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IMPROVING SAGO VALUE CHAIN FOR INDONESIA AND EU MARKET. A CASE STUDY OF KAPUAS DISTRICT IN CENTRAL KALIMANTAN, INDONESIA

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Improving Sago Value Chain for Indonesia and EU market.
A Case Study of Kapuas District in Central Kalimantan, Indonesia.

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LIST OF ACRONYMS

CO2	Carbon Dioxide
REDD+	Reducing Emissions from Deforestation and Forest Degradation
FMU	Forest Management Unit
KM2	Kilometre Square
GHG	Greenhouse Gas
COVID-19	Corona Virus Disease 19
SWOT	Strengths Weaknesses Opportunities and Threats
PESTEC	Political Economical Social Technological Environmental and Cultural
HA	Hectare
EU	European Union
KG	kilogram
PKK	Permbedayan Kesejahteraan Kalvarge
BRG	Peatland Restoration Body
KPKH	Kapuas Kahayan
UNEP	United Nations Environmental Programme
ID	Indonesian Rupiah
HACCP	Hazard Analysis and Critical Control Points
IFS	International Food Standards

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To my family, home is where all the love is. I appreciate your love, support, and relentless efforts in constantly bringing out the best in me.

DEDICATION

To the sago chain actors and supporters in Kapuas district of Central Kalimantan Indonesia.

ABSTRACT

Local farmers in Central Kalimantan have continued to destroy peatlands in the area to make space for planting more profitable crops like oil palm. These peatlands store huge amounts of carbon and degrading them increases the release of greenhouse gases emissions. For this reason, planting of naturally occurring peatland crops are being encouraged by the Indonesian government. One of these crops is sago palm, which is grown mostly for its starch however, local farmers complain of the unavailability of markets and have continued to degrade peatlands to plant other crops. The research thus aimed to investigate the current sago value chain in Central Kalimantan to analyse opportunities for chain development that will improve the livelihoods of local farmers and maintain peatlands. The research made use of semi structure interview to analyze the existing sago value chain and employed semi structured interviews to investigate the market demand for sago starch. Poor chain coordination was discovered to be the prominent issue hindering the chain from accessing the market. Other issues discovered were poor processing facilities, poor product quality and poor information flow. It was also revealed that sago palm is mostly mistaken for tapioca starch in Indonesia which also affects its marketability. The research additionally discovered that the demand for sago starch in Indonesia is higher in comparison with the EU market and strategies. It was thus concluded that Indonesian market is more favorable for sago marketing however, more attention can be paid to improve its marketability in the EU market.

1.0 INTRODUCTION

This section will give background information for the research stating the purpose of the research, its relevance, the objective, and the necessary questions to be answered regarding this research.

1.1 BACKGROUND INFORMATION

"Peatlands are among the worlds most underappreciated natural treasures. Found on every continent, these waterlogged ecosystems are among the most important carbon reservoirs on the planet" (Grump J. 2017).

Over the years, Indonesia has soured high in being among the top agricultural producers of crops like oil palm and paddy (Lee, 2013). While the worlds demand for cash crops like oil palm has continued to rise, more forests are being converted to plantations by locals for improved income. Some of the areas affected are peatlands. Indonesian peatlands hold large amounts of carbon in their soil and biomass, especially when in its original condition. Approximately 12% of the Indonesian land is covered by peatlands (Hooijer et al, 2010).

With a mean annual loss of approximately 8.6 thousand hectares, peatland deforestation leads to loss of protected habitat (Uda et al., 2017). In Central Kalimantan, Peat forests and the ecosystem services which they provide are being transformed at alarming rates. Between 2007 and 2015, the loss percentage was 2.6% per year in Sumatra and Kalimantan (Miettinen et al. 2016). Burning forests and peatlands is regarded as the most cost and labour-efficient system for eliminating vegetation and is being used by many Indonesian farmers including smallholders, medium-sized enterprises, and some industrial-scale companies. Burning these forests leads to peatland degradation and increases the emission of CO_2 into the atmosphere.

The need to reduce such emissions has been acknowledged and met with restrictions on oil palm plantations which largely drives deforestation in Central Kalimantan and Indonesia at large (Abrams et al, 2015). In 2010, the government of Indonesia began its efforts in the fight against deforestation and climate change. Through the REDD+ programme, the Indonesian government chose Central Kalimantan as its pilot province under the guidance of Forest Management Unit in Kapuas district, Central Kalimantan with the aim of reducing deforestation and peatland degradation through paludiculture (Forest Peoples Programme, 2011).

Paludiculture is an alternative technique for managing productive peatlands for food crops while maintaining ecological functions (Prastyaningsi, 2019). Paludiculture involves the use of naturally occurring peatland crops in the rehabilitation of degraded peatlands. One of such crops favourable for peatland rehabilitation is Sago palm (Prastyaningsi, 2019). Sago palm (metroxylon sagu) is a plant crop native to the tropical regions in Southeast Asia. The crop stores edible starch in its trunk and has been a source of carbohydrate for the indigenous people. The palm occurs naturally on swamp areas, can withstand flooding and has been praised for its ability to adapt to varying soil conditions including peat soils (Flach, 1997).

Local farmers in Central Kalimantan who grow this crop could benefit from its trade to improve their livelihoods. However, there is little demand for this crop hence, its environmental benefits are not being utilised fully because local producers have continued to burn peat areas to create land space for planting more profitable crops leading to deforestation and peatland degradation.

1.2 PROBLEM STATEMENT

To limit the degradation of peatlands for production of other profitable crops like oil palm and to improve environmental sustainability, paludiculture is being encouraged using crops like Sago palm.

While some parts of Indonesia are exploring this starch crop with environmental benefits, Central Kalimantan has suffered challenges in utilising this starch crop. The main problem is that local farmers see little or no reason to invest in this crop due to its low demand and profitability as compared to other crops like oil palm and paddy. This research thus investigates the existing sago value chain in Central Kalimantan to analyse opportunities for improving the chain and market linkages.

