to enhance broadband connections to rural and inland areas in Sarawak. Table 4-31 shows the percentage of completion and statistics of 3G and 4G coverage within whole Sarawak as revealed in Parliament (Dewan Rakyat) in September 2020. It can be seen that Sarawak lags significantly behind the national average coverage of 92%.

According to the Chief Minister of Sarawak Datuk Patinggi Abang Johari Tun Openg, the state government has allocated RM50mil to install very small aperture terminal (VSAT) stations to improve connectivity in underserved rural areas. (*Ling S., October 2020*).

There are also other programs such as PANDei Workshop (People Accessible, Network, for Digital Empowerment Inclusivity) with PUSTAKA Negeri Sarawak which teaches digital literacy skills to the community. Also the Rindok Digital program which provides opportunities for rural communities to interact directly with SMAs and other government agencies. (*Azam Sarawak, September 2020*)

Efforts to improve the communication network in Sarawak also involve various telecommunication infrastructure projects that have been planned and some are being launched under the efforts of Sarawak Multimedia Authority Rural Telecommunication (SMART) and in line with the National Fiberisation Connectivity Plan (NFCP) SKMM. Digital-based programs are also held to educate and expose the community to technological facilities.

Table 4-31: 3G and 4G Coverage Statistic for Sarawak

District	Percentage (%) Coverage	
	3G	4G
Asajaya	87.3	84.30
Bau	89.7	71.45
Belaga	30.5	20.16
Betong	83.0	69.64
Bintulu	82.7	72.64
Dalat	85.7	73.23
Daro	78.1	72.95
Julau	37.4	23.59
Kanowit	62.2	48.57
Kapit	42.2	32.31
Kuching	97.7	94.61

District	Percentage (%) Coverage	
	3G	4G
Lawas	73.2	60.73
Limbang	78.2	59.46
Lubok Antu	53.2	43.05
Lundu	82.7	69.35
Marudi	38.0	34.79
Matu	67.3	63.96
Meradong	95.8	77.67
Miri	89.6	81.51
Mukah	79.5	68.82
Pakan	51.8	30.33
Samarahan	99.1	95.01
Saratok	83.6	60.84
Sarikei	93.2	76.51
Selangau	49.6	36.21
Serian	83.2	64.50
Sibu	97.5	94.96
Simunjan	79.0	69.36
Song	37.9	20.10
Sri Aman	87.7	75.22
Tatau	49.4	40.86
AVERAGE	72.5	60.9

Source: Malaysia Wireless (September, 2020)

4.5.3 Sri Aman's Place Within Sarawak's Telecommunication System

The sole provider of fixed lines in Sri Aman Division is Telekom Malaysia Berhad (TMB). As of the time of writing, no other telecommunication company provides fixed line services.

Sacofa Sdn. Bhd is a local establishment founded in 2001 with the authority to coordinate, plan provide and approve all telecommunication infrastructures in Sarawak. Their emphasis is to coordinate, plan and consolidate the sharing of telecommunication towers to all the service providers. This includes providing telecommunication towers and telecommunication services.

At the beginning of October 2020, Sacofa signed two Memorandums of Understanding (MOUs) with Danawa Resources Sdn Bhd (Danawa) and PP Telecommunication Sdn Bhd (PPTTEL) respectively, at the International Digital Economy Conference Sarawak (IDECS) to establish strategic partnerships to further enhance and expand the coverage of telecommunications.

In Simanggang and Lubok Antu, there are broad levels of telecommunication availability compared to other locations within the Division (Table 4-32). In rural and remote villages within the sub-district areas there are only three components of telecommunications that have been installed: Digital Terrestrial TV/Radio, Satellite TV and Internet Access.

The absence of telecommunication towers would cause the transmission of the internet access to be much slower. There is no availability of mobile telecommunication access within the remote villages (Table 4-33). This would cause difficulty in building up connection with the communities from other parts of Sri Aman division and the neighboring area.

Table 4-32: General Town Profile and telecommunication Services

Infrastructure and Facilities	Divisional Town	District Town	Sub-District Town	Other Town
	Simanggang	Lubok Antu	Lingga, Pantu, Engkilili	Melugu, Lachau, Sg Tenggang
Telecommunication	Telecommunication Tower Internet Access Digital Terrestrial TV/Radio Satellite TV Wi-Fi Hotspot	Telecommunication Tower Internet Access Digital Terrestrial TV/Radio Satellite TV	Internet Access Digital Terrestrial TV/Radio Satellite TV	Internet Access Digital Terrestrial TV/Radio Satellite TV

Source: Sacofa and Sarawak Multimedia Authority

Table 4-33: Settlement Profile and Telecommunication Services

Infrastructure and Facilities	High Density, High Well Being	Settlement Areas		Low Density, Low Well Being
	Urban Residential	Suburb	Rural Villages	Remote Interior Village
Telecommunication	Land line 3G Mobile Broadband Wi-Fi Terrestrial/ Satellite TV Radio	Land line 3G Mobile Broadband Terrestrial/ Satellite TV Radio	2G Mobile Terrestrial/ Satellite TV Radio	Satellite TV Radio

Source: Sacofa and Sarawak Multimedia Authority

4.5.3.1 Telecommunication Towers

Presently there is a total of 81 telecommunication towers within Sri Aman Division;

- 31 in Sri Aman District,
- 16 in Pantu District,
- 2 in Lingga District,
- 11 in Lubok Antu District and
- 21 in Engkilili District.

The coverage is shown in Figure 4-42. Telecommunication services to the area are managed by Sacofa Sdn Bhd.

4.5.3.2 Cellular Telecommunication Services

There are 4 companies that provide cellular telecommunication services in Sri Aman Division: -

- Telekom Malaysia Berhad (TMB)
- Celcom (Malaysia) Bhd
- Maxis Communication Sdn Bhd
- Digi

TMB continues to maintain the ATUR (011) services for remote areas and where it has more extensive coverage but they are planning to further upgrade or expand their present services.

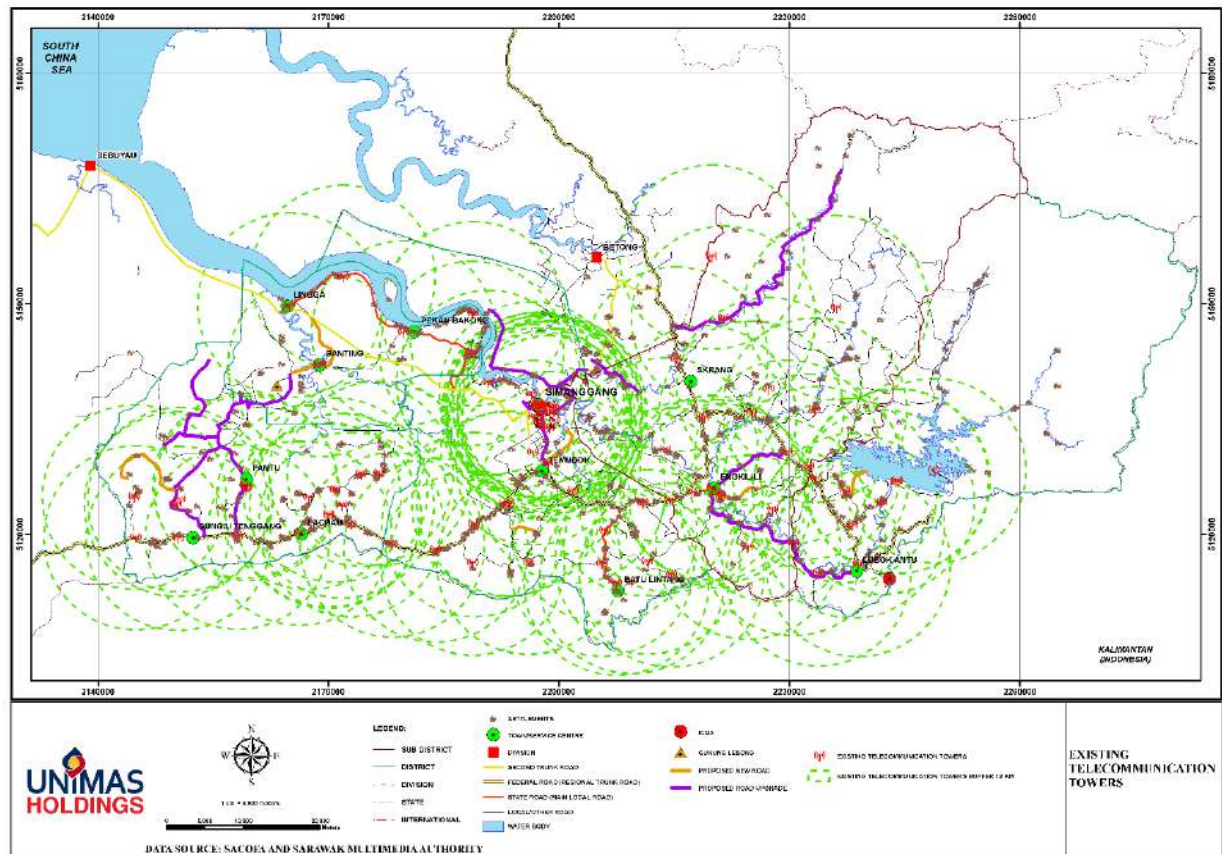


Figure 4-42: Existing Telecommunication Towers in Sri Aman

Source: Sacofa and Sarawak Multimedia Authority

4.5.4 Covid-19 & Its Impact on Telecommunications

The Covid-19 pandemic has resulted in an increased dependency on telecommunications to complete daily tasks in life. This reliance has become greater for people in both urban and rural areas. Without reliable telecommunications services in place, rural areas and remote places in Sri Aman have had reduced accessibility to the more urban areas, thus depriving them of certain services and needs. An example is the inability to engage in remote learning while the schools are closed during the pandemic.

Tower development work is still continuing in accordance with the instructions of the Sarawak State Government by following the proper Standard Operating Procedure (SOP).

4.5.5 Committed Plans

There are a total of 131 new towers to be installed under committed plans by the Government. These come under the following programs:

1. Jendela	-	45 Towers
2. Smart300 Phase 1	-	77 Towers
3. Smart300 Phase 2	-	19 Towers

Figure 4-43 shows the coverage provided by the proposed telecommunication towers together with the existing towers within Sri Aman division. The proposed telecommunication towers will enable better internet and IoTs coverage for the people in Sri Aman division.

The coverage from the existing and proposed towers assumes that each tower can provide coverage for a radius of 12 km. While topography may interfere with this coverage it can be considered a fairly conservative estimate for 4G coverage.

The result of the mapping indicates that fairly blanket coverage of Sri Aman Division can be achieved.

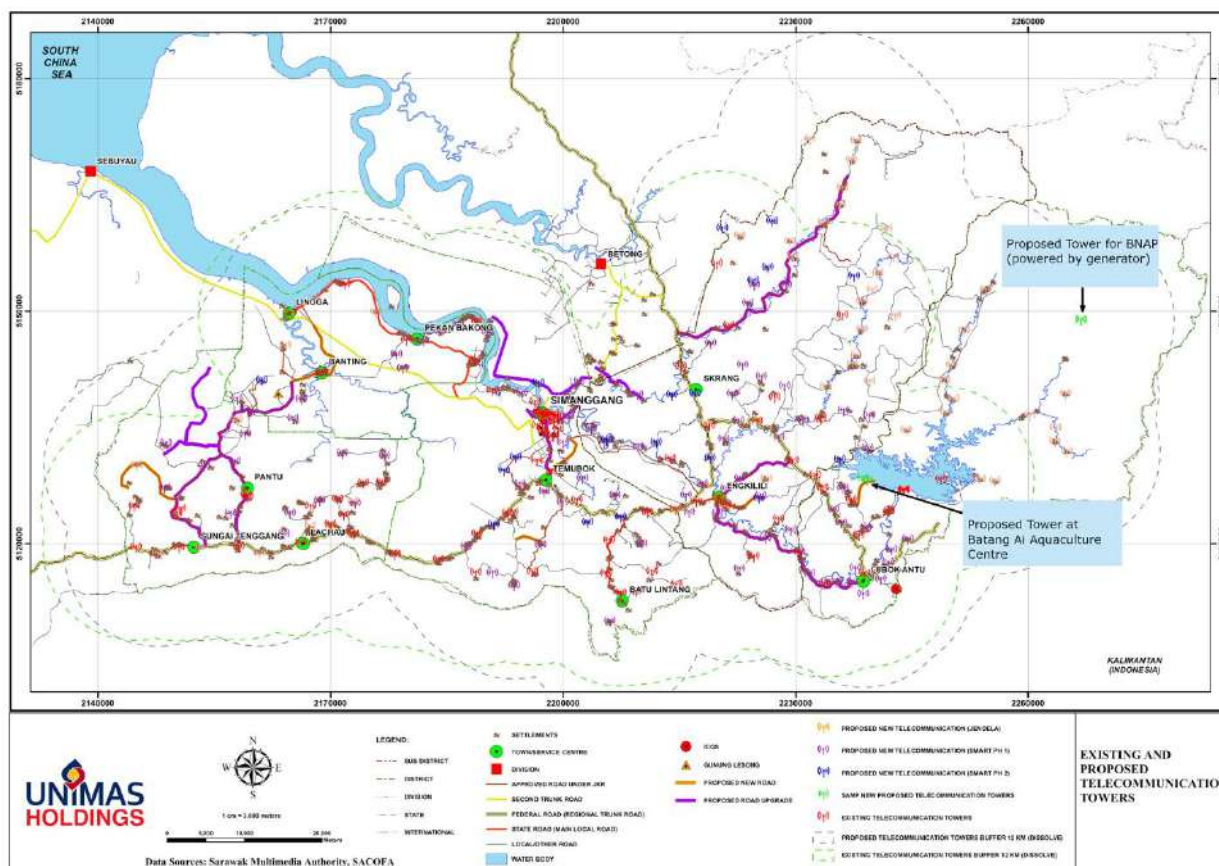


Figure 4-43: Telecommunication Tower Coverage Following Committed Project Implementation

Source: Sacofa and Sarawak Multimedia Authority

4.5.5.1 Proposal for State Government Owned Service Provider

There has been a reluctance on the part of commercial service providers to provide services to remote facilities, even if the tower infrastructure is provided. This is due to the low population numbers that will be serviced, resulting in low revenue compared with investment cost.

For this reason, the Sarawak Government has recently proposed setting up its own, government owned service provider. The business model for this is not available at present as of the time of writing. However, it can be assumed that they may subsidise this program through a levy on existing providers. In this way the well-served urban areas are able to support the marginalised rural and remote areas.

The coverage to rural and remote areas is critical to realise the agriculture development using smart farming methods, the marketing avenues for products and services and other proposals from the master plan that need the IT infrastructure and services to be in place.

4.5.6 Issues, Challenges & Opportunities

Sri Aman, with its large geographical area and low population density presents a challenging environment for the roll-out of telecommunications services.

The challenges faced by the SMA in the construction and installation of towers are

- difficult access roads (often logging roads),
- Some areas with river access only,
- land ownership disputes and difficulties in obtaining permission to erect towers
- hilly topography in certain areas.

4.5.6.1 *Very Small Aperture Terminal (VSAT)*

SMA has also taken the initiative to provide telecommunication services through the Very Small Aperture terminal (VSAT) as an interim solution in overcoming telecommunication problems experienced by the rural communities. The towers installed are not necessarily as high, some are placed on buildings or may be installed on lower ground (Figure 4-44).

The equipment rental cost is high (estimated RM70,000 per annum) to most individual residential and small commercial users.

VSAT is expected to assist rural entrepreneurs and farmers who need the internet to market their products and enhance connectivity with various agencies and organisations which can assist them.

4.5.6.2 *Fixed Wireless*

MOU and Danawa will collaborate on fixed wireless access to provide internet connectivity to rural communities in Sarawak, while PPTTEL MOPU will explore telecommunications infrastructure initiatives. PPTTEL will play a pivotal role in developing the underlying infrastructure to sustain the digital economy, giving Sarawak access to global internet content through new high-capacity submarine connectivity.



Figure 4-44: An Example of VSAT Dish Antenna from Maxis

SECTION 4.6 WASTE MANAGEMENT

4.6.1 Introduction

There are two distinct components to waste management – Solid waste, and Liquid Waste. They are both distinct and separate in the approaches used to manage each component.

4.6.2 Solid waste

Municipal Solid Waste (MSW) management in Malaysia is funded by the local authorities with support from both state and federal governments while, in Sarawak, it is only funded by the federal government.

In Sarawak the local authority (LA) is responsible for MSW management and it is required to establish or maintain a system for collection, removal and disposal of wastes from all premises within its area of jurisdiction as provided in the Local Authority (Cleanliness) By-Laws 1999. The local authorities are required to supply adequate waste bins at a cost to the owner or occupier of the premises. Figure 4-45 shows the model of municipal waste disposal in Malaysia.

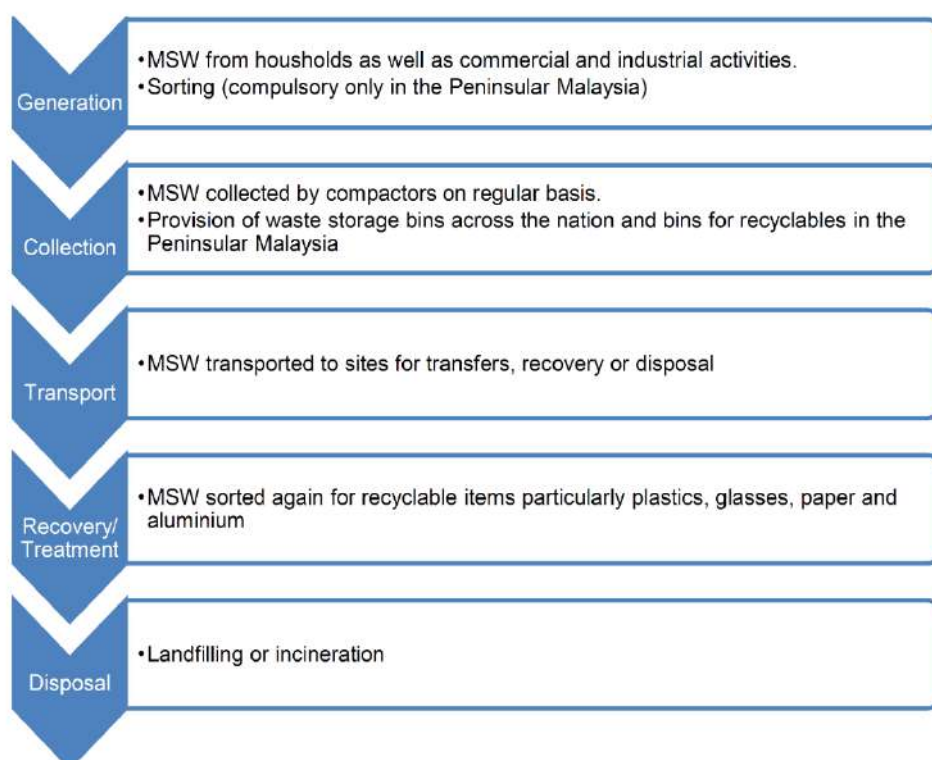


Figure 4-45: Flow of Municipal Solid Waste (MSW) Disposal Management

Source: PEMANDU. Solid Waste Management Lab 2015 - Final Lab Report (2015)

4.6.2.1 Classification of Solid Waste

Solid waste includes household, industrial, and commercial empty cans, boxes, papers, plastic bags, bottles, food remain etc. Typically, solid waste generated by premises is collected and transported to the dumpsites/landfills by the local authority.

Bulky and green waste are wastes from the gardens, old furniture, mattress, and other bulky items that do not fit into the bins provided. Besides disposing at the existing dumpsites/landfills, these bulky and green waste are often dumped illegally.

Construction and demolition waste are wastes associated with the construction sites which can be re-used or eventually disposed at dumpsites.

Scheduled waste are wastes that possess hazardous characteristics and there are a total of 77 types of scheduled wastes listed in the Environmental Quality (Scheduled Wastes) Regulations, 2005. Scheduled wastes can only be treated, recovered, or disposed at premises licensed by the Department of Environment. The nearest scheduled waste disposal site to Sri Aman is the Kuching Integrated Waste Management Park (KIWMP) which is licensed to dispose most of the scheduled wastes listed in the Environmental Quality (Scheduled Wastes) Regulations, 2005 except for radioactive wastes.

4.6.2.2 The Wider Picture – Solid Waste Disposal in Sarawak

Based on Ho (2020), Sarawak is faced with challenges of increasing solid waste generation which is putting pressure on its current landfill capacity. Increasing solid waste generation is related to increases in population, and increasing packaging waste in line with commercial trends in production.

In 2018, Natural Resources and Environment Board (NREB) stated that only 5 of the 46 landfills in Sarawak are sanitary landfills. These are:

- Kemuyang Sanitary Landfill in Sibu,
- Sibuti Sanitary Landfill in Miri,
- Kuching Integrated Waste Management Park (KIWSMP),
- Maradong Sanitary Landfill in Sarikei and
- the Rural Rubbish Disposal Facility in Kuching.

Currently 8 landfills in Sarawak have been classified (one is level-4, four are level-3, and three are level-2) as shown in Table 4-34, while the rest are level-1 landfills and open dumpsites.

Sarawak also has Lambir Transfer Station that operated by Majlis Perbandaran Miri where it serves as the only transfer station in the State to transit for MSW collected remotely from the landfills.

Table 4-34: Dumpsites and Landfills servicing in Sarawak

Local Authorities	Servicing Landfill/Dumpsite	Area (ha)	Weight of MSW Received (tonne per day)
Limbang	Level 2 Landfill	1.8	21.5
Marudi	Marudi dumpsite	1.5	6-8
	Long Lama dumpsite	2.7	4
	Sibuti level 3 sanitary landfill for Beluru Sub-district	100	1
Bau	Open dumpsite	4	60
Lundu	Open dumpsite	3.74	40
Betong	Lidong dumpsite	2.28	22
	Spaoh dumpsite	0.44	12

Local Authorities	Servicing Landfill/Dumpsite	Area (ha)	Weight of MSW Received (tonne per day)
	Debak dumpsite	1.38	12
	Pusa dumpsite	1.76	12
	Maludam dumpsite	3.28	12
Dalat and Mukah	Dalat dumpsite	2.8	48
	Balingian dumpsite	2.4	12
Lubok Antu	Lubok Antu level 1 landfill	3	10
	Engkilili level 1 landfill	3	10
Maradong and Julau	Maradong level 2 sanitary landfill	4.07	17
	Julau dumpsite	2	4
	Pakan dumpsite	2	4
Serian	Tebedu level 2 landfill	1.7	10
	Batu Lapan open dumpsite	5.3	130
	KIWMP for outer Serian		NA
Sri Aman	Entulang dumpsite	1	26.5
	Lingga dumpsite	2.5	1.34
	Pantu dumpsite	0.6	1.6
Simunjan	Kampung Pendek dumpsite	2	1.77
Miri	Sibuti level 3 sanitary landfill	100	232
	Kuala Baram dumpsite	27.5	100
	Bario temporary dumpsite	0.5	1
Saratok	Bukit Peradun dumpsite	5.5	23
	Paya Span dumpsite	2.5	10
Subis	Sibuti level 3 sanitary landfill	100	11
Lawas	Kuala Lawas open dumpsite	6.13	11
Kuching	KIWMP (Level 4 sanitary landfill)	112	513
Sibu	Kemuyang Level 3 sanitary landfill	5.3	133

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

The compactor trucks collect the MSW along the access road or at designated zone and deliver to the disposal sites. The MSW is then pushed and levelled by excavators and/or roller compactors.

4.6.2.2.1 Sanitary Landfills

All the sanitary landfills are well guarded, gated and regulated where the activities of scavenging and construction and demolition disposal are banned.

4.6.2.2.2 Open Dump sites

Dumpsites are typically not gated and secured, making them open to scavengers as well as the public to carry out open burning at dumpsite to recover recyclable metals due to lack of prohibition. Construction and demolition waste as well as tyres and electrical waste are typically found at dumpsites.

In addition, illegal dumping at remote areas such as Tanjung Dato and Teluk Melano in Lundu, is occurring where there is an absence of waste collection services.

4.6.2.3 Proposed landfill site improvements

New landfills and upgraded projects of existing sanitary landfill has continuously been proposed by the local authorities to upgrade waste disposal facilities in Sarawak a 10 ha level 2 landfill has been proposed for Dalat and Mukah whereas in Tebedu, the existing sanitary landfill has been anticipated to be upgraded. A 100 ha site near Jalan Bakam has been allocated for landfill development for Miri and Sibu while a 13.3 ha sanitary landfill has been proposed in Limbang. A level 3 landfill of 200 ha has been proposed in Bau that will be shared with Lundu.

4.6.2.4 Solid waste composition

Waste composition in Sarawak has a large proportion of food residue as shown in Table 4-35.

Table 4-35: Waste Composition for Small, Medium and Large Local Authorities

Water Category	Category of LAs		
	Small (%)	Medium (%)	Large (%)
Food waste	39.6	43	39.8
Yard/Garden Waste	1.6	3.4	2.8
Wood	0.3	0.7	0.5
Paper	11.6	13.1	14.2
Plastics	15.9	11.7	19.6
Glass	1.9	2.6	2.8
Metals	2.7	1.5	2.4
Hazardous waste	0.7	0.2	0.4
Textile	4.5	4.5	4.3
Rubber	0.3	1.1	1.1
Diapers	18.4	15.7	9.9
Leather	0.2	1	0.5
Others	2.4	1.6	1.7

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

According to the data shown in Table 4-35, the largest proportion of total waste generated comes from food residue. Plastics and diapers are ranked second and third respectively for small local authorities' that handle waste disposal. As for the medium LAs, the most abundant wastes after food are diapers and paper that fall in second and third respectively. From the table shown it can be concluded that food residues, diapers, plastics and paper are all within the major categories. The consistency of the waste composition is similar to the national household survey where food waste was the most abundant (44.5%), followed by plastic (13.2%), diapers (12.1%) and paper (8.5%).

4.6.2.5 Solid Waste in Sri Aman compared with other Districts

Based on Ho (2020), the Sri Aman Division has low daily MSW generation compared to the other districts in Sarawak where Kuching has the highest (690 tonnes), followed by Miri (281 tonnes), Serian (176.7 tonnes) and Betong (70 tonnes). Each of Sri Aman and Lubok Antu Districts has below 70 tonnes per day of daily MSW generation as shown in Figure 4-46.

The per capita generation rate is shown in Figure 4-47. Sri Aman District averages less than 0.4 kg/person/day of MSW while Lubok Antu District comes in higher at 0.6 kg/person/day. This indicates that Sri Aman Division generates a significant amount of MSW considering the population size.

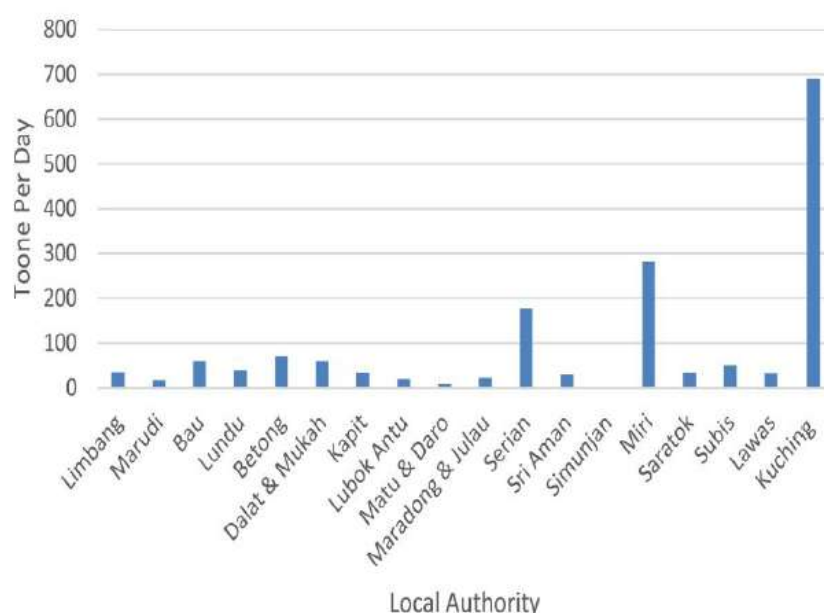


Figure 4-46: Daily Tonnage of MSW Generated from Local Authority

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

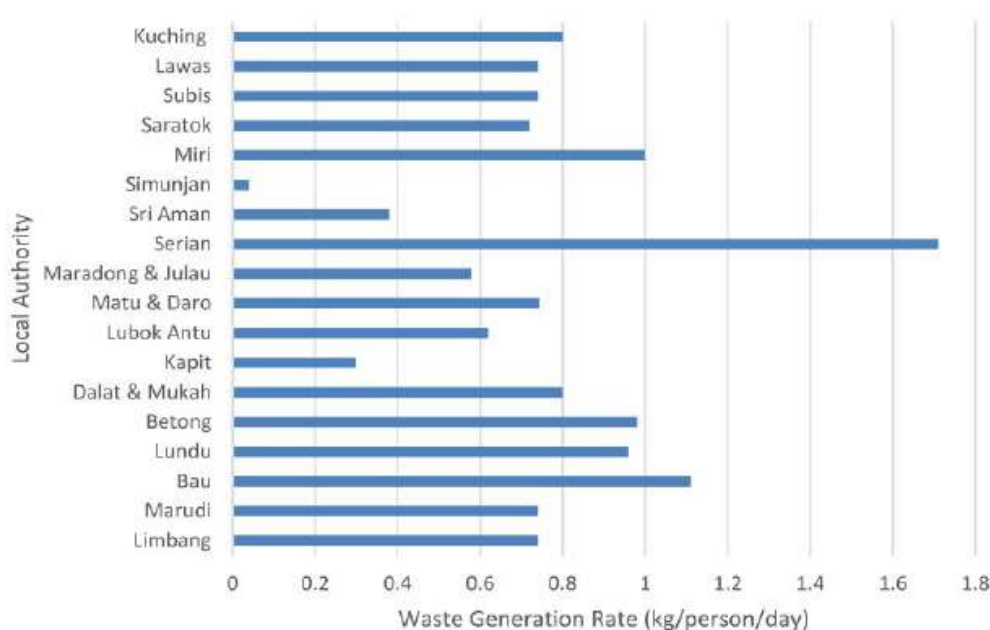


Figure 4-47: MSW Generation per capita rate by Local Authority

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

The MSW collection coverage differs among local authorities in Sarawak as shown in Table 4-36. The property type in the tabulated data are divided into three types, i.e. residential, commercial, and industrial. The urban and suburban houses and longhouses are categorized in residential properties. As for the commercial properties it comprises shophouses and malls. The industrial properties cover factories, workshops and other industrial lots located in designated small, medium and large industrial estates.

Sri Aman and Lubok Antu Districts have relatively low MSW collection coverage for residential properties due to the fact that many remote areas are not accessible by roads. In some cases where there are roads, the road width and condition do not permit the access of collection vehicles.

Table 4-36: MSW Collection Coverage (%) by Local Authority

Local Authorities	Property Type		
	Residential	Commercial	Industrial
Limbang	66.4	82.5	100
Marudi	17.2	17.3	41.2
Bau	89.1	98.1	75.6
Lundu	93.6	93.7	48.2
Betong	62	76.6	16.3
Dalat and Mukah	74.8	94.7	99.3
Kapit	24.5	53.3	23.1
Lubok Antu	32.8	82.9	NA
Matu and Daro	47.6	76.7	64.1
Maradong and Julau	12.6	58.8	92.2
Serian	79.8	100	91.8
Sri Aman	44.5	84	87
Simunjan	38.4	41	41
Miri	99	99.7	99.5
Saratok	40	90.7	48.4
Subis	76.6	98.6	91.7
Lawas	54	97.9	1.4

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

4.6.2.6 Waste Disposal in Sri Aman

4.6.2.6.1 Sri Aman District

The Sri Aman District, there are three open dumpsites for waste disposal. Table 4-37 shows the dumpsite in Entulang caters for the waste collection from residential, commercial and industrial areas at Simanggang town, Melugu, Pakit Temudok, Bayai Klasin and Batu Lintang in Sri Aman, while Pantu and Lingga open dumpsite caters residential area at Pantu and Lingga. A proposed new landfill site at Bukit Gran is yet to be implemented.

Table 4-37: Dumpsite in the Sri Aman District

Dumpsite/ Landfill	Location	Status	Size (ha)	Daily Tonnage	Coverage Area
Entulang	Sri Aman	Permanent	1	18.17	Residential area, Commercial areas, schools, villages from Simanggang Town, Melugu, Pakit, Temudok, Bayai, Klasin, Batu Lintang
Pantu	Pantu	Permanent	0.6	1.07	Selepong, Gua, Punggu, Lachau, Pantu, Sg. Tegang
Lingga	Lingga	Permanent	2.5	0.54	Pruan, Gran, Stumbin, Lingga, Bakong, Tg. Bijat
Bukit Gran	Sri Aman	Permanent	8.6	-	Pending Project from 2007

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

4.6.2.6.2 Lubok Antu District

In Lubok Antu District, there are two level-1 sanitary landfills as shown in Table 4-38.

Table 4-38: Dumpsite in Lubok Antu District

Dumpsite/Landfill	Location	Status	Size (ha)	Daily Tonnage
Lubok Antu	Lubok Antu	Level 1 Sanitary Landfill	3	10
Engkilili	Engkilili	Level 1 Sanitary Landfill	3	10

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

The location of existing landfill sites in Sri Aman is shown in Figure 4-48.

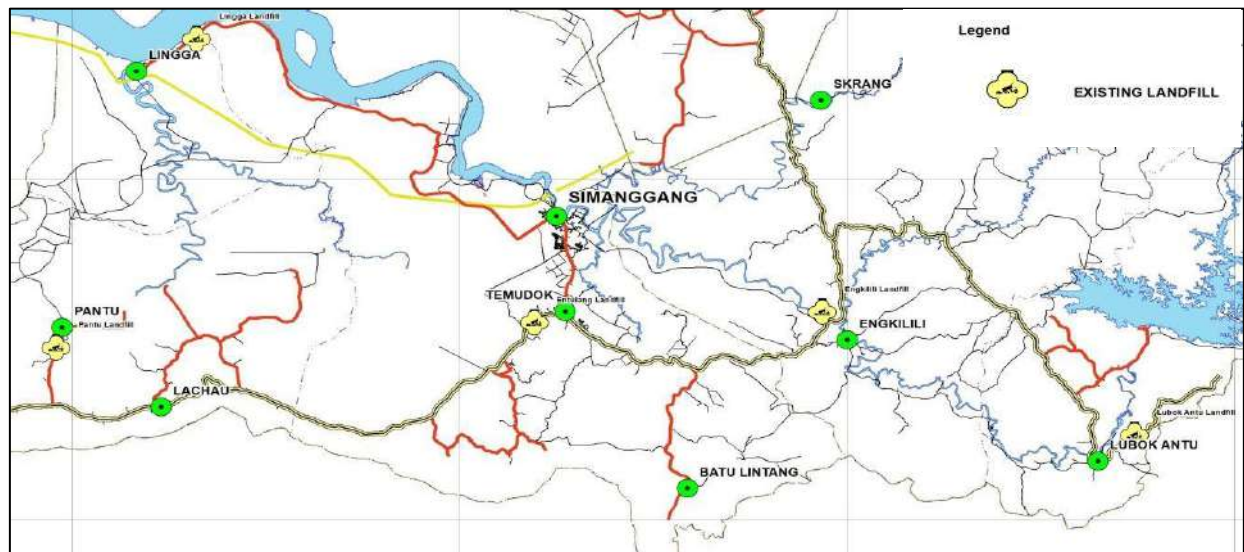


Figure 4-48: Location of existing landfill sites in Sri Aman Division

Source: Sri Aman District Council, Sewerage Services Department Sarawak

Photos of some of these landfills are provided in Figure 4-49, Figure 4-50 and Figure 4-51.

4.6.2.6.3 Entulang Open Dumpsite



Figure 4-49: Dumpsite in the Sri Aman District

Source: Google Street Map (2015)



Figure 4-50: Aerial view of Entulang Landfill site

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

4.6.2.6.4 Lubok Antu Level 1 Sanitary Landfill



Figure 4-51: Aerial view of Lubok Antu Landfill site

Source: Municipal Solid Waste Management in the Sarawak State of Malaysia and the Way Forward (September 2020)

4.6.2.7 Waste Collection

Smaller and remote local authorities of Sri Aman have lower MSW collection coverage than larger and more developed local authorities. MSW is collected generally from 2 times a week to daily using compactor trucks equipped with bin-lifters. Bins smaller than 240L are usually emptied manually. Waste collection is zoned in each LA and contracted to qualified contractors. Collected MSW is sent to dumpsites or landfills.

As for rural residential areas in Sri Aman, the MSW collection occurs fortnightly.

Sri Aman District collection frequency is twice a week in industrial zones which are typified by schools, government offices, hospitals and community halls compared to most other LAs where the MSW is collected from three times a week to daily. The geographical location and property types can influence the frequency of collection at institutional properties. This can be observed within the urban-rural variation at Sri Aman where the collection happens daily within urban area while in rural area the collection ranges from 2-3 times weekly.

4.6.2.8 Covid-19 & Its Impact on the Waste Disposal

During the pandemic it is expected that overall MSW generation would decrease as shown in Figure 4-52. It is too early to conclude that a spike in plastic usage during the pandemic will occur, without having actual statistics. The increase of plastic usage is related to the demand for food or goods packaging for deliveries or take outs. As the pandemic continues, the demand for plastics for medical purposes has shown considerable amount of increase. The plastic demand during the lockdown, however, has started to show a decrease in production and usage especially in the industry of transport, construction, leisure etc.

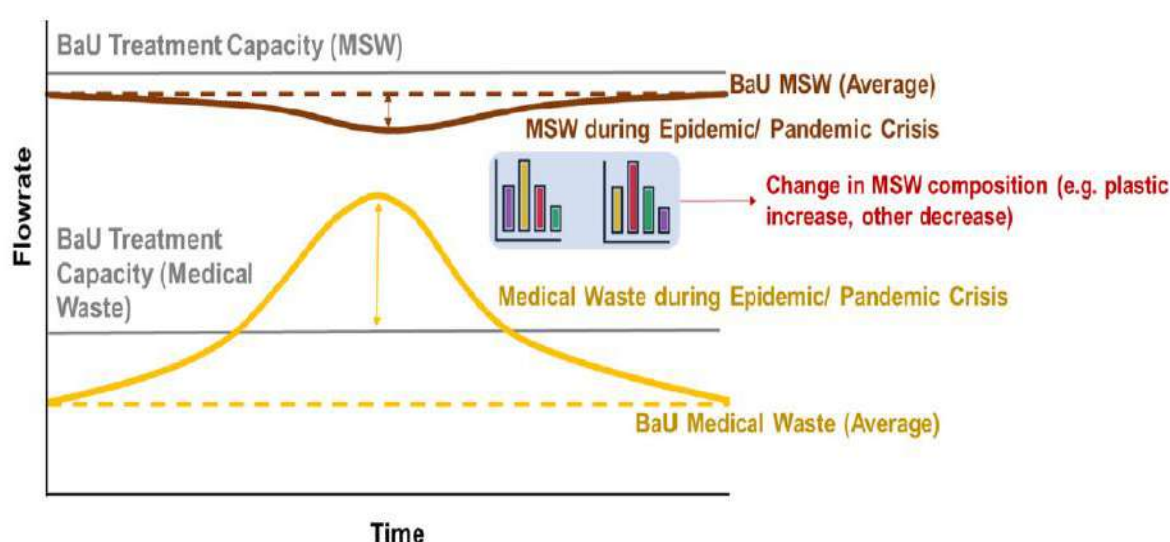


Figure 4-52: The expected trend of medical waste and MSW

Source: An Update of COVID-19 Influence on Waste Management (August, 2020)

The impacts and challenges are summarised in Figure 4-53.

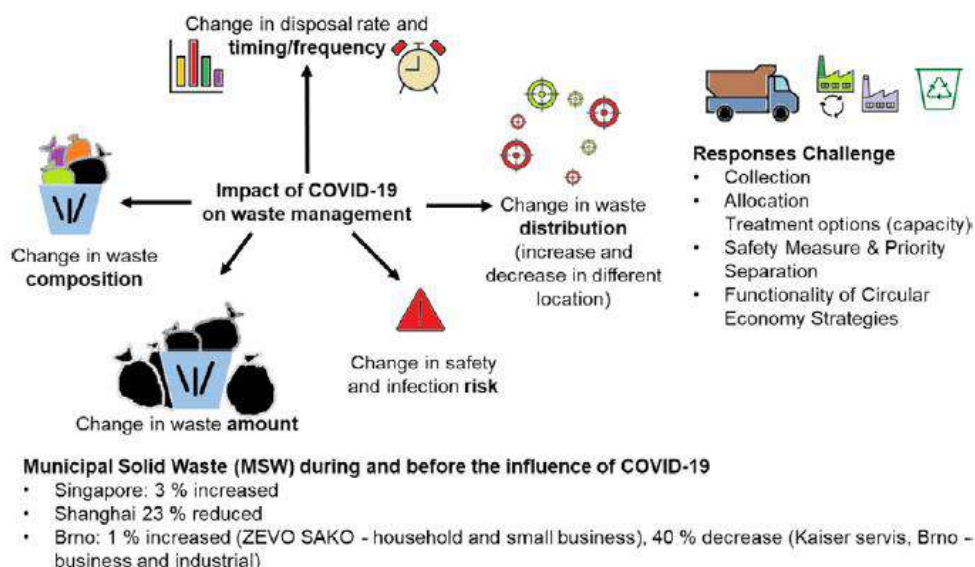


Figure 4-53: Impacts and Challenges of COVID-19 on Waste Management

Source: An update of COVID-19 influence on waste management (August, 2020)

The impacts and challenges of COVID-19 on waste management including the change in waste composition, waste amount, disposal frequency and timing, distribution and infection risk as illustrated in Figure 4-53. COVID-19 has affected one of the waste management approaches which is the circular economy, where the highlight is on retain, reuse and recycle etc. During this crisis it is difficult to continue recycling practices due to the risk of infection exposure to workers involved in sorting and handling waste. It was reported by Resource Recycling Inc (2020), since mid-March the pandemic has been impacting the US recycling programs.

4.6.2.9 Issues, Challenges & Opportunities for Solid Waste Management

Due to the large land area, lack of rural connectivity and difficult terrains, MSW management is particularly challenging and has resulted in low MSW collection coverage in remote and rural LAs.

As the population increases, the state is experiencing an increase in waste generation, testing the capacity of the existing dumpsites or landfills. The increase in infrastructural development, particularly of road networks, also leads to an increase of MSW collection coverage.

4.6.2.9.1 Remote Areas

The accessibility of rural settlements is a major obstacle of MSW collection in most LAs where road access is limited in the remote areas. Some of the road conditions in these areas are not viable for the access of collection vehicles. This has caused the rural settlements to have lower MSW collection coverage in most LAs with higher proportion of hard-to-access rural settlements.

As a result, the solid waste within these areas is commonly buried, or dumped directly into the river.

4.6.2.9.2 Prohibited Waste

Construction, demolitions wastes and electrical waste which are prohibited from landfills are often disposed of in illegal dumping grounds due to lack of awareness of proper disposal of waste in Sarawak. This activity is commonly found particularly at remote areas that are not covered by the waste collection services. As new landfills are being proposed, or existing landfills are upgraded, the LAs will continuously upgrade the facilities for this type of waste disposal.

4.6.2.9.3 Logistical Challenges

There are five major problems in MSW management of the LAs in Sarawak which also apply to Sri Aman Division.

- 1) The terrain and accessibility are a major factor and constraint limiting the ability to have wholistic waste collection across the Division
- 2) The existing dumpsites capacity is being reached due to the increasing waste generation.
- 3) The MSW received at the landfills and dumpsites consists of a large proportion of organic waste particularly food residues.
- 4) The limited recycling facilities and agents in Sarawak has resulted in limited waste segregation and recycling activities. Hence an efficient system for recycling has yet to be established.
- 5) LAs are facing financial constraints which limit efficient MSW management.

4.6.3 Solid Waste Recycling

4.6.3.1 Recycling and the Sustainability Trend

There is a continuing and expanding trend within Government and communities across the world to reduce their environmental footprints, to be more efficient in our use of resources, and to protect our environment. Waste disposal and management can play a major role in this process, through reducing disposal to landfill, and recycling waste into useful products.

Waste being disposed in landfills can have a huge negative impact on the natural environment. Harmful chemicals and greenhouse gases are released from rubbish in landfill sites. Recycling can help to reduce the pollution caused by waste.

Waste disposal represents a significant cost to the public purse. With recycling, a portion of this waste can be turned from a significant cost, to a potential profit. Even if the cost is only reduced but the environmental impact also significantly reduced this will still represent a real positive for Sarawak's environmental sustainability.

While the momentum for implementation of waste recycling schemes is growing in Sarawak, the facilities to realise this are not yet readily available. Constraints of land cost in the main cities, proximity to residential areas, and logistics of waste segregation all contribute to this.

4.6.3.2 *The Role Sri Aman Can Play*

Sri Aman is well placed to establish a state-of-the-art waste recycling industry. It could be developed on a greenfield site, well away from residential areas, and service recyclable waste from surrounding Divisions. With the increasing focus on reducing waste and recycling there would be a constantly growing market for these services. There is also a growing range of products that can be produced from waste apart from paper and recycled plastics and glass. Concrete from demolitions is often ground down to form road base, plastic bottle material is used for polar fleece clothing, rare metals are extracted from electronic goods, waste to energy power plants, etc.