1.3 PROBLEM OWNER/COMMISSIONER

This research has two problem owners. The primary/direct problem owner and the secondary/indirect problem owner. The Primary problem owner is the Forest Management unit (FMU) in Kapuas Kahayan district of Central Kalimantan headed by Mr. Bayu Nugroho. The secondary problem owners are the local sago farmers in Central Kalimantan.

1.3.1 INFORMATION ABOUT PROBLEM OWNER

The Forest management unit is a body whose obligation is ensuring that forests in Central Kalimantan are maintained and preserved. Among their duties lies the responsibility of reducing deforestation in Central Kalimantan and by extension, peatland degradation. This sole responsibility has however remained difficult. While the FMU has encouraged the conservation of peatlands through growing paludiculture crops like sago, Local farmers still engage in deforestation and peatland degradation to cultivate more profitable crops. For this reason, the FMU mandated the researcher to investigate alternative strategies that can improve Sago value chain in the province and connect the local farmers to better markets that will result in improved livelihoods for the farmers, reduction of deforestation, reduced peatland degradation and mitigation of carbon emission.

1.4 RESEARCH AIM

This research aims to investigate the current sago value chain in Central Kalimantan to analyse opportunities for chain development that will improve the livelihoods of local farmers and environmental sustainability.

1.5 RESEARCH OBJECTIVE

To analyse the sago value chain in Central Kalimantan and suggest recommendations for improvement through finding opportunities for markets linkages.

1.6 RESEARCH JUSTIFICATION

This research is Vital in solving challenges surrounding peatland degradation, climate change and low income of sago farmers in the local communities in Central Kalimantan. The Forest management Unit in Kapuas Kahayan district, Central Kalimantan has interest in discovering strategies that can lead to the boost of sago industry to enable local farmers to become more involved in sago cultivation. It is also important because poor market linkages have remained one of the indirect causes of peatland degradation. Finding market linkages for peatland crops like sago could be a more sustainable strategy in ensuring that local communities have improved income that will encourage peatland conservation.

1.7 RESEARCH SCOPE

This research is limited to analysing the existing Sago palm value chain in Central Kalimantan in Indonesia, highlighting its use in Paludiculture, and carrying out a market survey to find potential markets in the food sector for Sago starch.

1.8 RESEARCH QUESTIONS

1. What is the current situation of sago value chain in Central Kalimantan?
    a. What is the current sago palm/starch production methods and capacity?

b. How is the product processed and used?
c. Who are the stakeholders including gender in the sago value chain and what are their costs and value share?
d. What is the governance structure in the chain?
e. What are the challenges hindering sago value chain in Central Kalimantan?

1. What are the best market opportunities for sago and how can these opportunities improve sago value chain in Central Kalimantan?
   a. What is the market demand for Sago in Indonesia and the E.U?
   b. What are the market requirements of both and how can farmers meet requirements?
   c. Which of the two markets (Indonesia and EU) are more favourable to encourage sago production?
   d. What strategies can be implemented to improve Sago palm value chain that will improve peatland management in Central Kalimantan?

2.0 REVIEW OF RELATED LITERATURE

This section will make use of past literature related to this research in accordance with the conceptual framework to give a more detailed information about this research.

2.1 CONCEPTUAL FRAMEWORK

The conceptual framework gives an illustration of the relevant variables in the research showing how each variable will be analysed. The core concept represents the overall research, the dimensions represent the major areas the research will be looking at to solve a problem while the aspects represents the areas where the research will seek for findings. These aspects are in direct relation to the research questions however, in this research, the sustainability dimension is a justification of this research and answers no research question rather, it answers an overall question.

The interventions represent the discussions and recommendations that will arise from findings and analysis of findings and this will lead to the desired impact that fulfils the purpose of this research.

Source: Adapted from Verschuur, 2019.