The rationale of this proposal is that it will be relatively difficult to set up an efficient recycling industry in Kuching or Sibu, due to limitations on land availability and cost of land, as well as the difficulty of gaining acceptance by the community in the vicinity of the site. Sri Aman has land that is not suitable for agriculture or for urban development, but could be made suitable for a dedicated waste recycling centre serving both Kuching and Sibu, as well as Sri Aman. The key is to have waste segregation undertaken in these larger towns, with waste, that is already sorted, delivered to Sri Aman for processing into recycled products. The distance from Kuching and Sibu to Sri Aman is not excessive for this purpose.

Sri Aman itself is too small and too dispersed to justify a stand-alone dedicated recycling effort. To achieve scale, it must be designed to service larger towns such as Kuching and Sibu. The community demand for recycling as an important component in environmental sustainability will come from these larger towns first (Kuching and Sibu). The Sri Aman community is unlikely to lead in this effort, but will be a ready follower once facilities are available and it is adopted in the larger towns.

However, a State-of-the-Art recycling Industry Park could be established at a suitable site in Sri Aman. It will have facilities dedicated to recycling of a range of waste materials. Such a project is outlined in Volume C of this report.

4.6.4 **Liquid Waste - Sewerage**

In terms of waste-water management, sewage (black water) is typically routed to septic tanks whereas sullage (grey water) is typically discharged directly into nearby drains and thence to waterways.

Industrial effluents are liquid waste or wastewater that is generated from manufacturing processes, including treatment of water for water supply or any activity occurring at any industrial premises. Industrial effluent is to be treated as per the Environmental Quality (Industrial Effluent) Regulations, 2009.

However, it is noted that the processing of oil-palm fruit or oil palm fresh fruit bunches into crude palm oil whether as intermediate or final product is managed under the Environmental Quality (Prescribed Premise) (Crude Palm Oil) Regulations, 1977.

4.6.4.1 *Maintenance of Septic Tanks*

Septic tanks are required to be maintained to ensure efficiency. Regular desludging is recommended in order to maintain the efficiency of septic tanks. As per the Local Authorities (Compulsory Desludging of Septic Tanks) Amendment By-Law 2002, desludging activities are under the purview of the local authority and the recommended desludging frequencies as per the bylaw are shown in Table 4-39.

Table 4-39: Septic Tank Maintenance frequency (recommended)

Landuse Category	Desludging Frequency
Residential, including government staff quarters	Once in 4 years
Commercial, including commercial complexes	Once in 2 years
Government buildings, schools and premises used for religious purposes	Once a year
Hotels, hostels, lodging houses and industrial properties	Once in 6 months

Source: Local Authorities (Compulsory Desludging of Septic Tanks) Amendment By-Laws, 2022

Sludge from septic tanks is further treated at septic sewage treatment plants. Currently, there are no sewage treatment plants in the Sri Aman Division. The nearest septic sewage treatment plant from the Study Area is the Matang Septic Sewage Treatment Plant located in Kuching.

Therefore, more regional septic sewage treatment plants at strategic locations should be constructed to facilitate the transportation and logistic arrangement of desludging activities.

4.6.4.2 Construction of Regional Septic Sludge Treatment Facility

Under the eleventh Malaysian Plan (RMK-11), the Sri Aman-Betong Septic Sludge Treatment Plant has been proposed to serve the Sri Aman and Betong Division. The proposed Sri Aman-Betong Septic Sludge Treatment Plant is located next to the existing Betong Landfill, approximately 5 km from Betong Town. This treatment plant is designed to have an ultimate capacity of 100 m³/day. The project has a budget of RM15 million. While the design is completed, a completion date for the project has not yet been set.

Treated sludge can be further dried into fertilizers for landscaping purposes.

4.6.4.3 Issues, Challenges & Opportunities for Liquid Waste Management (Sewage)

4.6.4.3.1 Remote Communities

Many remote communities are provided with communal septic tank facilities. However, the maintenance of these is not practical and most are operating inefficiently as a result of lack of desludging.

Water polluted by sewage, if inadequately treated, represents a potential health issue for anyone who ingests the water or, in extreme cases, even comes in contact with it. At current levels there are risks associated with swimming, bathing, washing, drinking the river water downstream of settlements.

It is also likely that local communities are not trained in the management and maintenance of the systems, and the hazards associated with systems that work inefficiently.

4.6.4.3.2 Maintaining Septic Systems

Septic systems tend to be maintained on a responsive basis – that is when a system backs up, or is causing nuisance (odour, effluent) in its operation. Maintenance activities are further disincentivized by the fact that there is no facility available in the region to dispose of the sludge removed from septic tanks.

4.6.4.3.3 Costs Associated With Monitoring And Maintaining Sewerage Systems

No revenue is derived from running the local sewerage system. Any monitoring and maintenance activities undertaken by local authorities must be covered under general expenditure, and is rarely allocated its own budget. Thus, these activities tend to have low priority.

SECTION 4.7 SOCIAL AND COMMUNITY

4.7.1 Introduction

Social and community facilities link health, community wellbeing and the environment. The health of a community is determined by a range of factors including social disadvantage, population characteristics, social cohesion, access to social infrastructure, safety, housing affordability and density, transport and accessibility, physical activity and the availability of open space, exposure to pollutants and hazards, and climate change.

Social infrastructure refers to the community facilities, services and networks that help individuals, families, groups and communities meet their social needs and maximise their potential for development, and enhance community wellbeing. They include:

- education facilities and services such as universities, colleges, primary and secondary schools, training, health, open space, recreation and sport, safety and emergency services, religious, arts and cultural facilities, and community meeting places
- lifecycle-targeted facilities and services, such as those for children, young people and older people
- Hospitals and public health care centres
- targeted facilities and services for groups with special needs, such as families, people with a disability, and culturally diverse people

Investment in social infrastructure is essential for the health, wellbeing and economic prosperity of communities. It plays an important part in bringing people together, developing social capital, maintaining the quality of life, and developing the skills and resilience essential to strong communities

4.7.2 The Wider Picture – Social and Community Facilities in Sarawak

Social infrastructure has a long tradition in Sarawak. The state was already relatively well developed at the end of the 19th century during the Brookes era. The Sarawak General Hospital has been in existence since 1870. Based on existing documentation, in 1910, the hospital was initially located at the current site of the Kuching Central Prison and had a total of 920 patients that were admitted to the hospital during that year.

The first school in Kuching was also established under the Brookes administration in the mid-19th century. The most famous school, the Kuching High School was founded in 1916 by Kuching Teochew Association, an association for the Teochew community in Kuching.

After joining the Malaysia Federation in 1963 there was a strong emphasis from the Federal and State Governments to build new social infrastructure across the state. As a result, numerous schools, hospitals and sports facilities were built in Sarawak.

The last two decades witnessed a surge in the development of private medical clinics and hospitals in Sarawak. Private hospitals, private specialist medical centres and private medical clinics have mushroomed in every major city in the state. Private schools have also flourished across the state. In

Kuching alone, there are currently 21 private schools catering to children from the middle- and higher-income society.

4.7.3 Sri Aman's Place Within Sarawak's Facilities

The Sri Aman Division has two Districts, namely Sri Aman and Lubok Antu; and three sub-districts that are Lingga, Pantu and Engkilili. Sri Aman is 2,323.7 km² in size and comprising 377 kampongs; while Lubuk Antu is 3,142.6 km² with 286 kampongs. Currently, there are 64 primary schools, six secondary schools, and two GiatMARA centres in the Sri Aman Division (APAC Directory on Malaysian Education, 2020). 57 per cent of schools are located in the Sri Aman District and another 33 percent located in Lubuk Antu which commensurate with 78,300 people and 33,100 people respectively in each district. The teacher to student ratio is approximately 1:6 to 1:8.6 which is slightly above average for primary schools and comparable to the national standard for the secondary school. The schools are spread across the Sri Aman Division, both in Sri Aman and Lubuk Antu districts covering Temudok, Tg Bijat, Melugu, Pantu, Lingga, Engkilili areas

The Sri Aman Hospital is a general hospital built-in 1959. Currently, it has only two specialist staff (a general medical specialist and an obstetrics and gynaecology specialist, provided in August 2011), with many medical emergencies being transferred to the Sarawak General Hospital to undergo care. The hospital provides a flying doctor service for the local rural population. A new hospital currently under construction, shown in Figure 4-54, delayed due to Covid-19, will replace the older hospital which will be transformed into a polyclinic. The new Sri Aman Simanggang Hospital potentially offer 108 beds and within easy access for residents in Lubuk Antu, Simunjan and Betong. The new hospital is located in Simanggang in the Sri Aman District approximately 1 km from the former hospital.

An image of the new hospital under construction is shown in Figure 4-54.



Figure 4-54: New Hospital in Sri Aman under construction

Other healthcare facilities include public and private medical clinics which offer a range of services. Altogether there are 15 public Health Clinics, one Clinic 1Malaysia, one Pusat Perancang Keluarga Sri Aman. Additionally, there are 11 school dentists to cover dental services for school-going children.

Private health clinics are mostly located in Sri Aman District including 6 clinics, four pharmacies and one dental clinic.

Sports complexes have always been described as multi-purpose playing fields that bring communities together, their construction, use and funding often enter the public discourse to the advantage of the communities. Residents, football associations etc. in Sri Aman Division have access to two sports complexes, three football fields and one indoor mini stadium.

Befitting of the 2020 population of 111,400 people for Sri Aman (Department of Statistics Sarawak, 2020), and the wealth of nature and environment here, there are 7 children's playground and 15 natural recreation areas covering National Parks, Waterfalls, recreation areas. All of them are spread across the two districts.

The existing social and community facilities are shown in Table 4-40.

Table 4-40: The Existing Social and Community Facilities in The Sri Aman Division

Health Facility	Number	Community Facility	Number	Schools	Number	Teachers	Teacher-Student Ratio
Hospital	1	Children's Playground	7	Secondary	6	512	1:11 to 1:12.8
Health Clinics	15	Recreation Areas	15	Primary	64	1131	1:6 to 1:8.6
Clinic 1Malaysia	1	Indoor Mini Stadium	1	GiatMARA	2	6	1.15 to 1:4.8
Dentistry:		Suarah Hall	1				
School dentistry	11	Sports Complex	2				
Dental Clinic	1	Public Library	3				
Private Clinics	6	Football Field	3				
Pharmacies	4	Banks	7				
Fitness Centre	1	Hotels	12				
Pusat Keluarga Sri Aman	1	Homestays	1				

Source: EPU Sarawak, JKR Sarawak and PPD Sri Aman

4.7.4 Sri Aman Ethnic Profile and Community Building

The residents of Sri Aman are predominantly Iban with over 71,000 inhabitants (67% of the total population). This is followed by the Malays and the Chinese. Other ethnic groups included the Bidayuh and Melanau scattered throughout the hinterland with many of them living in traditional longhouses. Around 1500 residents are non-citizens mainly migrant workers from Indonesia. The ethnic breakdown in Sri Aman is shown in Table 4-41.

Table 4-41: Demographic Structure of Sri Aman District

Ethnic Group	
Iban	71,500 (67%)
Malay	20,000
Bidayuh	700
Melanau	200
Chinese	11,500
Indian	400
Other Bumiputera	700
Non Malaysia	1,500
Total	106,700

Source: SADA, 2016 and State Planning Unit (2016)

Community building is also an integrated part of regional planning. Building new communities involve not only the built environment, but also how people live and work together with the relationships that are formed in that community, and how the community develops over time, and its capacity to deal with and respond to change.

Community engagement relates to the decision-making processes involving state and local government and community interactions. They range from information sharing to community consultation, and in some instances, active participation in government decision making processes. This requires a good understanding of the special needs and interests of different ethnic groups within the community. The diverse ethnic structure of Sri Aman requires a strong working relationship between the state government, Sri Aman Development Agency (SADA), the local district authorities and representatives from all ethnic groups

Examples of Iban cultural events and artwork are shown below.



4.7.5 Pandemics and their Impact on the Community Facilities

Based on the recent COVID pandemic it is clear that pandemics and epidemics can target community centres and facilities such as schools and sports venues. Therefore, safety plans and guidance should be drafted to ensure safe operation and maintenance of such centres.

As part of the Master Plan, it is essential to draft overarching planning and design principles and guidelines for all schools, sports facilities and community centres. New space for additional hospital beds should be envisaged as part of the future planning

4.7.6 Social and Community Facilities Resource Inventory

Based on a predicted increase in residential population of around 50,000 over the next decade there will be a need for additional schools, sports facilities and hospital beds in the Sri Aman Division. Currently, a majority of new secondary schools are located in Simanggang. Majority of the household heads are demanding the setting-up of higher educational institutions within their localities. To them this is one way to stop the out-migration of their youths. Sri Aman should have a state-owned Institution of Higher Learning (IHL) offered course not available in CENTEX's Betong. Hostel accommodation should be provided as part of the new secondary school complex for all students living in remote areas of the Sri Aman Division. The future primary and secondary schools should be evenly distributed in the Sri Aman and Lubuk Antu districts. Provision of primary schools in the less accessible hinterland should be strongly considered.

Table 4-42 shows the requirement for new schools, new hospital beds and new sports facilities as a result of a population increase of 50,000 in the next decade. Based on data from the Department of Statistics Malaysia, the school-going population will be approximately ranging from 40 per cent to 60 per cent of the net population increase.

Population	2020	2030
Population aged 0-14 years	23.6	21.9
Population aged 15-64 years	68.6	66.8
Population aged 65 years and over	7.8	11.3

Source: Malaysia Department of Statistics 2020

Hence, the number of existing schools, hospitals and sports facilities in 2020 and the required number in 2030 as a result of population increase are shown in table above.

Table 4-42: Proposed New Schools, Hospital Beds and Sport Facilities in The Sri Aman Division

Social Infrastructure	2020	2030
Schools	72	Schools for 15000 students and more
Hospitals	1 old, 1 new	1 (92 beds)
Sports Facilities	1 mini stadium	1 major sport stadium

Source: EPU Sarawak, JKR Sarawak, UNIMAS and Frost & Sullivan analysis

It is recommended that the new hospital should be located in the Lubuk Antu District as currently there is no hospital there. The provision of future public medical clinics should also mainly target the Lubuk Antu District.

4.7.7 Committed Plans & Project Proposals

As of writing this report, a new hospital is currently under construction and targeted for completion in 2021. The Medan Niaga Sri Aman which is also under construction will provide business space units for the public engagement in entrepreneurship.

An overall map showing the location of schools (primary and secondary), sporting facilities and the two hospitals in shown in Figure 4-55.

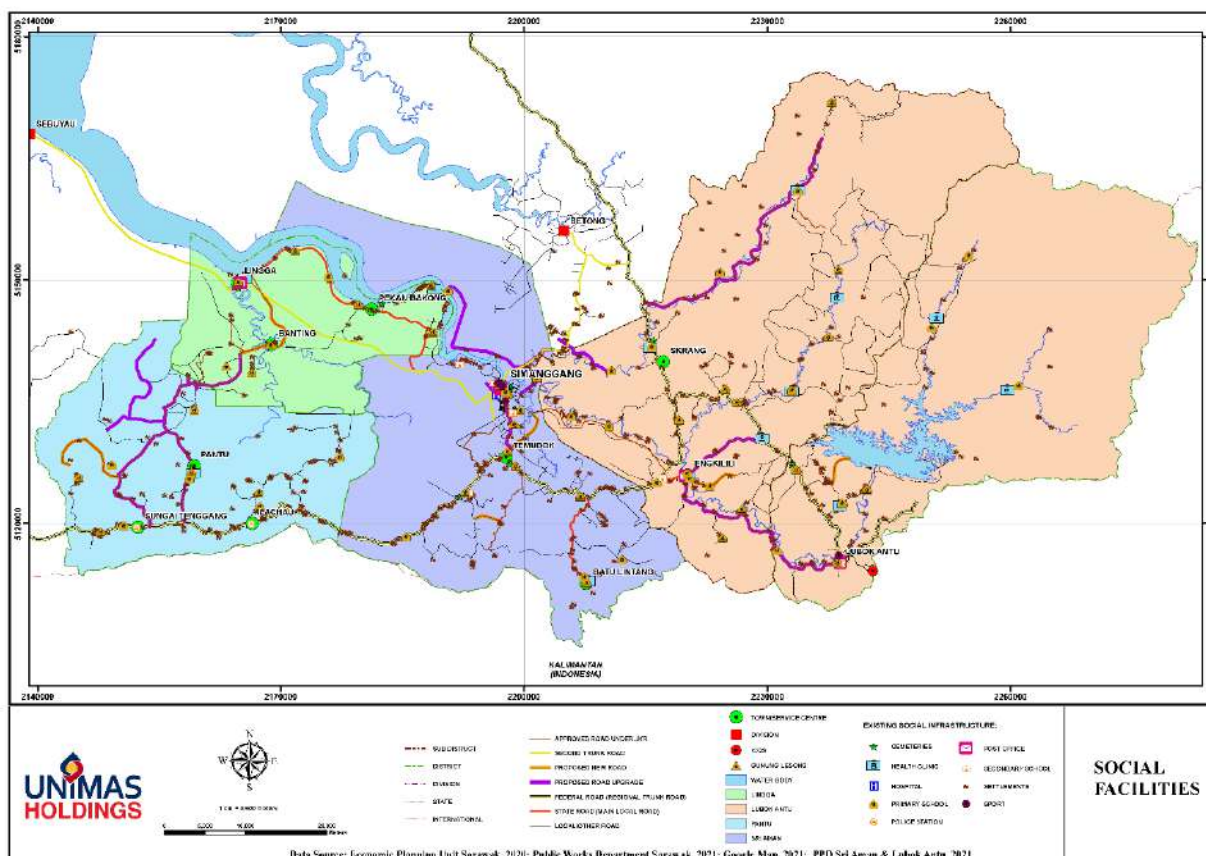


Figure 4-55: Location of Schools (primary and secondary), Sporting Facilities and Hospitals

Source: EPU Sarawak, JKR Sarawak, Google Map, PPD Sri Aman

4.7.8 Hazards, Effects and Resilience Planning

Addressing the impact of climate change has become one of the major challenges for professional urban planners and designers, architects, landscape architects. Preparation of policy guidelines and strategies addressing climate change and convincing public and private clients of the importance of introducing a more intelligent and sustainable approach to urban development has been high on the agenda in Malaysia and Sarawak for the past decade.

Several existing urban settlements in Sri Aman are susceptible to the potential impacts of natural hazards including floods and extreme weather conditions. In these areas, an adaptation approach will strengthen the community's overall resilience to potential impacts. This involves improved prevention, detection, response and recovery systems to protect the community, environment, businesses and infrastructure from the threat of disasters. New development in existing urban areas will need to incorporate design mechanisms to mitigate the effects of natural hazards and disasters.

It is important for all community facilities including new schools, hospitals, community and cultural centres to address the impacts of natural hazards and climate change. The Green Building Index (GBI) introduced in 2009 addresses the tropical and sustainable design and buildings and new townships. Community building design must comply with sustainable design requirements as set in the Malaysian Green Building Index (GBI index)

4.7.9 Issues, Challenges & Opportunities

Future residential development In Sri Aman will face a considerable amount of challenges. However, if properly addressed, it can provide opportunities to build quality social infrastructure and community facilities in the region

Challenges:

- Lack of financial sources to support social infrastructure development and upgrade
- Lack of community awareness
- The current state of the social infrastructure
- Small number of medical centres in the Lubuk Antu District
- Lack of primary schools in the remote hinterland areas

Opportunities:

- Forecasted population growth in the region
- The Iban culture and tradition
- Strong ethnic diversity in the region
- Potential growth of tourism
- Improvement of quality of life among residents
- Potential increase in school population
- Potential for an Institution of Higher Learning (IHL)

4.7.10 Initial Recommendations & Strategies

Sri Aman has a diverse range of cultures, involving the unique customs, beliefs, values, knowledge, heritage, traditions and way of life of this area. Cultural spaces, centres, and facilities play an important role in providing a place for community events, functions, meetings, and festivals, used by a range of different cultural groups and creating a sense of place and identity. As the Iban are the biggest ethnic community in the area Iban culture and traditions should be dominant in the region while preserving and safeguarding the values and needs of other ethnic groups.

Cultural heritage is a powerful development asset that can help attract tourists, bring revenues, regenerate local economies, promote inclusion, boost cultural diversity and reinvent territorial identity. For several decades now, regions have been pursuing cultural heritage catalyst projects. Certain knowledge has been accumulated on what these projects and strategies can and on their implications to a wide spectrum of policies ranging from culture to tourism, employment and skills, business development, innovation and spatial planning. At the same time, museums and cultural sites are increasingly experimenting with the new roles they can play as agents of economic development, social innovation and social inclusion while continuing to enrich their traditional preservation, restoration and education functions. In the Sri Man region, it is important to preserve and promote Iban culture labelling the place as the Iban cultural stronghold of Malaysia. The Sarawak government should launch and

coordinate the development of an Iban cultural centre which could become a catalyst project attracting thousands of tourists to the area. Benchmark projects from around the world such as the Aboriginal Cultural Centre Uluru, Australia, and the Jean Marie Tijibau Kanak Cultural Centre Noumea, New Caledonia are showcase examples of how cultural heritage projects can contribute to creating a new sense of place and identity and attracting local and international visitors

It is also imperative to promote sporting events. Maintaining and establishing regionally significant infrastructure for entertainment, sport, and conventions will foster creative art, recreation and leisure industries that will stimulate the local economy and increase job opportunities in the area.

Initial recommendations and strategies include:

- The number of new schools and hospital beds should be proportional to the population increase in the next decade
- Introduce tropical design guidelines for educational and community buildings
- Location of educational and community facilities should be within the designated urban footprint
- Promote cultural programs and events centered around the strong ethnic diversity
- Initiate a catalyst project: The Iban Cultural Centre

Benchmark examples showing catalyst projects (the Aboriginal Cultural Centre Uluru, Australia, and the Jean Marie Tijibau Kanak Cultural Centre Noumea, New Caledonia) that triggered economic prosperity and international tourism to the particular region are shown below: Benchmark examples for cultural catalyst projects the Aboriginal Cultural Centre Uluru, Australia (left), and the Jean Marie Tijibau Kanak Cultural Centre Noumea, New Caledonia (right).



Source: Tjibaou-Kanak Cultural Center website and Uluru-Kata Thuta Cultural Centre website

SECTION 4.8 HOUSING

4.8.1 Introduction

Access to adequate housing is an important component contributing towards the overall well-being of the local community. A range of housing options is needed to meet the requirements of the community in the Sri Aman Division. Providing diverse and affordable housing options is an important issue and key challenge both in Sarawak and in Sri Aman. A range of housing choices helps to create diverse communities and prevent social polarisation and displacement. With potential future population growth, Sri Aman will undergo an economic, social and demographic change.

This section looks briefly at the evolution of the housing industry in Sarawak including the Sri Aman context. This is followed by identifying the existing housing typology, demand for housing, housing profile, challenges and opportunities for the Sri Aman Division. A list of initial recommendations and strategies culminates this section.

4.8.2 The Wider Picture – Housing in Sarawak: From a Longhouse to a Modern Residential Complex

In pre-colonial times the island of Borneo including the area that makes up the Sarawak of the present, was inhabited by the Dayak population which comprised of the Land Dayaks and the Sea Dayaks. The Dayaks remain until today the native indigenous population of Sarawak. The traditional settlement types in Sarawak were linked to the cosmological beliefs and the natural terrain features. The Land Dayak population lived mainly in longhouse settlements situated along the rivers. In many instances, the whole village community lived under one roof in structures called the longhouses. Longhouses were built from timber and raised on wooden stilts 6 m above the ground. They comprised of individual rooms and a central shared community area. A longhouse could accommodate up to 200 people. The coastal parts of Sarawak were inhabited by the Sea Dayaks who built their timber houses on stilts forming settlement clusters constructed directly on the water. The inland areas were inhabited by farmers with the villages formed in clusters and surrounded by paddy fields and orchards. The Iban were the most populous of the Land Dayak group. The other dominant groups in Sarawak were the Bidayuh and Melanau.

In pre-colonial Sarawak, people lived in resilient community settlements which were built to adapt to the tropical climate. The majority of the dwellings were built from local materials and in terms of their orientation, physical form and structure they complimented the surrounding natural environment. The communities in Sarawak lived in harmony and balance with its natural surrounds.

A major change started to occur in the 19th century with the arrival of the western colonial powers. The northern part of the island of Borneo including Sarawak came under the influence of the British Empire while the central parts and southern areas of the island were gradually controlled by the Dutch. The traditional settlements started to develop into towns with a street network flanked by masonry buildings. For example, Kuching at the beginning of the 20th century developed into an organized town with a waterfront bazaar framed by masonry shophouses and civic buildings all supported by urban infrastructure including street lighting and a drainage system. In the northern parts of Borneo like elsewhere in Malaya, the British promoted the widespread use of neoclassical architectural styles for

civic and residential buildings. Although neoclassical colonial mimicked the neoclassical movement in Europe certain measures were adopted to suit the buildings to the local tropical environment and climate. In terms of colonial residential development, the Malay bungalow emerged in the British part of Borneo featuring a mixture of European and local features.

The influx of Chinese migrants to both the British and Dutch parts of Borneo in the late 19th century and early 20th century brought a new architectural typology; the Chinese shophouse. Shophouses were mixed-use 2-3 story's high masonry buildings, 30-60 meters deep and built-in rows. The ground floor was occupied by retail uses while the upper floors were designated for residential purposes. The buildings featured a shaded 'five-foot way' along its frontage which was a visible tropical climate-responsive structural element. The Chinese shophouse became a common characteristic physical element of a majority of emerging towns across Sarawak.

After 1963, when Sarawak became part of Malaysia the main focus was centred on national priorities and economic development rather than on retaining existing traditions and the local character. In the early post-independence period in Sarawak, there was an urgent need for progress and modernity and there was no time to dwell on the meaning and importance of the local roots.

The modern development in the second half of the century had transformed the urban landscapes across Southeast Asia. The once resilient and climate-responsive urban environments of Sarawak started to experience rapid urban growth in an unsustainable manner. The local sense of place and identity gradually paved the way for urban growth, modernization, and technology.

From the 1990s Southeast Asia has witnessed the emergence of globalization in the economic, social, political, cultural and physical urban environment. Globalization means the speedup of movements and exchanges all over the planet. One of the spinoffs of globalization visible in the urban areas is neoliberalism. Residential development in Sarawak has also been affected by globalisation and neoliberalism although the property prices in its capital Kuching are significantly lower than in Sabah's capital Kota Kinabalu. The most prestigious development which can serve as a showcase example of globalisation, neoliberalism and property led development is the Marina Park City in Miri which is now part of the Miri Resort City development.

The Ministry of Housing and Local Government, Sarawak is responsible for the provision of affordable housing within the state. Affordable housing was part of the Government of Sarawak's policy since the 1970s. One of the leading state development agencies is the Housing Development Corporation (HDC). HDC started operations in 1972 and since then they have built 29,983 affordable housing (low-cost housing) throughout Sarawak. They develop houses both in the urban and rural areas and this includes assisting longhouse dwellers to renovate and build new longhouses as part of a special Longhouse Loan Scheme.

The role of HDC includes programs in the state to meet different target groups of the society such as the Supply of Flats for Rentals Program targeted to reduce squatters and People Friendly Housing Program for fishermen and farmers who could not afford to build decent homes.

HDC has also shifted the direction to building more self-sustained and community-friendly housing by providing more greens, ample amenities, better infrastructure to boost the socio-economic standards of the people. This is reflected in the planning of their new projects such as in Muara Tebas and the re-planned Bandar Baru Sibu Jaya.

More recently the State Government has decided to implement Sri Pertiwi Affordable Housing Program to cater for and address the growing demand for affordable housing in Sarawak. This program is opened

to eligible private housing developers in the State who wish to play a meaningful and significant role in helping the Government to provide affordable housing to the community.

As a result of globalisation and neoliberal policies, Sarawak has witnessed the rapid growth of private sector development companies. One of the major private housing developers in Sabah is CMS Sdn Bhd. The Group's Property Development Division comprises of CMS Property Development Sdn Bhd, Projek Bandar Samariang Sdn Bhd and CMS Land Sdn Bhd. The Division owns two large land bands in and around Kuching, and one of these is a 3,911-acre land bank in Petra Jaya owned by Projek Bandar Samariang which is currently being developed into a riverine township called Bandar Samariang. Another major developer in Sarawak is Pantai Bayu Indah Sdn Bhd which is responsible for the Marina Park City development.

4.8.3 Sri Aman's Place within Sarawak's Housing

Housing development in Sri Aman is on the increase as a result of gradual annual population growth in the Division.

As a result of an absence of some vital demographic statistics in the divisional and district levels of Sarawak, the future population of Sri Aman Division is based on the annual growth pattern and trends of Sri Aman Division over the past 40 years (1980-2020). The annual growth rate of a population which has taken account of the birth, death, natural increase and migration rates of that population in the corresponding time, is valid as a base for projection of future population, however, it does not recognise the potential future development growth and the annual migrant population arrivals from Indonesia to the new in-migrant population.

Following the past annual growth rate pattern, the average annual population increase in the Sri Aman Division is forecast at 1.73% for 2020-2030. Based on this estimate, the population in the Sri Aman Division should grow by 21,000 in the next decade. Forecast population growth based on the past annual growth pattern is presented in Table 4-43.

Table 4-43: Sri Aman Division: Population Projection by Average Annual Growth Rate and Number of Population, 2020-2030.

Year	Average Annual Growth Rate		
	(1)	(2)	(3)
	1.62%	1.73%	1.75%
2020	111,400	111,400	111,400
2021	113,205	113,327	113,350
2022	115,039	115,288	115,333
2023	116,902	117,282	117,351
2024	118,796	119,311	119,405
2025	120,721	121,375	121,495
2026	122,676	123,475	123,621
2027	124,664	125,612	125,784
2028	126,683	127,784	127,985
2029	128,735	127,784	130,225
2030	130,821	132,244	132,504

Source: UNIMAS Holdings

Based on the existing growth pattern, the Sri Aman Division will require additional housing for 22,000 people which translates to 5400 additional dwellings (based on an average household size in Malaysia which is currently 4.1 people per household). Taking into account the future development prediction and migration from Indonesia the Sri Aman Division will require additional housing for 34,000 people which translates to 8,300 additional new dwellings.

Based on information from the Real Estate and Housing Developers Association (REHDA) Malaysia for low to medium residential density (the average is 25-35 dwellings per hectare) and based on the additional 8,300 new dwellings predicted for the Sri Aman Division by 2030 (on the assumption that the population increase will be 34,000 in the next decade) around 290 hectares of land has to be designated for new residential development. The preferred scenario future housing demand based on a population increase of 8,300 dwellings by 2030 is shown in Table 4-44.

Table 4-44: Future Housing Demand

Future Population Increase by 2030	Additional Dwellings	Land Designated for Future Residential Development
A projected population increase by 34,000 (based on predicted growth as a result of new development)	8,300	292 ha

Source: Daya Rancang

All new urban residential development in the region will be located within the designated urban footprint. This includes new low-density housing estates and low-cost residential terraced housing for migrant workers. Based on the information from the Sarawak Housing Development Corporation terraced housing is the preferred type for affordable and social housing targeting low-income brackets and migrant workers. The Sarawak Housing Development Corporation will increase the amount of affordable and social housing development to 10% of the total housing development as a result of the increased influx of population to Sri Aman.

It is also essential to promote agrarian urbanism. It is an emerging movement based on the idea of integrating sustainable food systems and education with the design of the urban environment. Agrarian urbanism featuring detached and terraced houses with hobby farms and orchards in the backyards could become a unique phenomenon of the future residential environment in the Sri Aman Division.

It is envisaged that the current low to medium density residential environment will be retained in Bandar Simanggang and other townships of Sri Aman. Medium density residential in the form of 3-4 storey apartment buildings should be located within or within proximity to commercial precincts. Locating medium density residential areas within walking distances to commercial precincts will ensure the vibrancy of these precincts.

It is also envisaged that as a result of tourism growth there will be growing demand for tourism accommodation in forms of hotels and serviced apartments. The future tourism accommodation should be located within the existing commercial areas.

The current urban development in Bandar Simanggang is scattered therefore utilising the current urban infill sites for residential development is crucial. As a result of new residential development Bandar Simanggang by 2030 should achieve a compact low-density urban character. The current land use map and urban grain pattern for Bandar Simanggang is shown in Figure 4-56. A detailed land use map for the entire Sri Aman Division showing urban areas including residential areas is shown in Figure 4-56.

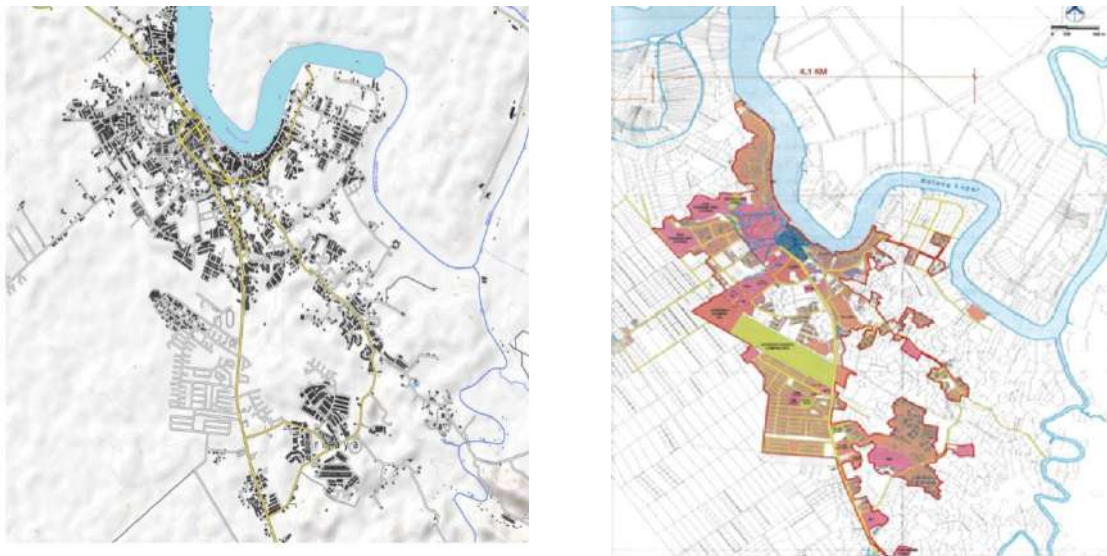


Figure 4-56: Urban grain pattern (left) and land use map (right) of Bandar Simanggang

Source: Daya Rancang

4.8.4 Existing Housing Typology

A significant proportion of residential dwellings in the Sri Aman Division are currently made up of single detached houses on individual allotments. There has also been an increasing trend in a townhouse development. According to the information from the Sarawak Ministry of Housing 832 affordable terraced houses and detached dwelling units have been constructed in the Sri Aman Division since 1978 for rent purposes. A majority of housing in Sri Aman is private owner occupier housing (94%) and this trend is likely to continue although with the increase in the number of migrant workers a growing demand for rented affordable accommodation is predicted.

There is a substantial amount of old traditional houses with a large proportion of them in poor building condition. A greater range and mix of dwellings are needed to create a more liveable, stronger community, however, the low-density character of the Sri Aman Division should be preserved. Houses on larger lots and traditional longhouse Iban houses are located in rural areas. Housing needs are changing in the region with the growing demand for low-cost housing for the migrants and tourist accommodation.

There are hundreds of longhouses in the urban and rural areas of Sri Aman. Images of the existing residential typologies are shown in Figure 4-57.



Figure 4-57: Existing housing typology in the Sri Aman Division

4.8.5 Existing Housing Profile

The survey which was predominantly administered to the head of the households, shows that males outnumbered females in all the districts covered. This is indicative of the general trend whereby male member of the family tend to be the leader in the household. In terms of age, majority are within their middle to late 50s, which is in line with the demographic profile of the Sri Aman division that is edging toward the ageing population.

Table 4-45: Respondents' Demographic Details

Survey Sites	Respondents' Details				
	Gender		Average Age	Marital Status (%)	
	Male (%)	Female (%)		Married	Single
Simanggang	71	29	58	76	24
Pantu	66.3	33.7	57	61.5	38.5
Lingga	55	44	59	61	40
Lubok Antu	59	41	55	74.4	25.6
Engkilili	70	30	58	81.5	18.5

Source: Sri Aman Master Plan Study-Household Survey (2020)

Table 4-46: Ethnic Background of the Household

Survey Sites	Ethnic Background (%)			
	Iban	Malay	Chinese	Others
Simanggang	50	22.4	25.2	2.4
Pantu	76.5	0	23.5	0
Lingga	57.7	39.4	2.4	0
Lubok Antu	76.4	10.8	11.2	1.6
Engkilili	49.7	16.4	31.7	2.1

Source: Sri Aman Master Plan Study-Household Survey (2020)

The household's ethnic distribution closely correlates with the geographic locations of Sri Aman's districts and sub-districts. Iban constitute the majority, where they are prevalent in all localities, while the Malays are mostly located in the Lingga and Simanggang areas, and Chinese within the urban & commercial areas such as the Bazaar areas of each sub-districts.

Table 4-47: Number of People Residing in Household

Survey Sites	No. of People in Household							
	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15 or more
Simanggang	49 (19.6%)	79 (31.6%)	80 (32%)	29 (11.6%)	8 (3.2%)	3 (1.2%)	1 (0.4%)	1 (0.4%)
Pantu	34 (33.3%)	37 (36.3%)	21 (20.6%)	9 (8.8%)	0	1 (1%)	0	0
Lingga	76 (36.5%)	60 (28.8%)	50 (24%)	17 (8.2%)	5 (2.4%)	0	0	0
Lubok Antu	50 (20%)	91 (36.4%)	70 (28%)	27 (10.8%)	6 (2.4%)	5 (2%)	1 (0.4%)	0
Engkilili	48 (25.4%)	66 (34.9%)	45 (23.8%)	25 (13.2%)	3 (1.6%)	1 (0.5%)	1 (0.5%)	0

Source: Sri Aman Master Plan Study-Household Survey (2020)

Overall, the size of the households within the Sri Aman division is relatively small, with the majority having only 3 to 4 people residing in the same house (33%), while those that have more than 10 people residing constitute less than 2%. At the divisional level, this shows that having a lot of children or extended family living in the same household is not a common phenomenon. From a sub-district's level, Simanggang people have a higher household size with more than 30% of household having 5 to 6 people residing. This may be due to the lower number of people out-migrating as these areas are relatively more affluent and have more job opportunities to offer. Adversely, economic squeeze and higher living might prolong adult children living at home. Pantu presents the lowest household size with around 70% of household that have 4 and less people. In the cases of rural sub-districts, the growth of urban employment opportunities and decreasing land plots have led to out-migration of the younger generation. They migrated to either town areas of Simanggang, or outside Sri Aman divisions to Sarawak city centres of Kuching, Miri, Sibu and Bintulu, while the popular destination outside of Sarawak are

Johor and Singapore for the Chinese and Iban communities. This phenomenon has led to small households with senior citizens heading the households.

4.8.6 House Ownership

The majority of the heads of household owned their houses either through purchase or inheritance. Table 4-48 illustrates that more than 95% of the household head owned their house in both the Sri Aman and Lubok Antu districts. There is around less than five per cent of the respondents who did not own the house and preferred to rent a house instead and this happened to be in places like Simanggang (4.10%), and Engkilili (3.20%) followed by Lubok Antu (1.20%). Other reasons for not owning the house such as preferring to stay in the family house only accounted for 0.80% and 0.50% for Simanggang and Lingga, respectively. Another finding from the survey is that in the Engkilili subdistrict 1.10% of the houses are provided by an employer.

Table 4-48: Type of Ownership Status

Survey Sites	House Ownership's Status (%)				
	Owned House	Rented House	Staying in other people/family house	Accommodation provided by employer	Others
Simanggang	95.1	4.1	0.8	0	0
Pantu	99	1	0	0	0
Lingga	96.1	1	0.5	0	2.4
Lubok Antu	98.4	1.2	0	0	0.4
Engkilili	94.7	3.2	0	1.1	1

Source: Sri Aman Master Plan Study-Household Survey (2020)

Table 4-49: Reasons for Not Owning A House

Survey Sites	Reasons for Not Owning House			
	Unaffordable	Prefer to Rent	Have Family House	Others
Simanggang	4 (66.67%)	0	2 (33.33%)	0
Pantu	0	0	1 (100%)	0
Lingga	3 (75%)	0	1 (25%)	0
Lubok Antu	0	1 (33.3%)	1 (33.3%)	1 (33.33%)
Engkilili	3 (37.50%)	0	2 (25%)	3 (37.5%)

Source: Sri Aman Master Plan Study-Household Survey (2020)

In the Sri Aman division, there are not many residents who do not own a house. For those who do not own a house, the major reason is the affordability of homes. This is clearly demonstrated by the cases of Simanggang (66.67%) and Lingga (75%). The other reason is that respondents already have a family home to stay in. It is also noted that at least one respondent from Pantu and Lingga have the same reason for not owning a house because they are staying with their family. Similar to Simanggang and Lingga, Engkilili 37.50 per cent of the non-owning respondents mentioned that they cannot afford a house, 25 per cent of them staying at their family house while other reasons for not owning the house remained 37.50 per cent in Lubok Antu's district. From Lubok Antu side, there is at least one respondent who is opting for renting while the remaining are staying at their family house instead of owning one.

Table 4-50: Monthly Rental Rate

Survey Sites	House Rental Rate (RM per month)		
	Min	Max	Median
Simanggang	200	500	250
Pantu	500	500	500
Lingga	63	300	181.5
Lubok Antu	90	1200	300
Engkilili	90	1200	300

Source: Sri Aman Master Plan Study-Household Survey (2020)

According to Table 4-50, house rental rate per month is varied across locations. Being nearer to town areas particularly in Simanggang and Pantu, both locations have the highest rental rate, while Lingga ranked the lowest. In Simanggang, the house rental per month can be priced as high as RM500 and RM200 at minimum. For Pantu's case, the house rental rate is fixed at RM500 while Lingga's rental rate is affordable at RM300 per month. The house rental in Lingga is surprisingly low as compared to other subdistricts since the rental fees can be priced as low as RM63 per month. Because of its low price, people tend to rent instead of buying or owning the house since they can easily pay the cheaper rental fees. It can also be noted that there is a huge disparity in housing rental rate in Lubok Antu district. Both Engkilili and Lubok Antu are known for their expensive house rental rate with an amount of RM1200 per month which is the maximum and the minimum rental rate is RM90 per month. The rental fee trend is common among the Lubok Antu district and hence, a lack of affordable housing can be seen from the previous survey particularly in Engkilili due to costly rent.

Table 4-51: Housing Structure & Design

Survey Sites	House Structure / Design			Toilet Facility (%)		
	1 Bedroom	2 Bedroom	3 or More Bedrooms	Tandas Curah	Tandas Tarik/ Pam	No Own Toilet
Simanggang	5	40	187	33	210	2
Pantu	14	24	53	38	68	2
Lingga	37	66	92	103	100	0
Lubok Antu	50	53	109	73	177	1
Engkilili	30	40	110	39	156	0

Source: Sri Aman Master Plan Study-Household Survey (2020)

Based on the Table 4-51, the majority of respondents from Simanggang, which makes up 80.60%, own 3 or more sleeping rooms, 17.24% have two bedroom and only five per cent have a single bedroom in one house. In the Lubok Antu district, both subdistricts are accounted for having 3 or more bedrooms per house and there are 51.42% and 61.1%, respectively. From the perspective of toilet facility, 13.20% of the respondents in Simanggang have *Tandas Curah*, 84% have *Tandas Tarik/Pam* and 0.80% have no toilet. In the Lubok Antu district, the majority of the respondents are using *Tandas Tarik/Pam* with 70.80% and 82.54% in Lubok Antu and Engkilili. The finding also illustrates that at least 0.80% from the survey do not own a toilet in their house particular in Simanggang and Pantu and 0.40% from Lubok Antu's survey. The implication from not owning a toilet will lead to a lack of sanitation and other health related issues.

Table 4-52: Housing Utilities

Survey Sites	Hydro	SEB	Solar	Generator	Kerosene Lamp	No 24-hrs Electricity Supply	River	Well	Rain	Gravity Feed Pipe	Water Board	Others
Simanggang	0	240 (96%)	0	6 (2.4%)	4 (1.6%)	5 (2%)	31 (12.4%)	1 (0.4%)	3 (1.2%)	63 (25.2%)	148 (59.2%)	0
Pantu	0	101 (99%)	0	0	0	0	10 (9.8%)	2 (1.96%)	27 (26.5%)	49 (48%)	18 (17.6%)	0
Lingga	0	205 (99%)	1 (0.4%)	2 (1%)	0	1 (0.6%)	0	0	81 (49.1%)	32 (19.4%)	158 (95.8%)	0
Lubok Antu	0	249 (99.6%)	1 (0.4%)	2 (0.8%)	1 (0.4%)	0	9 (3.6%)	1 (0.4%)	23 (9.2%)	32 (12.8%)	209 (83.6%)	0
Engkilili	3 (1.6%)	188 (99.5%)	1 (0.5%)	2 (1.1%)	1 (0.5%)	0	39 (20.6%)	0	24 (12.7%)	12 (6.4%)	137 (72.5%)	2 (1.1%)

Source: Sri Aman Master Plan Study-Household Survey (2020)

The proportion of households with reliable access to electricity and water supplies is very high in both districts. More than 95% of the respondents can easily access the electricity supply from Sarawak Energy Board and less than 3% are using other resources such as solar energy, generator, kerosene lamp and hydro energy. Certain areas in Simanggang and Lingga that are unable to access to 24-hours electricity supply only accounted for 2% and 0.6%, respectively. As for water supply, there is about 59.2% of the respondents from Simanggang getting their water supply from the Water Board, 25.20% from gravity feed pipe, 12.4% from the river and the remaining water supply is through either well or rain as their source of water. For Pantu's case, 48% of the respondents rely heavily on the gravity feed pipe and only use 17.6% water from the water board. As for Lingga subdistrict, 95.8% of water supply is coming from water board, 49.1% from the rain and 19.40% is through gravity feed pipe. In Lubok Antu district, both locations shown higher usage of water supply from Water Board which is 83.6% and 72.5%, respectively. However, it is notable that certain areas in Engkilili, 20.6% of them are getting their water supply from the river as compared to other sub-districts.