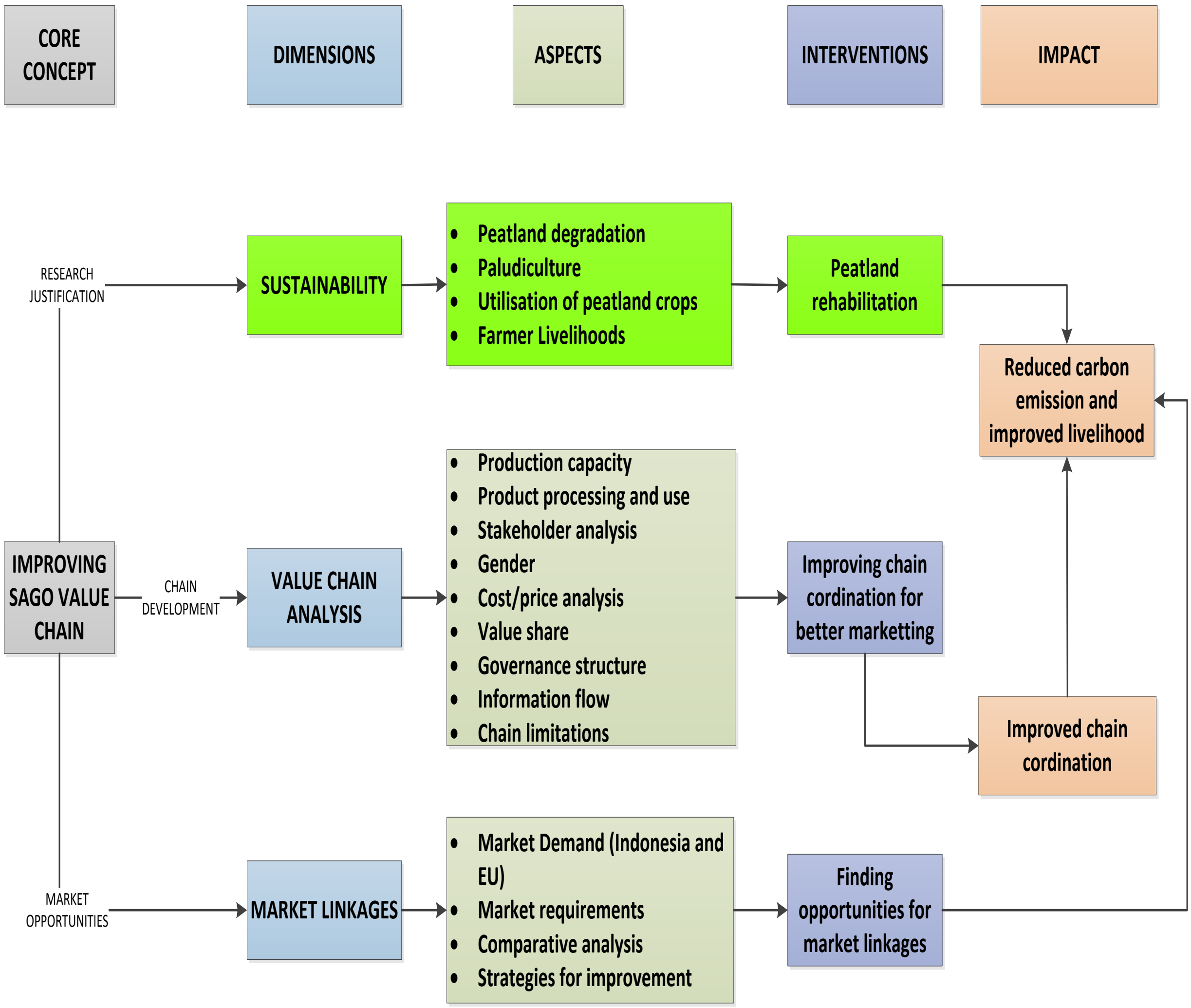


Figure 1: Conceptual Framework

2.2 GLOBAL PEATLANDS

The international peatland society (2020) defines peatland as terrestrial wetland ecosystems in which the production of organic matter exceeds its decomposition and a net accumulation of peat results. Xu, et al. (2018) defines peat as plant waste that has accumulated at the Earth's surface due to partial decomposition in waterlogged conditions while Turetsky et al (2014) states that Peat is soil comprising of partly decayed plant residues having less that 20-35% mineral content. Plant remains are left on the upper layer of the peat located above the mean water table where they undergo aerobic decomposition (Turetsky et al, 2014). Peatlands stores significant amount of carbon and is an important part of the global carbon cycle. Peatlands also plays an important role in providing water resources and is a natural habitat for various plant and animal species which makes it a vital part of global biodiversity (Carrol et al, 2015).

According to Xu et al (2017) global Peatlands occupies approximately 4.23million km^2 landmass accounting for 2.84% of total land area globally. Yu et al (2011) alternatively states that peatlands make up 3% of total global landmass and contains about 600 gigatons of carbon amounting to 30% of the worlds carbon. The highest number of peatlands is in the north and occurs mostly in boreal and subarctic regions such as Alaska, Central parts of Canada, Siberia, and North-western Europe. The second largest concentration of peatlands is situated in the tropics mostly in southeast Asia and South America. (Yu et al, 2011; FAO, 2020). The figure below shows the distribution of global peatlands in each continent in KM^2.

Table 1: Distribution of Peatlands by Continent in Km^2

CONTINENT	TOTAL LAND AREA (KM^2)	PEAT AREA (KM^2)
ASIA	44 579 000	1 623 182
AFRICA	30 370 000	187 061
EUROPE	10 180 000	528 337
NORTH AMERICA	24 709 000	1 339 321
SOUTH AMERICA	17 840 000	485 832
OCEANIA	7 692 024	68 636
TOTAL	148 647 000	4 232 369

Source: XU et al. (2018).

2.2.1 PEATLANDS IN INDONESIA

Peatlands in Indonesia is estimated to cover 14.9 million with majority of these peatlands found in Sumatra, Kalimantan, and Papua (Irian Jaya). Peatlands in Sumatra are the largest in the country followed by Kalimantan and lastly, Papua. Riau province has the largest concentration of peatlands in Indonesia occupying a total of 3 867 413 ha followed by central Kalimantan which has a total of 2 659 234 covered with peatlands (Wahyunto, 2014). Peatlands in these islands of Indonesia are covered by forested areas (mangrove, swamp forest, and plantation forest) occupying 56% of the peatlands and bushes occupying 21.7%. Other peatlands in Indonesia have been used for agriculture and settlements (Wahyunto, 2014).

The tropical peatlands of Sumatra and Kalimantan is home to a unique biodiversity and possesses ecosystem values. Indonesian peatlands are also habitats to a number of animal species including snakes, amphibians, freshwater fish and endangered mammals and birds however, logging, peat drainage, fires, and conversion of peat areas to plantations have rapidly increased causing a deterioration in ecosystem functions. (Miettien and Liew, 2010; Posa et al. 2011).