Table 4-53: Home Appliances

Survey Sites	Home Appliances					
	Computer	Radio	TV	Handphone	Electric / Gas Stove	Wooden Stove
Simanggang	75 (30%)	182 (72.8%)	242 (96.8%)	175 (70%)	36 (14.4%)	249 (99.6%)
Pantu	15 (14.7%)	68 (66.7%)	96 (94.1%)	32 (31.4%)	39 (38.2%)	102 (100%)
Lingga	12 (5.8%)	165 (80%)	191 (91.8%)	87 (42%)	92 (44.2%)	205 (98.5%)
Lubok Antu	44 (17.6%)	139 (55.6%)	241 (96.4%)	139 (55.6%)	54 (21.6%)	248 (99.2%)
Engkilili	53 (28%)	103 (54.5%)	182 (96.3%)	58 (30.7%)	38 (20.1%)	187 (98.9%)

Source: Sri Aman Master Plan Study-Household Survey (2020)

Table 4-53 illustrates the basic home appliances owned per household. Some of the basic home appliances are computer, radio, television, handphone, electric/gas stove and wooden stove. Based on the findings above, Simanggang is considered a more developed area and hence, more exposed to technology as compared to other subdistricts due to its complete infrastructure like network coverage and school facilities. Therefore, the percentage of owning computer and handphone are high in Simanggang which are 30% and 70%, respectively. Basic necessities such as television and stove particularly wooden stove are common among the households and hence, the percentage encountered for each home appliances are more than 94% in both Sri Aman and Lubok Antu districts. Similarly, the practice of using electrical or gas stove is fairly low in certain survey sites. For instance, Simanggang used the least amount of electric or gas stoves among the Sri Aman district, while the number of

respondents using electric or gas stove are equally balance in Lubok Antu subdistrict which accounted for more or less 21%.

4.8.7 Digital Housing Presence

Communications play a critical role in economic development, education and the health and wellbeing of communities, particularly those located in remote areas. Improved information communication technology services including high-quality internet are needed if residents of Sri Aman are to optimise global network communication opportunities.

4.8.8 Committed Plans & Project Proposals

The bulk of the residential development in Sri Aman is based on individual owner-occupier and small to medium scale development projects. There no major housing construction developments at this stage however this could change in the foreseeable future. Based on the information provided by the Ministry of Housing and Local Government in Sarawak there are 14 small to medium size residential developers operating in the Sri Aman Division.

4.8.9 Hazards, Effects and Resilience Planning: Pandemics

According to the latest information released by CPRC Kementerian Kesihatan Malaysia, the Sri Aman Region is COVID free as of early January 2021. Statistics from around the world have indicated that COVID is prevalent in highly dense urban areas. However, there are exceptions to this rule. In Sabah, the first cases of the second wave started in the rural districts' of Lahad Datu, Papar and Penampang before they spread to major urban centres of the state. Therefore, it is essential to address the issue of COVID as part of the future housing strategy for Sri Aman District.

As part of the Master Plan, it is essential to identify a set of urban planning and urban/architectural design measures, drawing recommendations to help mitigate the negative impact of an epidemic lockdown thereby improving community well-being. The planning and design measures should address total and partial lockdown implications and promote spaces for individual orchards, vegetable gardens, hobby farms, community engagement. Future adaptive designs and strategizing available empty lands for temporal activities should also be considered.

4.8.9.1 Hazards, Effects and Resilience Planning: The Adverse Impacts of Climate Change

Although Sarawak has yet to be severely impacted by climate change, it should still be strongly considered in the planning and designing of new housing estates. The Sri Aman division recognises the highly valued tropical character of the region and the built environments and lifestyles that have evolved as a result of it. Universal building design sparked by neoliberalism and property led development are not suitable forms for this part of Sarawak. There is a need to adapt and provide better opportunities for enjoying the local tropical way of life. Tropical design principles underpin and reinforce the good sustainable design. Incorporating tropical design principles into future development will reflect the local culture, the tropical climate and sense of place and identity

In the Sri Aman Division, the climate change challenges include increased air temperatures, increased extreme weather conditions and flooding and rising tidal waves.

Overcoming that challenge is one of the key tasks facing decision-makers, urban planners and designers. Ensuring mandatory passive sustainable design for all residential buildings and sustainable urban design principles for entire residential neighbourhoods is the only way to achieve physical, social and economic desired green environmental outcomes.

4.8.10 Issues, Challenges & Opportunities

Future residential development In Sri Aman faces a considerable amount of challenges, however, if properly addressed can provide opportunities for quality and affordable housing in the region

4.8.10.1 Challenges

- Orthodox planning legislation (1976 Planning Act)
- Lack of residential design codes and guidelines
- Lack of community awareness
- Existing development standards

4.8.10.2 Opportunities

- Gradual population growth
- Potential for tourism accommodation
- Potential for the regeneration of old housing stock including traditional longhouses
- Potential for the implementation of the Sri Pertiwi Affordable Housing Program
- Increase of population by 50,000 in the next decade

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AN	Ammoniacal Nitrogen
API	Air Pollutant Index
APIMS	Air Pollutant Index Management System
APM	Angkatan Pertahanan Awam
ASMC	ASEAN Specialised Meteorological Centre
BOD	Biochemical Oxygen Demand
CAGR	Compound Annual Growth Rate
CAN	Culture, Adventure and Nature
CAQM	Continuous Air Quality Monitoring
CBA	Cost Benefit Analysis
CBET	Community Based Ecotourism
CGE	Computable General Equilibrium
CIQ	Customs, Immigration and Quarantine
CMCO	Conditional Movement Control Order
CMWQM	Continuous Marine Water Quality Monitoring
COD	Chemical Oxygen Demand

CPO	Crude Palm Oil
CPPC	Collection, Processing and Packaging Centres
CRWQM	Continuous River Water Quality Monitoring
DEI	Digital Economy Index
DELSA	Disaster Emergency Logistics System for ASEAN
DID	Department of Irrigation
DO	Dissolved Oxygen
DOA	Department of Agriculture
DOE	Department of Environment
DOSM	Department of Statistics Malaysia
DPI	Dots per Inch
EDC	Environment Data Centre
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMR	Environmental Monitoring Report
EPU	Economic Planning Unit
EQMP	Environment Quality Monitoring Program
ESA	Environmental Sensitive Area
ETP	Economic Transformation Programme
FAMA	Federal Agriculture Marketing Authority
FCC	Faecal Coliform Count
FDRS	Fire Danger Rating System
FDS	Forest Department Sarawak
FGD	Focus Group Discussions
FLR	Forest Landscape Restoration
FO's	Farmers Organisations
GDP	Gross Domestic Products
GEMS	Global Environment Monitoring System
GHG	Greenhouse Gasses
GIS	Geographic Information System

GLCBET	Gunung Lesong Community Based Ecotourism Committee
GVATI	Gross Value-Added Tourism Industry
HCVF	High Conservation Value Forest
HEP	Hydro-Electric Power
HOB	Heart of Borneo
HPD	Highway Planning Division
ICQS	Immigration, Customs, Quarantine and Security
ICT	Information and Communications Technology
IDI	In-depth Interview
IEA	International Energy Agency
I-O Model	Input-Output Model
IOT	Internet of Things
ITCZ	Inter Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
JBALB	Jabatan Bekalan Air Luar Bandar
JKKK	Jawatankuasa Kemajuan dan Keselamatan Kampung
JKR	Jabatan Kerja Raya (Public Works Department)
JPAM	Jabatan Pertahanan Awam Malaysia
JPBN	JawantanKuasa Pengurusan Bencana Negeri
KPKT	Kementerian Perumahan dan Kerajaan Tempatan (Ministry of Housing and Local Government)
LCCF	Low Carbon City Framework
LFA	Livestock farming area
LOS	Level of Service
LPF	Licensed Planted Forest
MCAQM	Mobile Continuous Air Quality Monitoring
MCMC	Malaysian Communications and Multimedia Commission
MCO	Movement Control Order
MICE	Meetings, incentives, conferencing, exhibitions
MINTRED	Ministry of International Trade, Industry and Investment
MMWQM	Manual Marine Water Quality Monitoring

MNS	Malaysian Nature Society
MOH	Ministry of Health
MOHURD	Ministry of Housing and Urban Rural Development
MOTAC	Ministry of Tourism, Arts and Culture
MTCP	Ministry of Tourism, Creative Industry and Performing Arts Sarawak
MoU	Memorandum of Understanding
MP	Malaysia Plan
MPOB	Malaysian Palm Oil Board
MWA	Malaysian Water Association
My GAP	Malaysian Good Agriculture Practice
NADMA	National Disaster Management Agency
NCR	Native Customary Land
NFCP	National Fiberisation Connectivity Plan
NGO	Non-Governmental Agencies
NKRA	National Key Result Area
NP	National Park
NPP	National Physical Plan
NREB	Natural Resources and Environment Board
NRW	Non-Revenue Water
NWQS	National Water Quality Standards
O2O	Online-to-Offline
OPAL	Open Air Laboratory
OS	Operating System
P	Phosphorus
PEAA	Prime Existing Agriculture Areas
PFE	Permanent Forest Estate
PNG	Portable Network Graphics
POME	Palm Oil Mill Effluent
PPA	Prime Potential Agriculture Areas
PPACP	Public-Private-Academic Civil-Society
PPC	Pollution Prevention Control

PWD	Public Work Department
R&D	Research and Development
RECODA	Regional Corridors Development Authority
RELA	Jabatan Sukarelawan Malaysia
RES	Rural Electrification Scheme
RFT	Request for Tender
RGC	Rural Growth Centre
RMCO	Recovery Movement Control Order
RPSS	Rural Power Supply Scheme
RTVM	Road Traffic Volume Malaysia
RWQMP	River Quality Monitoring Programme
SADA	Sri Aman Development Agency
SALCRA	Sarawak Land Consolidation and Rehabilitation Authority
SARES	Sarawak Alternative Rural Electrification Scheme
SAVE	Scientific, Academic, Volunteerism and Education
SAWAS	Sarawak Alternative Water Supply
SCORE	Sarawak Corridor of Renewable Energy
SDG	Sustainable Development Goals
SEAC	Sarawak Economic Action Council
SEB	Sarawak Energy Berhad
SEDC	Sarawak Economic Development Cooperation
SES	Socio-Economic Survey
SETP	Socio-Economic Transformation Plan
SETP	Socio-Economic Transformation Plan
SFC	Sarawak Forestry Corporation
SIWRM	Sarawak Integrated Water Resources Management Resources Management
SMA	Sarawak Multimedia Authority
SME	Small and Medium Enterprises
SOM	Malaysian Organic Scheme
SOP	Standard Operating Procedure
SPV	Special Purpose Vehicle

STATO	Sarawak Trade and Tourism Office
STB	Sarawak Tourism Board
STOL	Short Take-off and Landing
STR	Second Trunk Road
TCC	Total Confirm Count
TOD	Transit Oriented Development
TPA	Totally Protected Area
TSS	Total Suspended Solid
UAVs	Unmanned Aerial Vehicles
UKPN	Unit Keselamatan dan Penguatkuasaan Negeri
UNCTAD	United Nations Conference on Trade and Development
UNIMAS	Universiti Malaysia Sarawak
VSAT	Very Small Aperture Terminal
WCS	Wildlife Conservation Society
WHO	World Health Organisation
WMAM	Waste Management Association of Malaysia
WQI	Water Quality Index
WTP	Water Treatment Plants
WWTTC	World Travel and Tourism Council

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APPENDICES

Appendix 1: List of Data Items

Source	No	Description of data	Status
Economic Planning Unit	1	Health facilities	Yes
	2	School and community map	Yes
	3	Division, district, sub-district and international boundary map	Yes
	4	Leadership / representative / political map boundary	Yes
	5	Major towns, kampung, long houses	Yes
	6	settlements	Yes
	7	Sarawak administrative areas	Yes
	8	Sri Aman division: administrative areas	Yes
	9	Sarawak Land use master plan study 2020	Yes
	10	Contour map	No
	11	Sarawak Agriculture Master Plan	No
Department of Agriculture	1	Agricultural Capability Area	Yes
	2	Agriculture Land Use in Sri Aman (Major Agriculture Commodities)	Yes
	3	Major Agricultural Commodities	Yes
	4	Existing agriculture land use or plantation / agriculture schemes map	Yes
	5	Major Soil Region	Yes
	6	Types of soil, soil/land capability	Yes
	7	Soil map	Yes
	8	Location and area of Collection, Processing & Packaging Centre (CPPC) in Lachau	Yes
	10	Cage Culture Area	Yes
	11	Inland fisheries	No
		List of fish landing points (rivers and reservoir) and location (with images)	
		No. of fishermen by fish landing points	
		No. of boats by fish landing points	
		No and type of fishing gears by landing points	
		Fish landings (tonnes)	
		Fish species caught	
		Fish price according to species	
		Current planned projects and future development programmes for inland fisheries at Sri Aman Division	

Source	No	Description of data	Status
		Conservation measures and management plans for inland fisheries especially for <i>Terubok</i> fishery	
		<i>Terubok</i> fishery - landings (tonnes) and value (RM) for last 5 years, conservation zone for <i>Terubok</i> fishery, issues and constraints	
	12	Aquaculture Data for Sri Aman Division	No
		i. Pond culture	
		List of aquaculture farms and location (with images)	
		No. and size of ponds	
		Production (tonnes) and value (RM) for last 5 years (2014-2019)	
		Species cultured	
		Ex-farm price and markets	
		ii. Cage culture (Batang Ai Reservoir and Batang Lupar)	
		List of aquaculture farms (cage culture) and location (with images)	
		No. and size of cages	
		Production (tonnes) and value (RM) for last five years (2014-2019)	
		Species cultured	
		Ex-farm price and markets	
		Current planned projects and future development programmes for aquaculture at Sri Aman Division	
	13	Fisheries based processing industries in the Division (basically based on Batang Lupar catch)	No
		List of operators and location (with images)	
		Type of fish products produced (with images)	
		Production (tonnes) and value (RM) for last 5 years (2014-2019)	
		Price of fish products	
		Markets	
	14	Tagang system at Sri Aman Division (with images)	No
		Current status (when started, still active?)	
		No. of communities involved at each area (with images)	
		Current management regime and practices (closed season etc.)	
		Type of fish caught	
		Fish restocking programme (type of fish release, frequency etc.) (with images)	
		Issues and constraints	
		New areas identified for the implementation of tagang system	
	15	Aquaculture area reserves in acres (undeveloped) in Sri Aman Division.	Yes
Department of Irrigation and Drainage (Sri Aman and Headquarters)	1	Waterbodies	Yes
	2	Flood Risk Map	No
	4	River and catchment map	No
	5	Gazetted water supply catchment map	No
	6	Irrigation & drainage schemes for agriculture	No
		Banting irrigation scheme	
		Tg Saduru Drainage Scheme	
		Sebubok Engkala Controlled Drainage Scheme	
		Sebrang Drainage Scheme	
		Sg Kerepok Controlled Drainage Scheme	
		Sungai Gran Drainage Scheme	
		Sungai Entulang controlled Drainage Scheme	
		Tg Bijat controlled drainage scheme	
		Basi-ljok controlled drainage scheme	
		Sg Ensurai Controlled Drainage Scheme	
		Skrang Drainage scheme	
Department of Mineral and Geoscience (Sarawak)	1	Geology and hydrogeological map	No
Forest Department Sarawak	1	Forest Cover	Yes
	2	Existing and Proposed Permanent Forest Estate	Yes
	3	Forest license areas	Yes
	4	Forest areas including Forest Estate	Yes
	5	Permanent Reserved Forest (PRF) map	Yes

Source	No	Description of data	Status
	6	Biodiversity data	No
	7	Ecological Areas	No
	8	Forestry and Forest Replanting	No
	9	A list of any planned / future projects in Sri Aman Division	No
Land and Survey Department Sarawak	1	Cadastral map	No
	2	Contour map / topography map	No
	3	Native Land Right Area (NLR)	No
	4	Land classification i.e. NCR land, plantation concession, state land etc.	No
	5	State and district structure plan	No
	6	Land cover	No
	7	Planned and Committed Projects Map	No
	8	Stones/rock quarries, mining, and sand/gravel extraction,	No
Malaysian Palm Oil Board	1	Lists of plantations owned by Private Sector, SALCRA, FELCRA, RISDA etc.	Yes
	2	Lists of oil palm mills	Yes
Ministry of Modernization of Agriculture, Native Land and Regional Development Sarawak (MANRED)	1	Batang Lupar Rice Project Development Plan under Agriculture Integrated Development Area (IADA)	No
Sarawak Energy Berhad	1	Power generation and transmission map	Yes
	2	Future power grid installation	Yes
	3	Electricity demand	Yes
Sarawak Forestry Corporation	1	National parks and totally protected areas	Yes
	2	Permanent Reserved Forest (PRF) map	Yes
	3	List of any planned / future projects in Sri Aman Division	No
Sarawak Multimedia Authority	1	Network coverage map and telecommunication towers	No
	2	Future digital infrastructure plans/projects in Sri Aman division	No
Department of Labour (Sarawak) / Institute of Labour Market Information and Analysis (ILMIA)	1	Labor force trend	No
Public Works Department	1	Current and future road network	Yes
	2	Current and future bridges	Yes
Sri Aman District Council / Lubok Antu District Office	1	Health facilities	Yes
	2	Existing and proposed landfill locations	Yes
	3	Community facilities	Yes
	4	Digital facilities	No
	5	Incoming new facilities- new proposals	No
	6	images of existing housing typologies from Sri Aman	-
	7	Images of existing streetscapes and public/community spaces	-
	8	Planned tourism or recreation projects by councils in Sri Aman Division.	No
Sewerage Department Sarawak	1	Sewerage treatment facilities (septic sludge treatment plant) in Sri Aman Division	No
	2	Centralized/ decentralized sewerage system in Sri Aman Division	No
Sarawak Rural Water Supply Department	1	a) Water grid/ water supply intake map/ booster pump station/ water treatment plant in Sri Aman Division b) existing & committed future planning from authority on water supply in Sri Aman Division	No
	2	Water demand in Sri Aman Division in the past 10 years	No
	3	Water catchment areas used for water supply (Gazetted and non-gazetted)	
Ministry of Public Health, Housing and Local Government	1	List of housing agencies in Sarawak	No
	2	List of residential developers in Sarawak	No
National Property Information Center	1	Existing housing stock - what is the dominant housing typology - landed properties, terraced housing?	Yes
	2	Number of completed residential units	Yes

Source	No	Description of data	Status
Jabatan Alam Sekitar Sarawak	1	Coastal ESA	No
	2	Inland ESA	No
Sarawak Museum Department Sarawak Crafts Council	1	A list of any planned / future projects in Sri Aman Division	No
	2	Monthly visitor arrivals to Fort Alice, Sri Aman. 2015-2019.	No
Ministry of Tourism, Creative Industry and Performing Arts Sarawak	1	Planned projects in Sri Aman Division	No
Sarawak Crafts Council	1	A list of any planned / future projects in Sri Aman Division	No
Department of Statistics	1	Annual crude birth rate, crude death rate and natural increase rate by ethnic groups, from 2000 to the most recent year. The data to tabulate according to Sri Aman and Lubok Antu districts, and Sri Aman, Betong, Sarikei and Sibu Divisions.	Yes
	2	GDP contribution by sector/ industry for the last 10 years. 2010-2020 in the Sri Aman Division. Final value of all goods and services for the last 10 years. 2010-2020 in the Sri Aman Division. Intermediate costs for the last 10 years. 2010-2020 in the Sri Aman Division. Foreign Direct Investment into Sri Aman division for the past 10 years (2010-2020) FDI by sector/ industry, number of projects, value (RM) of projects Domestic Direct Investment into Sri Aman division for the past 10 years (2010-2020) DDI by sector/ industry, number of projects, value (RM) of projects External trade statistics of Sri Aman division for past 10 years (value of exports, imports, total trade) (2010-2020) Sri Aman division's Exports of major products for past 5 years (2015-2020) (by share, value, BEC (broad economic category)) Sri Aman division's Imports of major products for past 5 years (2015-2020) (by share, value, end use, BEC (broad economic category)) Sri Aman division's Top 10 trading partners/countries for past 5 years (2015-2020) (by share, value) State and district level business census data at MSIC 3-digit level. Sarawak state, Sri Aman Division, Sri Aman District and Lubok Antu District. Industrial land reserves in acres (undeveloped) in Sri Aman Division. Agriculture land reserves in acres (undeveloped) in Sri Aman Division. Migration (Sri Aman division and Sarawak state) – 20-year time series (2000 - 2020). Time series values are indicated as migration rate and number of people Number of establishments by sector/ industry in Sri Aman division, Sarawak. Workforce by occupations (MASCO categories) – snapshot or 10-year time series for Sarawak state and Sri Aman Division. Employment data at 3 digits by the MSIC CODE for Sarawak and Sri Aman Division. Government consumption/ expenditure (Sarawak state, Sri Aman Division) Consumer consumption/ expenditure (Sarawak state, Sri Aman Division) Compensation of employees (Sarawak state, Sri Aman Division) Social Accounting Matrix (Ref: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=442&bul_id=MHAXTG4wSyttSGliVE5JdjFLbTFzZz09&menu_id=T E5CRUZCblh4ZTZMODZlbnk2aWRRQT09)	Not available at divisional level

Appendix 2: List of Surveyed Villages

Location	Name	
Lingga	1. Kampung Hulu	10. Stumbin
	2. Kampung Hilir Stumbin	11. Seduku Panjai
	3. Skirau Tengah	12. Bazaar Lingga
	4. Rawan Ili	13. Kampung Masjid
	5. Skait	14. Tanjung Panggu
	6. Kampung Pangkat	15. Chabu Ili
	7. Tanjung Bijat	16. Chabu Ulu
	8. Tawang Tengah	17. Nansang ili
	9. Sebakak	
Engkilili	1. Marup Atas	8. Selindung Ulu
	2. Stuga	9. Selindung Hilir
	3. Marup Cina	10. Kumpang Langgir
	4. Bazaar Engkilili	11. Kumpag Paoh A & B
	5. Jelukong	12. Kandis
	6. Merio	13. Soh
	7. Kampung Melayu	14. Merbong
Lubok Antu	1. Bintong	8. Kampung Hilir
	2. Nyemungan	9. Bui Panjai
	3. Nanga Mepi	10. Skarok
	4. Empit	11. Tinting
	5. Kampung Melayu	12. Nanga Pan
	6. Wong Panjai	13. Nanga Jela
	7. Sebangki Panjai	14. Bazaar LA
Simanggang	1. Kampung Hilir	11. Jalan Kapitan
	2. Kampung Resak	12. Kampung Sri Wangi
	3. Selepong Kunang	13. Jalan Brayun
	4. Selepong Jingau	14. Jalan Batang Lupar
	5. Selepong Lop	15. Sebangkoi Undop
	6. Gua Ming	16. Samak
	7. Gua Sukat	17. Entebar
	8. Kampung Sabu	18. Bazaar Batu Lintang
	9. Sri Jaya	19. Kampung Kenyungan
	10. Kampung Muhibbah	20. Kampung Titikah
Pantu/Lachau	1. Lachau Ili	6. Bazaar Lachau
	2. Lachau Baru	7. Sg Tebelian
	3. Pantu Bazaar	8. Sebemban Selanjan
	4. Sebemban Jampu	9. Rapak
	5. Sebemban asal	

Appendix 3: Questions for Ketua Kampung

1. What is the total number of households in your Kpg/Rumah Panjang? No. of people?
2. Is the number of people increasing or decreasing for the last 10 or 20 years?
3. What is the average number of children each family have? (Note: Large (7 or more); medium (4-6), and small (1-3)).
4. Are there many young people here (0-14 years old)? Many? Few?
5. Are there many young people (15 years & above) attending secondary schools?
6. Do these young people (15 years & above) know how to read & write?
7. Are there a lot of people from here that are staying away from the Kpg/Rh? Why? Where do they go to?
8. Do the people often go to the Kalimantan border? Many? Often?
9. Which locations/places do they normally go to in Kalimantan? The reason for going there?
10. Are there any local people here that have relatives across the Kalimantan border? Few? Many? None/

-----Winding down questions---

11. What are the issues/ problems facing your Kpg/Rh (e.g. economic, social, infrastructure, border issues etc)? Which is the MOST challenging/crucial?
12. What are the assets/resources that can be developed in your Kpg/Rh?
13. What type of assistance/programs are needed for the development of your Kpg/Rh?

Appendix 4: Sri Aman Division Population by Age, Sex and Ethnic Group, 2000

(' 000)

Age/Sex Group	Total	Ethnic Group														Non	
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%	Malaysian	%
Total	88.2	58	1.44	18.5	0.31	10.6	0.23	0.6	0.01	0.1	0.00	0.2	0.00	0	0.00	0.5	0.01
0-4	10.8	6.3	1.35	3.2	0.42	1.1	0.19	0.1	0.01	0	0.00	0	0.00	0	0.00	0	0.00
5-9	9.6	6.1	1.40	2.3	0.36	1.2	0.24	0.1	0.01	0	0.00	0	0.00	0	0.00	0	0.00
10-14	9.3	6	1.43	2.1	0.34	1.2	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
15-19	7.7	5.1	1.45	1.5	0.30	1	0.24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
20-24	5.4	3.4	1.41	1.3	0.37	0.6	0.19	0	0.00	0	0.00	0	0.00	0	0.00	0.1	0.03
25-29	5.6	3.3	1.31	1.5	0.41	0.6	0.19	0.1	0.03	0	0.00	0	0.00	0	0.00	0.1	0.03
30-34	6.5	4.2	1.41	1.5	0.35	0.8	0.24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
35-39	6.2	4.1	1.46	1.3	0.33	0.8	0.25	0.1	0.02	0	0.00	0	0.00	0	0.00	0	0.00
40-44	5.7	3.9	1.49	0.9	0.21	0.8	0.28	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
45-49	5.1	3.5	1.48	0.8	0.21	0.7	0.23	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	4.4	3.1	1.49	0.6	0.19	0.5	0.21	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
55-59	3.6	2.7	1.59	0.5	0.19	0.4	0.22	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	2.9	2.1	1.54	0.4	0.19	0.4	0.27	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	2.2	1.6	1.52	0.3	0.19	0.3	0.29	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	1.5	1.2	1.73	0.2	0.18	0.1	0.09	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	1.0	0.9	1.86	0.1	0.14	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.7	0.7	2.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Male	44.0	28.6	1.43	9.3	0.31	5.6	0.24	0.2	0.01	0.1	0.00	0.2	0.01	0	0.00	0.3	0.01
0-4	5.5	3.2	1.35	1.7	0.46	0.5	0.17	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5-9	4.9	3.1	1.40	1.1	0.31	0.5	0.19	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10-14	4.7	3.1	1.43	0.9	0.27	0.6	0.22	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.9	2.6	1.43	0.7	0.26	0.5	0.23	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
20-24	2.7	1.7	1.40	0.6	0.32	0.3	0.16	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
25-29	2.7	1.5	1.31	0.8	0.40	0.4	0.29	0	0.00	0	0.00	0	0.00	0	0.00	0.1	0.05
30-34	3.2	2.1	1.45	0.6	0.26	0.4	0.24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
35-39	2.9	1.8	1.40	0.6	0.29	0.4	0.27	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
40-44	2.9	1.8	1.32	0.5	0.24	0.4	0.27	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
45-49	2.6	1.7	1.44	0.4	0.21	0.4	0.30	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	2.2	1.5	1.46	0.3	0.19	0.3	0.29	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.8	1.3	1.49	0.2	0.15	0.2	0.15	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.5	1	1.39	0.2	0.18	0.2	0.18	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.0	0.7	1.38	0.1	0.14	0.1	0.14	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.8	0.6	1.67	0.1	0.17	0.1	0.17	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.5	0.4	1.75	0.1	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.3	0.2	1.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Female	44.2	29.6	1.47	9.1	0.30	4.9	0.20	0.3	0.01	0.1	0.00	0.1	0.00	0	0.00	0.2	0.01
0-4	5.3	3.1	1.35	1.5	0.38	0.5	0.18	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5-9	4.6	2.9	1.39	1.1	0.33	0.5	0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10-14	4.6	2.9	1.39	1.1	0.33	0.5	0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.7	2.5	1.49	0.7	0.26	0.5	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
20-24	2.7	1.8	1.55	0.6	0.30	0.4	0.29	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
25-29	2.8	1.7	1.38	0.7	0.35	0.4	0.28	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	3.3	2.2	1.47	0.7	0.29	0.4	0.24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
35-39	3.3	2.3	1.51	0.6	0.25	0.4	0.24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
40-44	2.9	2	1.42	0.5	0.24	0.4	0.27	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
45-49	2.5	1.9	1.68	0.4	0.21	0.3	0.27	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	2.2	1.7	1.69	0.3	0.19	0.2	0.13	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.8	1.4	1.71	0.3	0.21	0.2	0.14	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.4	1.1	1.70	0.2	0.20	0.1	0.10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.2	0.9	1.67	0.2	0.22	0.1	0.11	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.7	0.6	1.80	0.1	0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.6	0.5	1.75	0.1	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.5	0.3	1.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Notes:

1. Population Projections (Renised) based on the Population and Housing Census of Malaysia 2010
2. The added total may differ dur to rounding
3. Includes Indians

Appendix 5: Sri Aman District Population by Age, Sex and Ethnic Group, 2000

('000)

Age/Sex Group	Total	Ethnic Group														Non	
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%	Malaysian	%
Total	64.2	37.3	0.58	17.8	0.28	8.3	0.13	0.5	0.01	0.1	0.00	0.2	0.00	0.0	-	0.3	0.00
0-4	8.2	4.1	0.50	3.1	0.38	0.9	0.11	0.1	0.01	0.0	-	0.0	-	0.0	-	0.0	-
5-9	6.9	3.8	0.55	2.2	0.32	0.9	0.13	0.1	0.01	0.0	-	0.0	-	0.0	-	0.0	-
10-14	6.6	3.6	0.55	2.0	0.30	0.9	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
15-19	5.5	3.2	0.58	1.4	0.25	0.8	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
20-24	3.9	2.1	0.54	1.2	0.31	0.5	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.1	0.03
25-29	4.0	2.0	0.50	1.4	0.35	0.5	0.13	0.1	0.03	0.0	-	0.0	-	0.0	-	0.1	0.03
30-34	4.7	2.7	0.57	1.4	0.30	0.6	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
35-39	4.5	2.6	0.58	1.2	0.27	0.6	0.13	0.1	0.02	0.0	-	0.0	-	0.0	-	0.0	-
40-44	4.2	2.6	0.62	0.9	0.21	0.6	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
45-49	3.8	2.4	0.63	0.8	0.21	0.6	0.16	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
50-54	3.2	2.1	0.66	0.6	0.19	0.4	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
55-59	2.7	1.9	0.70	0.5	0.19	0.3	0.11	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
60-64	2.1	1.4	0.67	0.4	0.19	0.3	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
65-69	1.6	1.1	0.69	0.3	0.19	0.2	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
70-74	1.1	0.8	0.73	0.2	0.18	0.1	0.09	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
75-79	0.7	0.6	0.86	0.1	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
80+	0.5	0.5	1.00	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Male	32.0	18.3	0.57	8.9	0.28	4.4	0.14	0.2	0.01	0.1	0.00	0.2	0.01	0.0	-	0.2	0.01
0-4	4.2	2.1	0.50	1.6	0.38	0.4	0.10	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
5-9	3.5	1.9	0.54	1.1	0.31	0.4	0.11	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
10-14	3.3	1.9	0.58	0.9	0.27	0.5	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
15-19	2.7	1.6	0.59	0.7	0.26	0.4	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
20-24	1.9	1.0	0.53	0.6	0.32	0.3	0.16	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
25-29	2.0	0.9	0.45	0.8	0.40	0.3	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.1	0.05
30-34	2.3	1.3	0.57	0.6	0.26	0.3	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
35-39	2.1	1.1	0.52	0.6	0.29	0.3	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
40-44	2.1	1.2	0.57	0.5	0.24	0.3	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
45-49	1.9	1.1	0.58	0.4	0.21	0.3	0.16	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
50-54	1.6	1.0	0.63	0.3	0.19	0.2	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
55-59	1.3	0.9	0.69	0.2	0.15	0.2	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
60-64	1.1	0.7	0.64	0.2	0.18	0.2	0.18	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
65-69	0.7	0.5	0.71	0.1	0.14	0.1	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
70-74	0.6	0.4	0.67	0.1	0.17	0.1	0.17	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
75-79	0.4	0.3	0.75	0.1	0.25	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
80+	0.2	0.1	0.50	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Female	32.2	19.1	0.59	8.8	0.27	3.9	0.12	0.2	0.01	0.1	0.00	0.1	0.00	0.0	-	0.1	0.00
0-4	4.0	2.0	0.50	1.5	0.38	0.4	0.10	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
5-9	3.3	1.8	0.55	1.1	0.33	0.4	0.12	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
10-14	3.3	1.8	0.55	1.1	0.33	0.4	0.12	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
15-19	2.7	1.6	0.59	0.7	0.26	0.4	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
20-24	2.0	1.1	0.55	0.6	0.30	0.3	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
25-29	2.0	1.0	0.50	0.7	0.35	0.3	0.15	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
30-34	2.4	1.4	0.58	0.7	0.29	0.3	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
35-39	2.4	1.5	0.63	0.6	0.25	0.3	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
40-44	2.1	1.4	0.67	0.5	0.24	0.3	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
45-49	1.9	1.3	0.68	0.4	0.21	0.2	0.11	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
50-54	1.6	1.1	0.69	0.3	0.19	0.2	0.13	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
55-59	1.4	1.0	0.71	0.3	0.21	0.2	0.14	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
60-64	1.0	0.7	0.70	0.2	0.20	0.1	0.10	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
65-69	0.9	0.6	0.67	0.2	0.22	0.1	0.11	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
70-74	0.5	0.4	0.80	0.1	0.20	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
75-79	0.4	0.3	0.75	0.1	0.25	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
80+	0.4	0.2	0.50	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-

Notes:

1. Population Projections (Revised) based on the Population and Housing Census of Malaysia 2010
2. The added total may differ due to rounding
3. Includes Indians

Appendix 6: Lubok Antu District Population by Age, Sex and Ethnic Group, 2000

(' 000)

Age/Sex Group	Total	Ethnic Group														Non	
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%	Malaysian	%
Total	24.0	20.7	0.9	0.7	0	2.3	0	0.1	0	0.0	0	0.0	0	0.0	0.0	0.2	0
0-4	2.6	2.2	0.8	0.1	0	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
5-9	2.7	2.3	0.9	0.1	0	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
10-14	2.7	2.4	0.9	0.1	0	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
15-19	2.2	1.9	0.9	0.1	0	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
20-24	1.5	1.3	0.9	0.1	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
25-29	1.6	1.3	0.8	0.1	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
30-34	1.8	1.5	0.8	0.1	0	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
35-39	1.7	1.5	0.9	0.1	0	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
40-44	1.5	1.3	0.9	0.0	0	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
45-49	1.3	1.1	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
50-54	1.2	1.0	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
55-59	0.9	0.8	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
60-64	0.8	0.7	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
65-69	0.6	0.5	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
70-74	0.4	0.4	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
75-79	0.3	0.3	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
80+	0.2	0.2	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
Male	12.0	10.3	0.9	0.4	0	1.2	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.1	0
0-4	1.3	1.1	0.8	0.1	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
5-9	1.4	1.2	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
10-14	1.4	1.2	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
15-19	1.2	1.0	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
20-24	0.8	0.7	0.9	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
25-29	0.7	0.6	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
30-34	0.9	0.8	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
35-39	0.8	0.7	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
40-44	0.8	0.6	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
45-49	0.7	0.6	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
50-54	0.6	0.5	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
55-59	0.5	0.4	0.8	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
60-64	0.4	0.3	0.8	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
65-69	0.3	0.2	0.7	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
70-74	0.2	0.2	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
75-79	0.1	0.1	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
80+	0.1	0.1	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
Female	12.0	10.5	0.9	0.3	0	1.0	0	0.1	0	0.0	0	0.0	0	0.0	0.0	0.1	0
0-4	1.3	1.1	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
5-9	1.3	1.1	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
10-14	1.3	1.1	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
15-19	1.0	0.9	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
20-24	0.7	0.7	1.0	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
25-29	0.8	0.7	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
30-34	0.9	0.8	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
35-39	0.9	0.8	0.9	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
40-44	0.8	0.6	0.8	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
45-49	0.6	0.6	1.0	0.0	0	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
50-54	0.6	0.6	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
55-59	0.4	0.4	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
60-64	0.4	0.4	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
65-69	0.3	0.3	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
70-74	0.2	0.2	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
75-79	0.2	0.2	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0
80+	0.1	0.1	1.0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0	0.0	0

Notes:

1. Population Projections (Renised) based on the Population and Housing Census of Malaysia 2010
2. The added total may differ dur to rounding
3. Includes Indians

Appendix 7: Sri Aman Division Population by Age, Sex and Ethnic Group, 2010

Age/Sex Group	Total	Ethnic Group													
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%
Total	94.7	64.20	67.79	17.80	18.80	10.70	11.30	0.60	0.63	0.80	0.84	0.40	0.42	0.30	0.32
0-4	9.2	6.20	67.39	1.90	20.65	0.80	8.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-9	10.2	7.00	68.63	2.00	19.61	1.00	9.80	0.10	0.98	0.00	0.00	0.00	0.00	0.00	0.00
10-14	9.5	6.70	70.53	1.90	20.00	1.00	10.53	0.10	1.05	0.00	0.00	0.00	0.00	0.00	0.00
15-19	9.8	6.50	66.33	1.90	19.39	1.10	11.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20-24	8.4	5.60	66.67	1.70	20.24	0.80	9.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-29	7.1	4.40	61.97	1.60	22.54	0.80	11.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30-34	6.0	3.90	65.00	1.20	20.00	0.70	11.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35-39	6.4	4.40	68.75	1.20	18.75	0.70	10.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40-44	6.2	4.20	67.74	1.10	17.74	0.70	11.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45-49	5.6	3.80	67.86	0.90	16.07	0.70	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50-54	4.5	3.00	66.67	0.70	15.56	0.60	13.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55-59	3.5	2.30	65.71	0.60	17.14	0.60	17.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60-64	2.9	2.10	72.41	0.40	13.79	0.40	13.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65-69	2.1	1.50	71.43	0.30	14.29	0.20	9.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70-74	1.3	1.00	76.92	0.20	15.38	0.20	15.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75-79	1.0	0.70	70.00	0.10	10.00	0.10	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80+	1.0	0.70	70.00	0.10	10.00	0.10	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Male	47.7	31.80	66.67	9.10	19.08	5.80	12.16	0.30	0.63	0.40	0.84	0.20	0.42	0.10	0.21
0-4	4.5	3.10	68.89	0.90	20.00	0.50	11.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-9	5.1	3.40	66.67	1.00	19.61	0.50	9.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-14	4.8	3.20	66.67	0.90	18.75	0.50	10.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-19	4.9	3.30	67.35	1.00	20.41	0.60	12.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20-24	4.1	2.60	63.41	0.80	19.51	0.50	12.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-29	3.5	2.10	60.00	0.80	22.86	0.50	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30-34	3.0	2.00	66.67	0.60	20.00	0.40	13.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35-39	3.2	2.10	65.63	0.60	18.75	0.40	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40-44	3.1	2.10	67.74	0.50	16.13	0.40	12.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45-49	2.9	1.90	65.52	0.50	17.24	0.40	13.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50-54	2.4	1.60	66.67	0.40	16.67	0.40	16.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55-59	2.0	1.30	65.00	0.30	15.00	0.30	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60-64	1.4	1.00	71.43	0.20	14.29	0.20	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65-69	1.1	0.80	72.73	0.20	18.18	0.10	9.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70-74	0.7	0.50	71.43	0.10	14.29	0.10	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75-79	0.4	0.30	75.00	0.10	25.00	0.10	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80+	0.4	0.30	75.00	0.10	25.00	0.10	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Female	47.0	32.40	68.94	8.70	18.51	4.20	8.94	0.30	0.64	0.40	0.85	0.20	0.43	0.20	0.43
0-4	4.6	3.20	69.57	0.90	19.57	0.30	6.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-9	5.1	3.60	70.59	1.00	19.61	0.40	7.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-14	4.9	3.30	67.35	0.90	18.37	0.40	8.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-19	4.8	3.20	66.67	0.90	18.75	0.40	8.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20-24	4.3	3.00	69.77	0.80	18.60	0.40	9.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-29	3.5	2.30	65.71	0.70	20.00	0.30	8.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30-34	3.0	2.00	66.67	0.50	16.67	0.30	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35-39	3.2	2.30	71.88	0.50	15.63	0.30	9.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40-44	3.0	2.10	70.00	0.50	16.67	0.30	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45-49	2.6	1.80	69.23	0.40	15.38	0.30	11.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50-54	2.1	1.50	71.43	0.30	14.29	0.20	9.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55-59	1.7	1.10	64.71	0.30	17.65	0.20	11.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60-64	1.5	1.10	73.33	0.20	13.33	0.10	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65-69	1.0	0.80	80.00	0.10	10.00	0.10	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70-74	0.7	0.50	71.43	0.10	14.29	0.10	14.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75-79	0.6	0.30	50.00	0.10	16.67	0.10	16.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80+	0.6	0.50	83.33	0.10	16.67	0.10	16.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 8: Sri Aman District Population by Age, Sex and Ethnic Group, 2010

Age/Sex Group	Total	Ethnic Group													
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%
Total	66.5	39.3	59.10	17	25.56	9	13.53	0.5	0.75	0.4	0.60	0.2	0.00	0.2	0.00
0-4	6.5	3.8	58.46	1.8	27.69	0.7	10.77	0	0.00	0	0.00	0	0.00	0	0.00
5-9	7.2	4.3	59.72	1.9	26.39	0.8	11.11	0.1	1.39	0	0.00	0	0.00	0	0.00
10-14	6.8	4.1	60.29	1.8	26.47	0.8	11.76	0.1	1.47	0	0.00	0	0.00	0	0.00
15-19	6.9	4	57.97	1.8	26.09	0.9	13.04	0	0.00	0	0.00	0	0.00	0	0.00
20-24	5.9	3.4	57.63	1.6	27.12	0.7	11.86	0	0.00	0	0.00	0	0.00	0	0.00
25-29	5.0	2.7	54.00	1.5	30.00	0.7	14.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	4.2	2.4	57.14	1.1	26.19	0.6	14.29	0	0.00	0	0.00	0	0.00	0	0.00
35-39	4.5	2.7	60.00	1.1	24.44	0.6	13.33	0	0.00	0	0.00	0	0.00	0	0.00
40-44	4.3	2.6	60.47	1	23.26	0.6	13.95	0	0.00	0	0.00	0	0.00	0	0.00
45-49	3.9	2.3	58.97	0.9	23.08	0.6	15.38	0	0.00	0	0.00	0	0.00	0	0.00
50-54	3.2	1.8	56.25	0.7	21.88	0.5	15.63	0	0.00	0	0.00	0	0.00	0	0.00
55-59	2.5	1.4	56.00	0.6	24.00	0.5	20.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	2.0	1.3	65.00	0.4	20.00	0.3	15.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.5	0.9	60.00	0.3	20.00	0.2	13.33	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.9	0.6	66.67	0.2	22.22	0.2	22.22	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.7	0.4	57.14	0.1	14.29	0.1	14.29	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.7	0.4	57.14	0.1	14.29	0.1	14.29	0	0.00	0	0.00	0	0.00	0	0.00
Male	33.7	19.5	57.86	8.7	25.82	4.9	14.54	0.2	0.59	0.2	0.59	0.1	0.00	0.1	0.00
0-4	3.2	1.9	59.38	0.9	28.13	0.4	12.50	0	0.00	0	0.00	0	0.00	0	0.00
5-9	3.6	2.1	58.33	1	27.78	0.4	11.11	0	0.00	0	0.00	0	0.00	0	0.00
10-14	3.4	2	58.82	0.9	26.47	0.4	11.76	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.5	2	57.14	1	28.57	0.5	14.29	0	0.00	0	0.00	0	0.00	0	0.00
20-24	2.9	1.6	55.17	0.8	27.59	0.4	13.79	0	0.00	0	0.00	0	0.00	0	0.00
25-29	2.5	1.3	52.00	0.8	32.00	0.4	16.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	2.1	1.2	57.14	0.6	28.57	0.3	14.29	0	0.00	0	0.00	0	0.00	0	0.00
35-39	2.2	1.3	59.09	0.6	27.27	0.3	13.64	0	0.00	0	0.00	0	0.00	0	0.00
40-44	2.2	1.3	59.09	0.5	22.73	0.3	13.64	0	0.00	0	0.00	0	0.00	0	0.00
45-49	2.0	1.2	60.00	0.5	25.00	0.3	15.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	1.7	1	58.82	0.4	23.53	0.3	17.65	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.4	0.8	57.14	0.3	21.43	0.3	21.43	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.0	0.6	60.00	0.2	20.00	0.2	20.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.8	0.5	62.50	0.2	25.00	0.1	12.50	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.5	0.3	60.00	0.1	20.00	0.1	20.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.3	0.2	66.67	0.1	33.33	0.1	33.33	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.3	0.2	66.67	0.1	33.33	0.1	33.33	0	0.00	0	0.00	0	0.00	0	0.00
Female	32.8	19.8	60.37	8.3	25.30	4.1	12.50	0.2	0.61	0.2	0.61	0.1	0.00	0.1	0.00
0-4	3.2	2	62.50	0.9	28.13	0.3	9.38	0	0.00	0	0.00	0	0.00	0	0.00
5-9	3.6	2.2	61.11	1	27.78	0.4	11.11	0	0.00	0	0.00	0	0.00	0	0.00
10-14	3.4	2.1	61.76	0.9	26.47	0.4	11.76	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.4	2	58.82	0.9	26.47	0.4	11.76	0	0.00	0	0.00	0	0.00	0	0.00
20-24	3.0	1.8	60.00	0.8	26.67	0.4	13.33	0	0.00	0	0.00	0	0.00	0	0.00
25-29	2.5	1.4	56.00	0.7	28.00	0.3	12.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	2.1	1.2	57.14	0.5	23.81	0.3	14.29	0	0.00	0	0.00	0	0.00	0	0.00
35-39	2.2	1.4	63.64	0.5	22.73	0.3	13.64	0	0.00	0	0.00	0	0.00	0	0.00
40-44	2.1	1.3	61.90	0.5	23.81	0.3	14.29	0	0.00	0	0.00	0	0.00	0	0.00
45-49	1.8	1.1	61.11	0.4	22.22	0.3	16.67	0	0.00	0	0.00	0	0.00	0	0.00
50-54	1.5	0.9	60.00	0.3	20.00	0.2	13.33	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.2	0.7	58.33	0.3	25.00	0.2	16.67	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.0	0.7	70.00	0.2	20.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.7	0.5	71.43	0.1	14.29	0.1	14.29	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.5	0.3	60.00	0.1	20.00	0.1	20.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.4	0.2	50.00	0.1	25.00	0.1	25.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.4	0.3	75.00	0.1	25.00	0.1	25.00	0	0.00	0	0.00	0	0.00	0	0.00