Source: Uda et al. (2018)

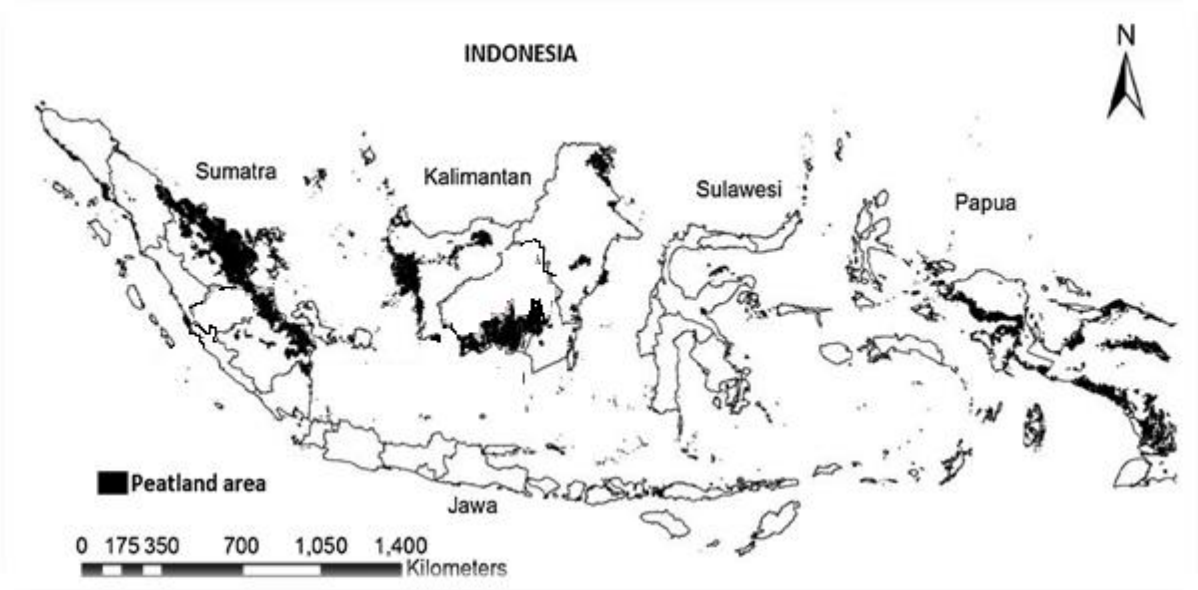


Figure 2: Peatland Areas in Indonesia

In Indonesia, small-scale swamp, and thin peatland cultivation especially by traditional communities in Kalimantan (Dayak ethnic group) has been going on since ancient times (Najiyati et al., 2005; Osaki et al., 2016).

2.2.2 PEATLAND DEGRADATION

Agriculture is one of the major drivers of global peatland loss. Peatlands are drained to enable planting of other crops in many parts of the world such as maize in Germany, sugar cane in Florida and Aloe Vera in some parts of Indonesia. Draining of these peatlands has caused fundamental peatland degradation that has led to financial and environmental challenges and caused the eventual loss of productive value of peat soils (Joosten et al, 2012).

The drainage associated with peatland conversion lowers the water level which exposes the peat to oxygen that allows oxidisation, fires and by extension, the emission of CO_2 (Hoyt et al, 2020). Drainage of peatlands induces collapse of land and further raises the risks of flood and saltwater invasion in many coastal peatlands like the peatlands of Indonesia (Balittanah, 2005). According to Urak et al. (2017), Asia including the south eastern parts have increased peatland degradation activities over the years unlike Europe who have improved peat conservation activities. At this rate, peat degraded area is estimated to reach 500000km^2 by 2050 (Urak et al., 2017).

As of 2015, only 6% of peatland areas in Indonesia remained in its original peat form. Most of the peatlands in Indonesia have been used for smallholder agriculture and degraded peat swamp forest. About 27% of these peatlands has been converted to industrial agriculture (Hoyt et al, 2020).

According to Suraham (2017), Peatland degradation affects the peat ecosystem and increases the carbon footprint. Agricultural practices on peatlands increases the rate of decomposition and reduces peat stabilization. According to Kareksela et al. (2015) Peatland drainage induces degradation of peatland ecosystems. Emissions from degraded peatlands and deforestation for agricultural purposes are integral sources of greenhouse gas emissions. Peat drainage and peat fires are also other contributors of degradation that increases the emission of GHG (Surahman, 2017). According to Nurzakiah (2020) Peat surface is more vulnerable to drought and fires specially with little or no water management. Ecosystem services on degraded peatlands could be improved by targeting activities that enhances the reduction of carbon emission and biodiversity (Law et al, 2014). The figure below shows the progression of global peatland degradation and the estimated projections of peatland degradation in the next 5 and 30 years.

Source: Urak et al. (2017)