Appendix 9: Lubok Antu District Population by Age, Sex and Ethnic Group, 2010

Age/Sex Group	Total	Ethnic Group													
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%
Total	28.2	24.9	88.30	0.8	2.84	1.7	6.03	0.1	0.35	0.4	1.42	0.2	0.71	0.1	0.35
0-4	2.7	2.4	88.89	0.1	3.70	0.1	3.70	0	0.00	0	0.00	0	0.00	0	0.00
5-9	3.0	2.7	90.00	0.1	3.33	0.2	6.67	0	0.00	0	0.00	0	0.00	0	0.00
10-14	2.9	2.6	89.66	0.1	3.45	0.2	6.90	0	0.00	0	0.00	0	0.00	0	0.00
15-19	2.9	2.5	86.21	0.1	3.45	0.2	6.90	0	0.00	0	0.00	0	0.00	0	0.00
20-24	2.5	2.2	88.00	0.1	4.00	0.1	4.00	0	0.00	0	0.00	0	0.00	0	0.00
25-29	2.1	1.7	80.95	0.1	4.76	0.1	4.76	0	0.00	0	0.00	0	0.00	0	0.00
30-34	1.8	1.5	83.33	0.1	5.56	0.1	5.56	0	0.00	0	0.00	0	0.00	0	0.00
35-39	1.9	1.7	89.47	0.1	5.26	0.1	5.26	0	0.00	0	0.00	0	0.00	0	0.00
40-44	1.9	1.6	84.21	0.1	5.26	0.1	5.26	0	0.00	0	0.00	0	0.00	0	0.00
45-49	1.7	1.5	88.24	0	0.00	0.1	5.88	0	0.00	0	0.00	0	0.00	0	0.00
50-54	1.3	1.2	92.31	0	0.00	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.0	0.9	90.00	0	0.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	0.9	0.8	88.89	0	0.00	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.6	0.6	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.4	0.4	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.3	0.3	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.3	0.3	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Male	14.0	12.3	87.86	0.4	2.86	0.9	6.43	0.1	0.71	0.2	1.43	0.1	0.71	0	0.00
0-4	1.3	1.2	92.31	0	0.00	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
5-9	1.5	1.3	86.67	0	0.00	0.1	6.67	0	0.00	0	0.00	0	0.00	0	0.00
10-14	1.4	1.2	85.71	0	0.00	0.1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
15-19	1.4	1.3	92.86	0	0.00	0.1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
20-24	1.2	1	83.33	0	0.00	0.1	8.33	0	0.00	0	0.00	0	0.00	0	0.00
25-29	1.0	0.8	80.00	0	0.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	0.9	0.8	88.89	0	0.00	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
35-39	1.0	0.8	80.00	0	0.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
40-44	0.9	0.8	88.89	0	0.00	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
45-49	0.9	0.7	77.78	0	0.00	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
50-54	0.7	0.6	85.71	0	0.00	0.1	14.29	0	0.00	0	0.00	0	0.00	0	0.00
55-59	0.6	0.5	83.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	0.4	0.4	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.3	0.3	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.2	0.2	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.1	0.1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.1	0.1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Female	14.2	12.6	88.73	0.4	2.82	0.1	0.70	0.1	0.70	0.2	1.41	0.1	0.70	0.1	0.70
0-4	1.4	1.2	85.71	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5-9	1.5	1.4	93.33	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
10-14	1.5	1.2	80.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
15-19	1.4	1.2	85.71	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
20-24	1.3	1.2	92.31	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
25-29	1.0	0.9	90.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	0.9	0.8	88.89	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
35-39	1.0	0.9	90.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
40-44	0.9	0.8	88.89	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
45-49	0.8	0.7	87.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	0.6	0.6	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
55-59	0.5	0.4	80.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	0.5	0.4	80.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.3	0.3	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.2	0.2	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.2	0.1	50.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.2	0.2	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Appendix 10: Sri Aman Division Population by Age, Sex and Ethnic Group, 2020

Age/Sex Group	Total	Ethnic Group													
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%
Total	111.4	74.7	67.06	21.1	18.94	11.7	10.50	0.7	0.63	0.9	0.81	0.3	0.27	0.4	0.36
0-4	8.2	5.2	63.41	1.9	23.17	0.9	10.98	0.1	1.22	0	0.00	0	0.00	0.1	1.22
5-9	7.9	5	63.29	1.8	22.78	0.9	11.39	0.1	1.27	0	0.00	0	0.00	0	0.00
10-14	8.7	5.8	66.67	1.9	21.84	0.8	9.20	0	0.00	0	0.00	0	0.00	0	0.00
15-19	10.6	7.4	69.81	2	18.87	1	9.43	0	0.00	0.1	0.94	0	0.00	0	0.00
20-24	10.4	7.2	69.23	2	19.23	1.1	10.58	0.1	0.96	0.1	0.96	0	0.00	0	0.00
25-29	10.1	7	69.31	1.9	18.81	1	9.90	0	0.00	0.1	0.99	0	0.00	0	0.00
30-34	9.3	6	64.52	1.8	19.35	0.9	9.68	0	0.00	0.1	1.08	0	0.00	0	0.00
35-39	7.3	4.4	60.27	1.6	21.92	0.7	9.59	0	0.00	0	0.00	0	0.00	0	0.00
40-44	6.5	4.2	64.62	1.2	18.46	0.7	10.77	0	0.00	0	0.00	0	0.00	0	0.00
45-49	6.7	4.4	65.67	1.1	16.42	0.7	10.45	0	0.00	0	0.00	0	0.00	0	0.00
50-54	6.5	4.5	69.23	1	15.38	0.7	10.77	0	0.00	0	0.00	0	0.00	0	0.00
55-59	5.6	3.8	67.86	0.9	16.07	0.7	12.50	0	0.00	0	0.00	0	0.00	0	0.00
60-64	4.5	3.1	68.89	0.7	15.56	0.6	13.33	0	0.00	0	0.00	0	0.00	0	0.00
65-69	3.5	2.3	65.71	0.5	14.29	0.6	17.14	0	0.00	0	0.00	0	0.00	0	0.00
70-74	2.7	2	74.07	0.3	11.11	0.3	11.11	0	0.00	0	0.00	0	0.00	0	0.00
75-79	1.7	1.2	70.59	0.2	11.76	0.2	11.76	0	0.00	0	0.00	0	0.00	0	0.00
80+	1.2	1	83.33	0.1	8.33	0.1	8.33	0	0.00	0	0.00	0	0.00	0	0.00
Male	56.5	37	65.49	10.7	18.94	6.3	11.15	0.4	0.71	0.5	0.88	0.1	0.18	0.2	0.36
0-4	4.3	2.6	60.47	1.2	27.91	0.5	11.63	0	0.00	0	0.00	0	0.00	0	0.00
5-9	4.2	2.6	61.90	1.1	26.19	0.5	11.90	0	0.00	0	0.00	0	0.00	0	0.00
10-14	3.9	2.6	66.67	0.9	23.08	0.4	10.26	0	0.00	0	0.00	0	0.00	0	0.00
15-19	5.4	3.7	68.52	0.9	16.67	0.5	9.26	0	0.00	0.1	1.85	0	0.00	0	0.00
20-24	5.3	3.5	66.04	1	18.87	0.6	11.32	0	0.00	0	0.00	0	0.00	0	0.00
25-29	5.2	3.6	69.23	0.9	17.31	0.5	9.62	0	0.00	0	0.00	0	0.00	0	0.00
30-34	4.7	2.9	61.70	0.9	19.15	0.5	10.64	0	0.00	0	0.00	0	0.00	0	0.00
35-39	3.7	2.1	56.76	0.7	18.92	0.4	10.81	0	0.00	0	0.00	0	0.00	0	0.00
40-44	3.3	2.1	63.64	0.5	15.15	0.4	12.12	0	0.00	0	0.00	0	0.00	0	0.00
45-49	3.3	2.1	63.64	0.6	18.18	0.4	12.12	0	0.00	0	0.00	0	0.00	0	0.00
50-54	3.5	2.4	68.57	0.5	14.29	0.4	11.43	0	0.00	0	0.00	0	0.00	0	0.00
55-59	2.9	1.9	65.52	0.5	17.24	0.4	13.79	0	0.00	0	0.00	0	0.00	0	0.00
60-64	2.3	1.5	65.22	0.4	17.39	0.4	17.39	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.8	1.2	66.67	0.3	16.67	0.3	16.67	0	0.00	0	0.00	0	0.00	0	0.00
70-74	1.3	1	76.92	0.2	15.38	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.8	0.6	75.00	0.1	12.50	0.1	12.50	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.5	0.4	80.00	0.1	20.00	0.1	20.00	0	0.00	0	0.00	0	0.00	0	0.00
Female	54.8	37.7	68.80	10.3	18.80	5.4	9.85	0.4	0.73	0.4	0.73	0.1	0.18	0.2	0.36
0-4	3.8	2.5	65.79	0.8	21.05	0.4	10.53	0	0.00	0	0.00	0	0.00	0	0.00
5-9	3.7	2.4	64.86	0.7	18.92	0.4	10.81	0	0.00	0	0.00	0	0.00	0	0.00
10-14	4.8	3.3	68.75	0.9	18.75	0.4	8.33	0	0.00	0	0.00	0	0.00	0	0.00
15-19	5.3	3.7	69.81	1	18.87	0.5	9.43	0	0.00	0	0.00	0	0.00	0	0.00
20-24	5.1	3.6	70.59	0.9	17.65	0.5	9.80	0	0.00	0	0.00	0	0.00	0	0.00
25-29	5.0	3.4	68.00	0.9	18.00	0.5	10.00	0	0.00	0	0.00	0	0.00	0	0.00
30-34	4.6	3.2	69.57	0.8	17.39	0.5	10.87	0	0.00	0	0.00	0	0.00	0	0.00
35-39	3.6	2.3	63.89	0.7	19.44	0.4	11.11	0	0.00	0	0.00	0	0.00	0	0.00
40-44	3.1	2.1	67.74	0.6	19.35	0.3	9.68	0	0.00	0	0.00	0	0.00	0	0.00
45-49	3.3	2.3	69.70	0.6	18.18	0.3	9.09	0	0.00	0	0.00	0	0.00	0	0.00
50-54	3.1	2.2	70.97	0.5	16.13	0.4	12.90	0	0.00	0	0.00	0	0.00	0	0.00
55-59	2.7	1.9	70.37	0.4	14.81	0.3	11.11	0	0.00	0	0.00	0	0.00	0	0.00
60-64	2.5	1.5	60.00	0.3	12.00	0.2	8.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.7	1.1	64.71	0.3	17.65	0.2	11.76	0	0.00	0	0.00	0	0.00	0	0.00
70-74	1.3	1	76.92	0.2	15.38	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.9	0.6	66.67	0.1	11.11	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.8	0.7	87.50	0.1	12.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Appendix 11: Sri Aman District Population by Age, Sex and Ethnic Group, 2020

Age/Sex Group	Total	Ethnic Group													
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%
Total	78.3	45.8	58.49	20.1	25.67	9.8	12.52	0.5	0.64	0.6	0.77	0.2	0.26	0.2	0.26
0-4	5.4	2.7	50.00	1.8	33.33	0.7	12.96	0.1	1.85	0	0.00	0	0.00	0	0.00
5-9	5.2	2.6	50.00	1.7	32.69	0.7	13.46	0.1	1.92	0	0.00	0	0.00	0	0.00
10-14	6.1	3.5	57.38	1.8	29.51	0.7	11.48	0	0.00	0	0.00	0	0.00	0	0.00
15-19	7.5	4.6	61.33	1.9	25.33	0.8	10.67	0	0.00	0.1	1.33	0	0.00	0	0.00
20-24	7.4	4.5	60.81	1.9	25.68	0.9	12.16	0.1	1.35	0.1	1.35	0	0.00	0	0.00
25-29	7.2	4.4	61.11	1.8	25.00	0.8	11.11	0	0.00	0.1	1.39	0	0.00	0	0.00
30-34	6.7	3.8	56.72	1.7	25.37	0.8	11.94	0	0.00	0.1	1.49	0	0.00	0	0.00
35-39	5.1	2.7	52.94	1.5	29.41	0.6	11.76	0	0.00	0	0.00	0	0.00	0	0.00
40-44	4.7	2.7	57.45	1.1	23.40	0.6	12.77	0	0.00	0	0.00	0	0.00	0	0.00
45-49	4.7	2.7	57.45	1.1	23.40	0.6	12.77	0	0.00	0	0.00	0	0.00	0	0.00
50-54	4.6	2.8	60.87	1	21.74	0.6	13.04	0	0.00	0	0.00	0	0.00	0	0.00
55-59	4.0	2.4	60.00	0.9	22.50	0.6	15.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	3.2	2	62.50	0.7	21.88	0.5	15.63	0	0.00	0	0.00	0	0.00	0	0.00
65-69	2.5	1.5	60.00	0.5	20.00	0.5	20.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	1.9	1.3	68.42	0.3	15.79	0.3	15.79	0	0.00	0	0.00	0	0.00	0	0.00
75-79	1.2	0.8	66.67	0.2	16.67	0.2	16.67	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.9	0.7	77.78	0.1	11.11	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
Male	39.9	22.7	56.89	10.2	25.56	5.3	13.28	0.3	0.75	0.3	0.75	0.1	0.25	0.1	0.25
0-4	2.8	1.3	46.43	1.1	39.29	0.4	14.29	0	0.00	0	0.00	0	0.00	0	0.00
5-9	2.8	1.3	46.43	1	35.71	0.4	14.29	0	0.00	0	0.00	0	0.00	0	0.00
10-14	2.7	1.5	55.56	0.9	33.33	0.3	11.11	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.8	2.3	60.53	0.9	23.68	0.4	10.53	0	0.00	0.1	2.63	0	0.00	0	0.00
20-24	3.8	2.2	57.89	1	26.32	0.5	13.16	0	0.00	0	0.00	0	0.00	0	0.00
25-29	3.8	2.3	60.53	0.9	23.68	0.4	10.53	0	0.00	0	0.00	0	0.00	0	0.00
30-34	3.4	1.9	55.88	0.9	26.47	0.4	11.76	0	0.00	0	0.00	0	0.00	0	0.00
35-39	2.6	1.3	50.00	0.7	26.92	0.3	11.54	0	0.00	0	0.00	0	0.00	0	0.00
40-44	2.4	1.4	58.33	0.5	20.83	0.3	12.50	0	0.00	0	0.00	0	0.00	0	0.00
45-49	2.3	1.3	56.52	0.6	26.09	0.3	13.04	0	0.00	0	0.00	0	0.00	0	0.00
50-54	2.5	1.5	60.00	0.5	20.00	0.3	12.00	0	0.00	0	0.00	0	0.00	0	0.00
55-59	2.1	1.2	57.14	0.5	23.81	0.3	14.29	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.7	1	58.82	0.4	23.53	0.3	17.65	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.3	0.8	61.54	0.3	23.08	0.2	15.38	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.9	0.6	66.67	0.2	22.22	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.6	0.4	66.67	0.1	16.67	0.1	16.67	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.4	0.3	75.00	0.1	25.00	0.1	25.00	0	0.00	0	0.00	0	0.00	0	0.00
Female	38.3	23.1	60.31	9.8	25.59	4.5	11.75	0.3	0.78	0.3	0.78	0.1	0.26	0.1	0.26
0-4	2.5	1.4	56.00	0.8	32.00	0.3	12.00	0	0.00	0	0.00	0	0.00	0	0.00
5-9	2.4	1.3	54.17	0.7	29.17	0.3	12.50	0	0.00	0	0.00	0	0.00	0	0.00
10-14	3.4	2	58.82	0.9	26.47	0.3	8.82	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.8	2.3	60.53	1	26.32	0.4	10.53	0	0.00	0	0.00	0	0.00	0	0.00
20-24	3.6	2.2	61.11	0.9	25.00	0.4	11.11	0	0.00	0	0.00	0	0.00	0	0.00
25-29	3.5	2.1	60.00	0.9	25.71	0.4	11.43	0	0.00	0	0.00	0	0.00	0	0.00
30-34	3.2	1.9	59.38	0.8	25.00	0.4	12.50	0	0.00	0	0.00	0	0.00	0	0.00
35-39	2.5	1.4	56.00	0.7	28.00	0.3	12.00	0	0.00	0	0.00	0	0.00	0	0.00
40-44	2.2	1.3	59.09	0.6	27.27	0.3	13.64	0	0.00	0	0.00	0	0.00	0	0.00
45-49	2.3	1.4	60.87	0.6	26.09	0.3	13.04	0	0.00	0	0.00	0	0.00	0	0.00
50-54	2.2	1.4	63.64	0.5	22.73	0.3	13.64	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.9	1.2	63.16	0.4	21.05	0.3	15.79	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.5	0.9	60.00	0.3	20.00	0.2	13.33	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.2	0.7	58.33	0.3	25.00	0.2	16.67	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.9	0.6	66.67	0.2	22.22	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.6	0.4	66.67	0.1	16.67	0.1	16.67	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.6	0.5	83.33	0.1	16.67	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Appendix 12: Lubok Antu District Population by Age, Sex and Ethnic Group, 2020

Age/Sex Group	Total	Ethnic Group													
		Iban	%	Malay	%	Chinese	%	Bidayuh	%	Orang Ulu	%	Melanau	%	Others	%
Total	33.1	28.9	87.31	1	3.02	1.9	5.74	0.2	0.60	0.3	0.91	0.1	0.30	0.2	0.60
0-4	2.8	2.5	89.29	0.1	3.57	0.2	7.14	0	0.00	0	0.00	0	0.00	0.1	3.57
5-9	2.7	2.4	88.89	0.1	3.70	0.2	7.41	0	0.00	0	0.00	0	0.00	0	0.00
10-14	2.6	2.3	88.46	0.1	3.85	0.1	3.85	0	0.00	0	0.00	0	0.00	0	0.00
15-19	3.1	2.8	90.32	0.1	3.23	0.2	6.45	0	0.00	0	0.00	0	0.00	0	0.00
20-24	3.0	2.7	90.00	0.1	3.33	0.2	6.67	0	0.00	0	0.00	0	0.00	0	0.00
25-29	2.9	2.6	89.66	0.1	3.45	0.2	6.90	0	0.00	0	0.00	0	0.00	0	0.00
30-34	2.6	2.2	84.62	0.1	3.85	0.1	3.85	0	0.00	0	0.00	0	0.00	0	0.00
35-39	2.2	1.7	77.27	0.1	4.55	0.1	4.55	0	0.00	0	0.00	0	0.00	0	0.00
40-44	1.8	1.5	83.33	0.1	5.56	0.1	5.56	0	0.00	0	0.00	0	0.00	0	0.00
45-49	2.0	1.7	85.00	0	0.00	0.1	5.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	1.9	1.7	89.47	0	0.00	0.1	5.26	0	0.00	0	0.00	0	0.00	0	0.00
55-59	1.6	1.4	87.50	0	0.00	0.1	6.25	0	0.00	0	0.00	0	0.00	0	0.00
60-64	1.3	1.1	84.62	0	0.00	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
65-69	1.0	0.8	80.00	0	0.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.8	0.7	87.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.5	0.4	80.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.3	0.3	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Male	16.6	14.3	86.14	0.5	3.01	1	6.02	0.1	0.60	0.2	1.20	0	0.00	0.1	0.60
0-4	1.5	1.3	86.67	0.1	6.67	0.1	6.67	0	0.00	0	0.00	0	0.00	0	0.00
5-9	1.4	1.3	92.86	0.1	7.14	0.1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
10-14	1.2	1.1	91.67	0	0.00	0.1	8.33	0	0.00	0	0.00	0	0.00	0	0.00
15-19	1.6	1.4	87.50	0	0.00	0.1	6.25	0	0.00	0	0.00	0	0.00	0	0.00
20-24	1.5	1.3	86.67	0	0.00	0.1	6.67	0	0.00	0	0.00	0	0.00	0	0.00
25-29	1.4	1.3	92.86	0	0.00	0.1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
30-34	1.3	1	76.92	0	0.00	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
35-39	1.1	0.8	72.73	0	0.00	0.1	9.09	0	0.00	0	0.00	0	0.00	0	0.00
40-44	0.9	0.7	77.78	0	0.00	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
45-49	1.0	0.8	80.00	0	0.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	1.0	0.9	90.00	0	0.00	0.1	10.00	0	0.00	0	0.00	0	0.00	0	0.00
55-59	0.8	0.7	87.50	0	0.00	0.1	12.50	0	0.00	0	0.00	0	0.00	0	0.00
60-64	0.6	0.5	83.33	0	0.00	0.1	16.67	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.5	0.4	80.00	0	0.00	0.1	20.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.4	0.4	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.2	0.2	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.1	0.1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Female	16.5	14.6	88.48	0.5	3.03	0.9	5.45	0.1	0.61	0.1	0.61	0	0.00	0.1	0.61
0-4	1.3	1.1	84.62	0	0.00	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
5-9	1.3	1.1	84.62	0	0.00	0.1	7.69	0	0.00	0	0.00	0	0.00	0	0.00
10-14	1.4	1.3	92.86	0	0.00	0.1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
15-19	1.5	1.4	93.33	0	0.00	0.1	6.67	0	0.00	0	0.00	0	0.00	0	0.00
20-24	1.5	1.4	93.33	0	0.00	0.1	6.67	0	0.00	0	0.00	0	0.00	0	0.00
25-29	1.5	1.3	86.67	0	0.00	0.1	6.67	0	0.00	0	0.00	0	0.00	0	0.00
30-34	1.4	1.3	92.86	0	0.00	0.1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
35-39	1.1	0.9	81.82	0	0.00	0.1	9.09	0	0.00	0	0.00	0	0.00	0	0.00
40-44	0.9	0.8	88.89	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
45-49	1.0	0.9	90.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
50-54	0.9	0.8	88.89	0	0.00	0.1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
55-59	0.8	0.7	87.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
60-64	0.6	0.6	10.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65-69	0.5	0.4	80.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
70-74	0.4	0.4	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
75-79	0.3	0.2	66.67	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
80+	0.2	0.2	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Appendix 13: Sri Aman Division: Forecast Population By Natural Increase Rate (NIR)*, 2000, 2010, 2020 and 2030

Year	NIR*	Population
2000	13.0	88,441
2001	12.85	89,591
2002	12.90	90,742
2003	11.53	91,913
2004	11.88	92,972
2005	12.10	94,076
2006	12.25	95,212
2007	9.53	96,378
2008	9.10	97,296
2009	8.80	98,182
2010	8.58	99,046
2011	8.48	99,895
2012	6.63	100,742
2013	6.53	101,409
2014	7.08	102,071
2015	5.25	102,793
2016	4.63	103,332
2017	3.70	103,810
2018	3.20	104,194
2019	8.83	104,528
2020	8.96	105,450
2021	8.26	106,395
2022	7.69	107,274
2023	7.12	108,099
2024	6.56	108,869
2025	5.99	109,583
2026	5.42	110,239
2027	4.85	110,837
2028	4.28	111,374
2029	3.71	111,851
2030	3.14	112,266

Note: *3 years moving average of 2000 to 2018 NIR of Betong and their extended time Series analysis.

Appendix 14: Sri Aman District: Forecast Population By Natural Increase Rate (NIR)*2000, 2010, 2020 and 2030

Year	NIR*	Population
2000	14.80	64,475
2001	13.00	65,429
2002	12.30	66,280
2003	11.60	67,095
2004	11.50	67,873
2005	10.20	68,654
2006	10.60	69,354
2007	9.30	70,089
2008	10.30	70,741
2009	8.80	71,470
2010	7.90	72,099
2011	8.70	72,668
2012	7.90	73,301
2013	7.20	73,880
2014	6.10	74,412
2015	4.80	74,865
2016	4.70	75,225
2017	4.60	75,578
2018	4.10	75,926
2019	8.83	76,237
2020	8.96	76,910
2021	8.26	77,599
2022	7.69	78,240
2023	7.12	78,842
2024	6.56	79,403
2025	5.99	79,924
2026	5.42	80,403
2027	4.85	80,839
2028	4.28	81,231
2029	3.71	81,578
2030	3.14	81,881

Note: *3 years moving average of 2000 to 2018 NIR of Betong and their extended time Series analysis.

Appendix 15: Lubok Antu District: Forecast Population By Natural Increase Rate (NIR)*, 2000, 2010, 2020 and 2030

Year	NIR	Population
2000	12.4	23,966
2001	12.8	24,263
2002	13.1	24,574
2003	11.5	24,896
2004	12.0	25,182
2005	12.7	25,484
2006	12.8	25,808
2007	9.6	26,138
2008	8.7	26,389
2009	8.8	26,619
2010	8.8	26,853
2011	8.4	27,089
2012	6.2	27,317
2013	6.3	27,486
2014	7.4	27,659
2015	5.4	27,864
2016	4.6	28,014
2017	3.4	28,143
2018	2.9	28,239
2019	8.83	28,321
2020	8.96	28,571
2021	8.26	28,827
2022	7.69	29,065
2023	7.12	29,288
2024	6.56	29,497
2025	5.99	29,690
2026	5.42	29,868
2027	4.85	30,030
2028	4.28	30,176
2029	3.71	30,305
2030	3.14	30,417

Note: *3 years moving average of 2000 to 2018 NIR of Betong and their extended time Series analysis.

Appendix 16: List of Focus Group Discussion

No	Cluster	Stakeholder	Consultant	Date (Time)
1	Infrastructure and Public Utilities	Sarawak Energy Berhad	- Khathijah Md Jaafar - Michael Bain	6 April 2021 (10:00 am)
2	Social Services, Human Resources and Demography	Centre of Technical Excellence (CENTEXS)	AP Dr Kartinah Ayupp	14 April 2021 (4:30 pm)
3	- Infrastructure and Public Utilities - Regional and Urban Planning	- Sarawak Rural Water Supply Department - Economic Planning Unit	- Khathijah Md Jaafar - Michael Bain - Jaclyna - Dr Md Nasrudin Md Salleh	20 April 2021 (9:00 am)
4	Social Services, Human Resources and Demography	Sarawak Department of Labour	AP Dr Kartinah Ayupp	22 April 2021 (10:00 am)
5	Social Services, Human Resources and Demography	i-CATS University College	AP Dr Kartinah Ayupp	23 April 2021 (9:00 am)
6	Infrastructure and Public Utilities	Sri Aman Drainage and Irrigation Department	- Michael Bain - Khathijah Md Jaafar	27 April 2021 (10:00 am)
7	Economic Planning and Development	- Ministry of Tourism, Creative Industry and Performing Arts - Sarawak Forestry Corporation - Sarawak Tourism Board - Sarawak Museum Department - Sarawak Craft Council	- Prof Dato' Dr Morshidi Sirat - Wayne Tarman - Michael Bain - Khathijah Md Jaafar	28 April 2021 (2:30 pm)
8	Primary Industry/Sector Business Model	- Ministry of Modernisation of Agriculture and Regional Development - Department of Agriculture Sarawak - Department of Veterinary Services Sarawak HQ - Sri Aman Divisional Agriculture Office - Department of Veterinary Services Sri Aman Division - IADA Batang Lupar - Department of Irrigation and Drainage Sarawak (DID) HQ - Sarawak Land Consolidation and Rehabilitation Authority (SALCRA) - Land Custody and Development Authority (LCDA)	- Datu Dr Hatta Solhi - Dato' Abdul Kadir - Khathijah Md Jaafar - Michael Bain	29 April 2021 (9:00 am)
9	Regional and Urban Planning	Land and Survey Sarawak	- Prof Dato' Dr Morshidi Sirat - Dr Md Nasrudin Md Salleh - Khathijah Md Jaafar - Howard Trett - Dato' Kamal Zaharin - Harem Peri - Prof Dr Shahren Ahmad Zaidi Adruce	29 April 2021 (2:00 pm)
10	Infrastructure and Public Utilities	SACOFA	- Khathijah Md Jaafar - Michael Bain - Prof Dr Shahren Ahmad Zaidi Adruce	30 April 2021 (10:00 am)

No	Cluster	Stakeholder	Consultant	Date (Time)
11	Economic Planning and Development	- Sarawak Economic Development Corporation - Ministry of International Trade and Industry	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Aduce - Khathijah Md Jaafar - Michael Bain - Chia Yi Han - AP Dr Md Affendy Arip - Barry Lim	3 May 2021 (10:00 am)
12	Regional and Urban Planning	- State Planning Authority - Public Works Department (JKR)	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Aduce - Dr Md Nasrudin Md Salleh - Khathijah Md Jaafar - Howard Trett - Dato' Kamal Zaharin - Harem Peri - Goh Bok Yen	5 May 2021 (10:00 am)
13	- Regional and Urban Planning - Infrastructure and Public Utilities	- Sarawak Disaster Management Committee - Fire and Rescue Department Sarawak - Sarawak RELA Office - Sarawak Malaysian Civil Defence Force - Sri Aman District Council - Sarawak Contingent Police Headquarters - Sri Aman Resident Office	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Aduce - Khathijah Md Jaafar - Dr Ting Siew King - Nordin Abdullah - Michael Bain	6 May 2021 (10:00 am)
14	- Regional and Urban Planning - Infrastructure and Public Utilities	- Natural Resources and Environment Board Sarawak - Department of Environment Sarawak	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Aduce - Khathijah Md Jaafar - Michael Bain - Jaclyna	6 May 2021 (2:00 pm)
15	- Economic Planning and Development - Social Services, Human Resources and Demography	- Centre of Technical Excellence (CENTEXS) - CATS University College - GIATMARA - Institut Latihan Perindustrian (ILP) Miri - Institut Kemahiran Belia Negara Miri - Sarawak Education Department	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Aduce - Khathijah Md Jaafar - Chia Yi Han - AP Dr Kartinah Ayupp	7 May 2021 (10:00 am)
16	Primary Industry/Sector Business Model	- Department of Marine Fisheries (Biosecurity Section) - Inland Fisheries Branch, Department of Agriculture - Batang Ai Ecofish Sdn. Bhd. - Supreme Cold Storage	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Aduce - Khathijah Md Jaafar - Gopinath Nagaraj	7 May 2021 (2:30 pm)

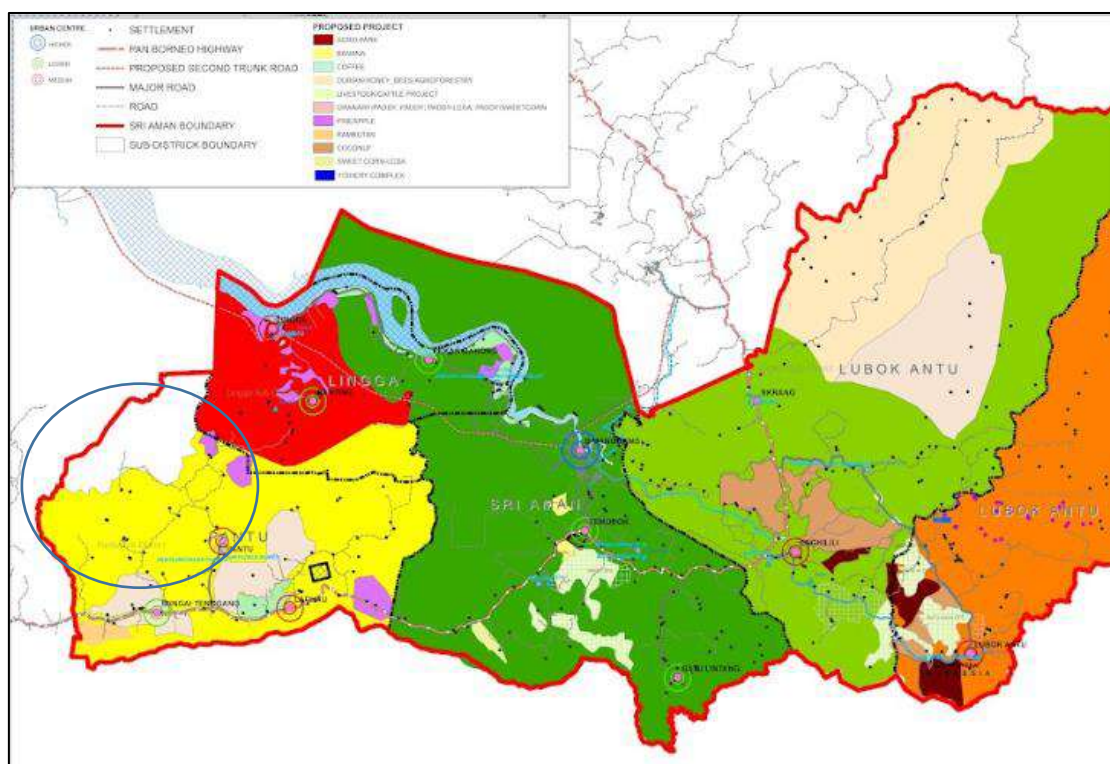
No	Cluster	Stakeholder	Consultant	Date (Time)
17	Primary Industry/Sector Business Model	- Persatuan Nelayan Kawasan Sebuyau - Persatuan Nelayan Kawasan Layar Rimbis / Pusak - Jabatan Perikanan Laut Daerah Sebuyau - Ibu Pejabat Jabatan Perikanan Laut	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Adruce - Khathijah Md Jaafar - Gopinath Nagaraj	10 May 2021 (10:00 am)
18	Economic Planning and Development	- Sarawak Multimedia Authority (SMA) - Sarawak Digital Economy Corporation (SDEC)	- Prof Dato' Dr Morshidi Sirat - Prof Dr Shahren Ahmad Zaidi Adruce - Khathijah Md Jaafar - Chia Yi Han - Barry Lim - Saranya Sundaram - AP Dr Md Affendy Md Arip	10 May 2021 (2:30 pm)
19	Infrastructure	- Economic Planning Unit (EPU) - Ministry of Urban and Natural Resources (MUDeNR) - Sarawak Drainage and Irrigation Department - Sri Aman Drainage and Irrigation Department - Ministry of Public Health, Housing and Local Government - Sewerage Services Department - Land and Survey Department Sarawak - Public Works Department Sarawak	- Khathijah Md Jaafar - Michael Bain - Harem Peri - Dr Md Nasrudin Md Salleh	24 June 2021 (10.00 am)
20	Utilities	- Economic Planning Unit (EPU) - Ministry of Urban and Natural Resources (MUDeNR) - Sarawak Rural Water Supply Department - Sarawak Energy Berhad (SEB) - Sarawak Multimedia Authority (SMA)	- Khathijah Md Jaafar - Michael Bain - Jaclyna Ang - AP Dr M Affendy Arip - AP Dr Puah Chin Hong - AP Dr Lee Nung Kion - Harem Peri - Dr Abang Ekhsan	28 June 2021 (2.30 pm)
21	Drainage and Sewerage	- Economic Planning Unit (EPU) - Ministry of Urban and Natural Resources (MUDeNR) - Sarawak Drainage and Irrigation Department - Sri Aman Drainage and Irrigation Department - Ministry of Public Health, Housing and Local Government - Natural Resources and Environment Board (NREB) - Public Works Department Sarawak - Land and Survey Department Sarawak	- Prof Dato' Morshidi Sirat - Khathijah Md Jaafar - Michael Bain - Jaclyna Ang - AP Dr Lee Nung Kion - Harem Peri - Dr Abang Ekhsan - Dr Md Nasruddin	2 July 2021 (2.30 pm)

No	Cluster	Stakeholder	Consultant	Date (Time)
22	Agriculture	• Economic Planning Unit (EPU) • Ministry of Urban and Natural Resources (MUDeNR) • Sarawak Drainage and Irrigation Department • Sri Aman Drainage and Irrigation Department • Ministry of Modernisation of Agriculture and Regional Development (MANRED) • Pantu Department of Agriculture • Engkelili Department of Agriculture • Sri Aman Department of Agriculture • Land and Survey Department Sarawak • Sarawak Rural Water Supply Department (JBALB) • Sarawak Land Consolidation and Rehabilitation Authority (SALCRA) • Department Of Veterinary Services Sarawak	Prof Dato' Morshidi Sirat Khathijah Md Jaafar Michael Bain Dato Abdul Kadir AP Dr Lee Nung Kion Harem Peri	9 July 2021 (2.30 pm)

Appendix 17: Establishment of Pantu District

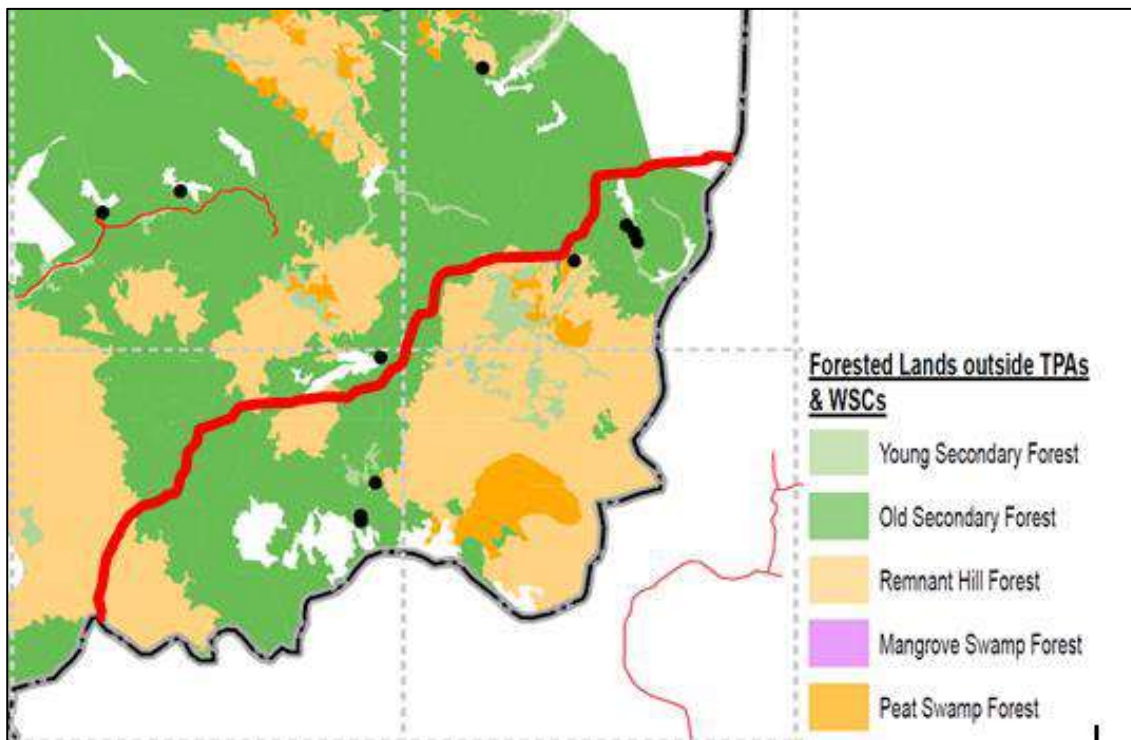
In 2021, the Sarawak government establishes a new district of Pantu. The new district involves annexes of part of Samarahan Division in Sebuyau. The new area is approximately 16,000 hectares (see Figure 1).

Figure 1: Expansion of Pantu District



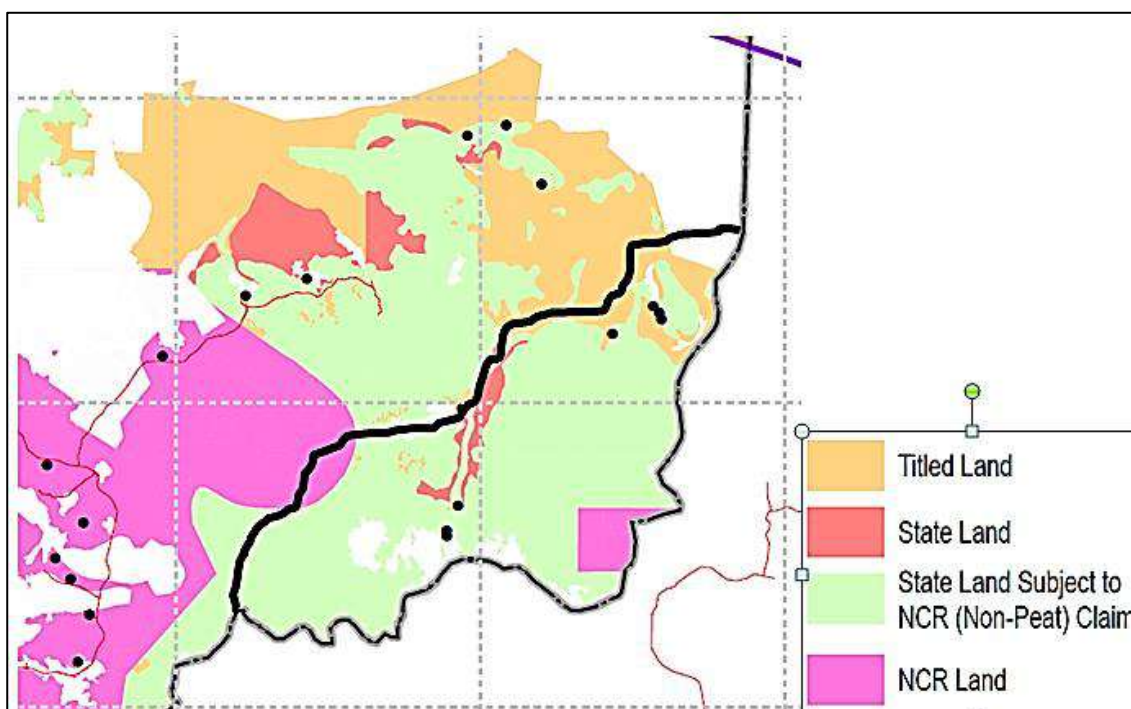
This area is located in the community agricultural areas involving 6 settlements. At present the vegetation cover is mostly remnant hill forest and old secondary forest, outside TPAs and WSCs (Figure 2)

Figure 2: Vegetation Cover & Settlement Areas



Most of the land is state land subject to NCR claim (Figure 3)

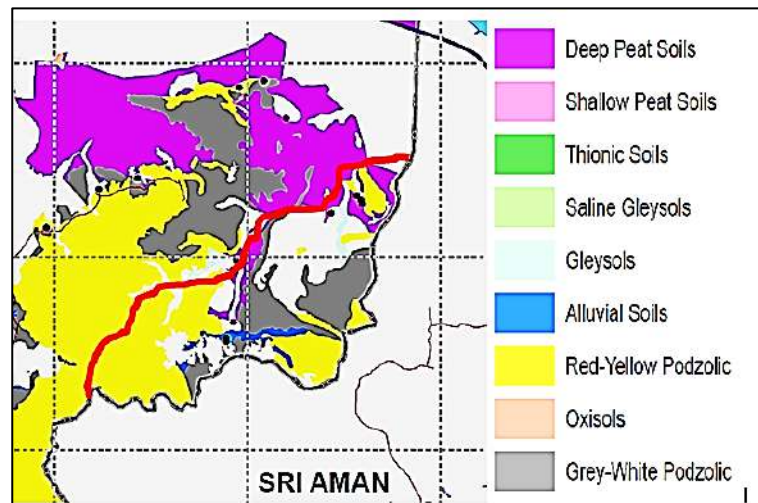
Figure 3: Land Ownership



Soil Groups

Potential agricultural Areas estimated at 12,000 hectares. The soils are generally good made up of Podzolic soils (Red Yellow Podzolic, Grey White Podzolic) class 3 & 4. Terrain is mainly low hilly midland (Figure 3)

Figure 3: Soil Types



The area is suitable for a number of crops including oil palm, pepper, rubber, pineapple and durian. We are proposing 1,000 ha durian/coffee, 3,000 ha TKPM pineapple, and 8,000 ha for oil palm under SALCRA to be developed in the area (Figure 4)

Figure 4: Proposed Agriculture Development in the new area in Pantu District