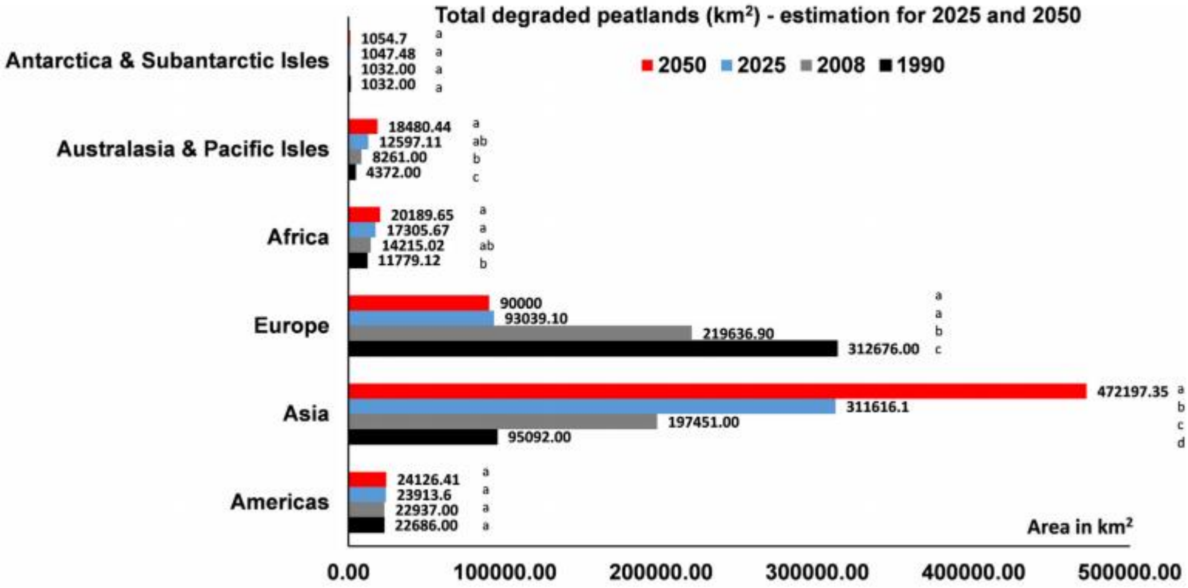


Figure 3: 2025 and 2050 Estimations of Peatland Degradation by Continent

2.3 PALUDICULTURE

Bonn et al (2016) states that paludiculture is the peat conserving sustainable form of productive land use on peatland with an objective of maintaining and/or restoring the multiple services provided by wet peatland ecosystem while allowing biomass harvests. Tata H.L (2019) further states that paludiculture employs plant species that can grow on wet and rewetted peatlands and can be cropped to provide a source of livelihood for farmers. Budiman et al (2020) highlights that agri-silviculture (revegetation of traditional forest plant on peatlands) and agro-sylvofishery (integration of agriculture, forestry, and fishery on peatlands) are effective paludiculture techniques.

In addition to the direct impact of paludiculture on peatland sustainability, paludiculture also impacts the level of forest vegetation cover and carbon sequestration. Paludiculture also has an impact on economic benefits and Managing trade-offs in 'compromised' paludiculture operations (Budiman et.al. 2020). The aim of paludiculture is to cultivate plants that grows well in wet conditions and produces sufficient and quality biomass without affecting peat soil negatively. These plants grown on rewetted peatlands has the potential to reduce carbon emission, establish productive land use, restore habitats for threatened and rare plant and animal species, produce biomass with versatile utilisation options and revitalise traditional types of land use in combination with new ways of processing (Abel, 2013).

2.3.1 UTILISING PALUDICULTURE CROPS

More than 300 types of plants can be found in peat swamps in Indonesia among which several of them have been successful in paludiculture-based agroforestry system (Prastyaningsih et al, 2019). Some of these crops are coconut, areca nut, rubber, coffee bean and Sago palm. Sago palm has potential for improving food security as a food crop and can be cultivated in the inner parts of peatlands because it needs no drainage to retain productivity (Prastyaningsih et al, 2019). (Budiman et.al, 2020) on the other hand mentioned balangeran, Jelutung and Ramin as paludiculture crops used in Indonesia.

Sago palm is worthy of attention as a rare crop that can grow on tropical peat soil without drainage of groundwater and yields a great amount of starch (164-189kg) per plant on a dry weight basis (Yamamoto et al., 2003). Growing sago palm on peatlands instead of other commercial crops that require peat draining produces peat benefits such as prevention of floods and drought. The fibrous root of sago palm also traps silt and other heavy metals that may poison life in the peatlands (Abd-Aziz, 2002).

2.4 SAGO PALM

Sago palm *(Metroxylon sagu Rottb.)* is a plant native to the hot humid tropics of South-East Asia and Oceania. The palm completes its life cycle after it produces flowers and fruits which leads to its death. Starch is stored in the trunk which the plant uses to produce flowers and fruits and this process takes an average of 12 years. (Flach, 1997). Under prolonged flooding, the palm forms roots on top of the soil that functions as respiratory organs. Starch stored in the trunk of the palm has always been extracted as a staple food for Humans (Flach,1997). Sago palms can grow up to 18m in length and can reach about 25cm to 70cm in width (Jong,2018). Sago palms naturally grows in the wild however, some sago plantations are cultivated. In Irian and Papua New Guinea, local inhabitants collect starch from wild growing plants during the initiation of flowering when the starch is highest (Flach, 1997).

Sago palms are soboliferous. This means that the palm produces suckers from the lowest part of a mother plant forming a cluster in various developmental stages. Occasionally, suckers may form higher on the stem. Sago palms are also considered hapaxantic meaning that they produce flowers and fruits only once in its lifecycle before senescence and eventual death (Flach, 1997). The figure below shows the growth cycle of sago palms and its reproductive process.

Source: Schuiling and Flach (1985)

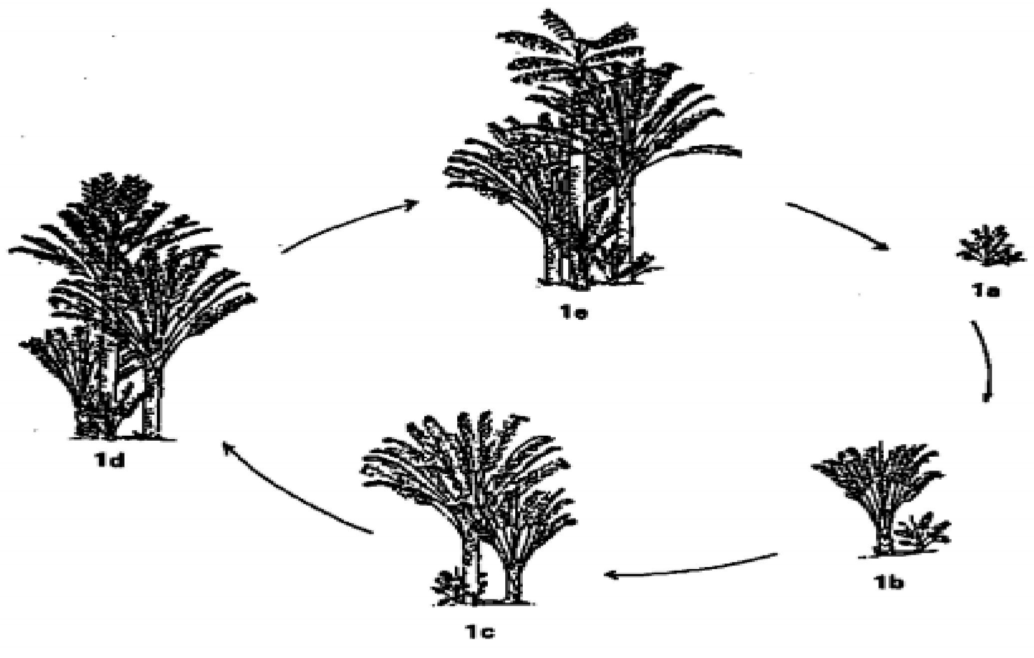


Figure 4: Growth Cycle of Sago Palm

Sago plants grows naturally in the lowlands to an altitude of 300 m above sea level, in swampy areas on the coast and along inundated streams. Sago grows on mineral soils, swamp areas, and peat soils with shallow to normal depth (Ekamawanti, et. Al., 2017). Besides having economic value and being a main carbohydrate need of staple foods, sago can also adapt to flooded areas thereby increasing CO2 absorption, increasing carbon stocks and can play a role in mitigating greenhouse gas (GHG) emissions (Ekamawanti, et. Al., 2017). Indonesia, Malaysia, Papua, New Guinea, Philippines, and Thailand are the countries with distribution of sago palms. These countries have different distributions of the palm with Indonesia, Malaysia and Papua having the widest distribution of sago palms (Bintoro, 2018).

2.4.1 SAGO PALM PRODUCTION IN INDONESIA

Indonesia is the largest producer of sago in the world. With an estimate of 2million hectares of sago growing areas in the world, Indonesia is home to 60% of sago plantations (Novarianto and Barat, 2012). The Directorate General of Plantations said that in 2011 the area of sago in Indonesia reached 100,616 hectares both from cultivation and semi-cultivation. Sago palm in Indonesia spreads across the Mentawai Islands of West Sumatra province, Papua, Riau Islands, Kalimantan, Sulawesi, and Maluku. Sago is the second staple food in Indonesia after rice. Majority of people in Indonesia still depend on rice, however, sago remains a source of carbohydrates in some areas that still have dense forest areas in Indonesia such as Papua, Sumatra, and Kalimantan (Imelda, 1980).

2.4.2 SAGO PALM USES

Sago palm is mostly utilised for its starch however, the palms are also relevant for their leaves which are used in making thatched roofs. The leaves can also be used in weaving baskets, weaving bags, making twines, and are used in wrapping food (Abd-Aziz, 2002). Sago palms are also used as breeding farms for sago grubs. Sago grubs are larvae from the Capricorn beetle that is eaten raw or roasted (Abd-Aziz, 2002). The figure below gives a detailed overview of the various uses of sago palm.

Source: Janssen and Widaretna (2018); Flach (1997); Singhal et al (2008); Awg-Adeni et al (2013).

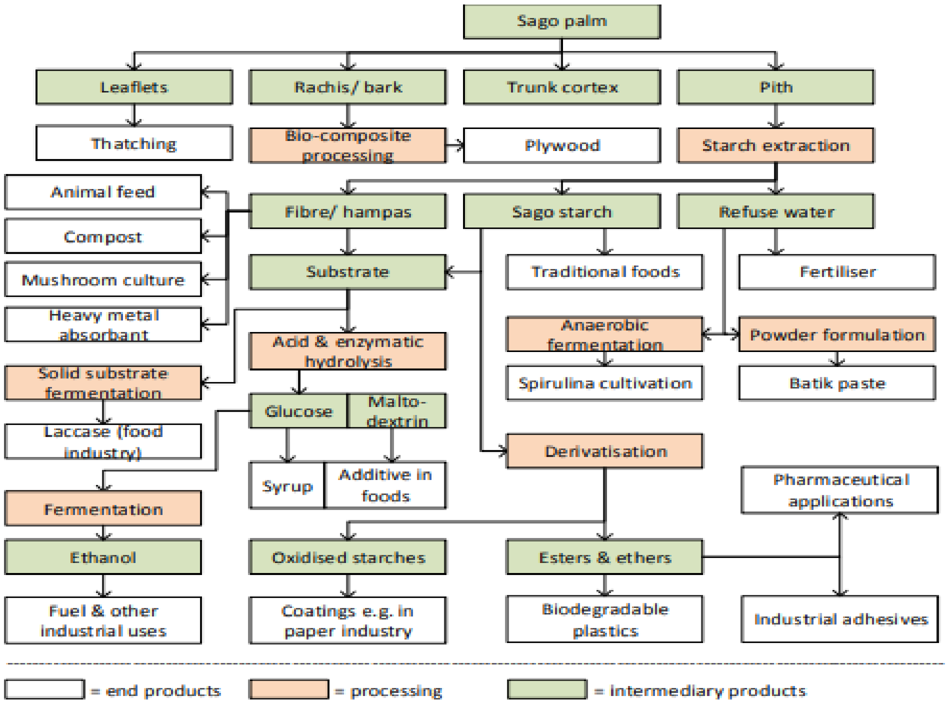


Figure 5: Sago Palm Uses

2.5 SAGO STARCH

The pith of sago trunks store starch that has been obtained and used as a staple food for human and livestock consumption (Konuma, 2018). According to Grommers and Krogt (2009) size and swelling power of granules, transition temperature, taste and the presence of amylose determine the efficiency of starch application. Sago starch contains about 27% amylose and 73% amylopectin with a maximum viscosity of 960 Brabender units (Flach 1997; Ito et al 1979; Cecil 1986). However, Karim et al (2008) states that sago starch has a peak viscosity of 1100, a slight increase from the 960 stipulated by Cecil (1986).

Sago starch has certain characteristics that makes it stand out among other starches such as a low glycaemic index that makes it tolerable for diabetics. Sago starch is also gluten free which makes it a good substitute for other starches in people with gluten intolerance (Interviewee 2, 2020). The table below gives a brief description of sago starch properties in comparison to other starches.

Table 2: Sago Starch Properties in Comparison With other Starches

STARCH SOURCE	SAGO	POTATO	CORN	WHEAT	CASSAVA
GELLING TEMPERATURE	69- 70	60-65	75-80	80-85	60-65
PEAK VISCOSITY	1100	3000	600	300	1000
STARCH PASTE VISCOSITY	High	Very high	medium	low	high

Source: Grommers and Krogt, (2009); Singhal et al, (2008); Karim et al (2008).

2.5.1 SAGO STARCH PROCESSING

Processing of sago starch involves many processes and can be done either traditionally or through modern methods. Sago palms are first harvested by cutting the palm trunk using either a knife or an axe. After sago trees have been harvested, the leaves are removed, and the logs are further divided into smaller logs for easy transportation. The logs are then debarked using a knife in traditional processing or a machine in modern processing and the pith is grinded (Interviewee, July 2020).

For starch to be extracted from sago, sufficient clean water must be available (Flach, 1997). After grinding the pith, the ground pith is mixed with water. The water is forced through a sieve fastened against sticks in the forest carrying with it the starch and leaving the fibre behind. The water is left in an old canoe where the starch is left to settle at the bottom of the vessel. The water is discarded, and the wet starch is collected for processing (Flach, 1997). In industrial starch extraction, a modern starch extracting plant is built to perform this process. Wet starch is stored under water and can remain fresh for about 2 weeks (Interviewee, July 2020).

In most traditional processing of sago starch, wet starch is sundried to convert it to dry starch. This is done by spreading the wet sago starch in the sun till the starch becomes dry to touch. This method is however challenging and could lead to poor quality starch specially during the rainy seasons when humidity is very high. Modern starch drying methods exists where drying machines are used to dry wet sago starch.

2.5.2 UTILISATION OF SAGO STARCH

Starch from sago has several uses. It is used as a food, animal feed and used in the production of glucose and detroxe. These derivatives have uses in the paper and textile industry, among others. Two enzymes, cc-amylase and amyl glucosidase are used to convert starch into glucose. While the former loosens the molecular structure to lower viscosity, the latter is used in the final formation of glucose. Glucose from sago starch is used for high fructose syrup and in the fermentation industry (Abd-Aziz, 2002). Konuma, (2018) states that sago starch can be used to substitute wheat flour by 40% in production of baked goods like cookies and other types of applications. Sago starch have in recent times been given special attention for its potential use in ethanol production for biofuel.

2.6 VALUE CHAIN CONCEPT

Chong et al. (2018) defines value chain as a set of activities performed to design, produce, market, deliver and support products. Value chain breaks down a series of activities individually to reveal the strengths and weaknesses and to identify opportunities for value creation. Teridala et al. (2013) stated that there are three flows in a chain to be considered: the flow of products from downstream to upstream participants, the flow of money from upstream to downstream participants and information flow throughout the participants. Porter, (1989) explains that for a firm to have competitive advantage, it must engage in value activities and margins which involves primary activities and support activities. While primary activities involve a chain of activities that sees a product from product input to sales, the support services encourage an enabling environment for the primary activities (Porter, 1989).

2.6.1 GOVERNANCE STRUCTURE

Havice et al. (2017) defines chain governance as power relationship among firms in a value chain. This agrees with Dietz (2017) who defines governance as the ability to yield control along the chain for a particular purpose. Lead actors are usually the most powerful in value chains with power to choose and replace suppliers and these actors are driven by quality and safety competitiveness and increased pressure from the public for good social and environmental conduct.

Five different types of governance structures exist which are Market, modular, relational, captive, and hierarchical governance. Each of these types of governance have different types of determinants ranging from complexity of transactions, ability to codify transactions, to capabilities in supply base and degree of power asymmetry. The diagram below shows a pictorial overview of the various types of governance and their degree of coordination (Dietz, 2017).

Source: UNIDO (2009).

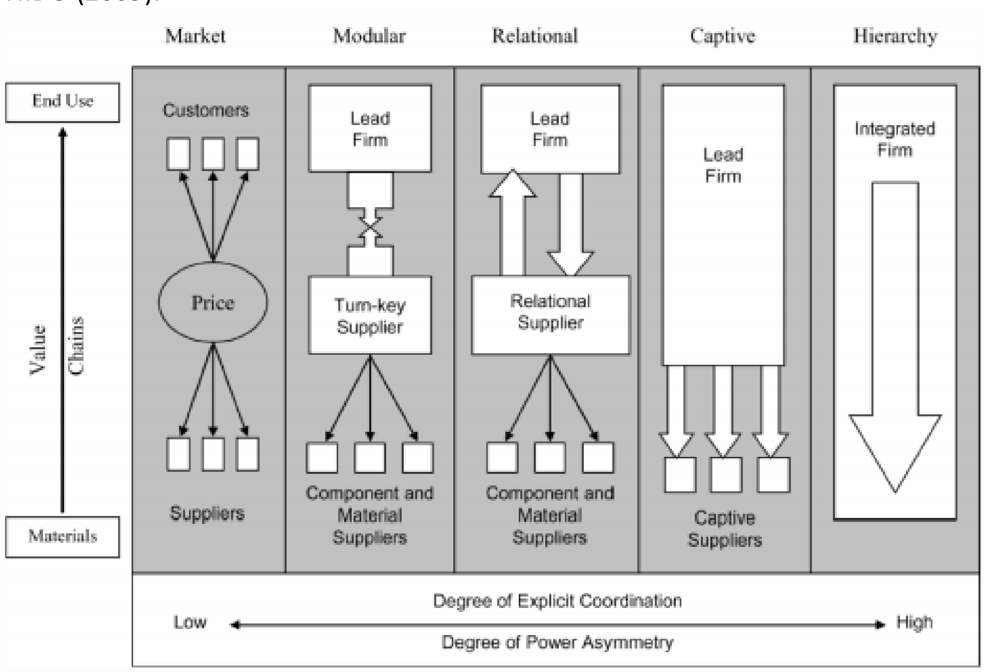


Figure 6:Types of Chain Governance

2.6.2 STAKEHOLDERS IN VALUE CHAINS

Value chains consists of a series of chain actors and supporters. Chain actors are linked by product flow, finance, information, and services while the chain supporters provide chain actors with services that provide an enabling environment for Chain actors to thrive. Chain actors are made up of input suppliers, producers, processors, manufacturers, traders, and consumers. At each stage of the chain, value is added to a product to make it more valuable to the customer which causes costs to accumulate at each stage (KIT, 2012).

2.6.2 GENDER IN VALUE CHAINS

Gender in value chains is the involvement of gender equity in Value chains for the purpose of social justice, poverty reduction, and increased business opportunity (KIT,2012).

2.6.3 COST ANALYSIS AND VALUE SHARE

Value share is the amount of value added in percentages to a certain product by each actor in the chain. To calculate the value share in a chain, the variable and fixed costs, revenue, and profits must be established. Variable costs are costs that change along according to the quantity of produce whereas, fixed costs are independent of the amount traded. After costs are subtracted from revenue, the result is multiplied by 100 and divided by the final retail price to get the value share of each actor in the chain (KIT, 2008).

2.6.4 SAGO VALUE CHAIN IN INDONESIA

In Indonesia, the chain consists of small holder farmers who plant and harvest sago. The Farmers are also involved in small scale processing. Small processing companies exists and extract starch from the pith of the plant for processing into dry starch. The dry starch is transported to bigger manufacturing companies who process the starch into other products (Taridala et al., 2013). Below shows a sago chain map representing various chains in Indonesia.

Source: Taridala et al (2013).

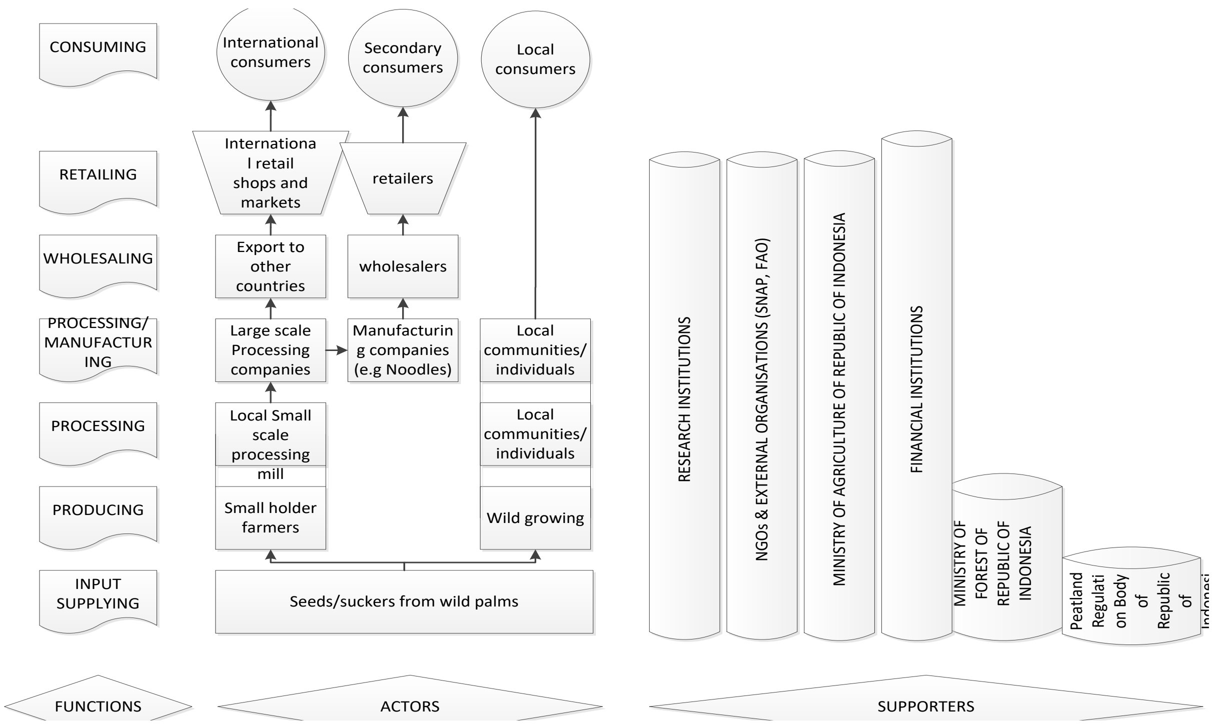


Figure 7: Sago Starch Chain Map in Indonesia

2.7 MARKET DEMAND FOR SAGO

Currently, the marketing of sago starch is mainly focused towards meeting domestic demands in Malaysia and Indonesia however, the demand for starch as a commodity for food and industrial applications can provide opportunities for sago to have a share in the huge world starch market. Sago starch can be used as a multipurpose raw material for both food and non-food applications such as in the fermentation industry (Jong 2018).

2.7.1 STRATEGIES FOR IMPROVING SAGO VALUE CHAIN

According to KIT (2008), strategies for improving value chains involves building market institutions, strengthening chain relations, and implementing policies. These can be done by organising chain actors, exploring and building chain partnership, Chain coordination, transparent market information, improving financial services, and policy leverage (KIT, 2008).

3.0 RESEARCH METHODOLOGY

The research methodology explains the methods used in conducting this research including the criteria for selections and methods of implementation to the methods of analysis.

3.1 CONDUCTING RESEARCH DURING COVID-19

Corona Virus is a viral disease that infects the respiratory system causing symptoms like dry cough, headaches, fever and sometimes, fatality. In 2019, a new strain of the Corona virus named COVID-19 emerged from Wuhan China which spread all over the world causing a pandemic. Strict measures were initiated globally limiting free movement to curtail the spread of the Virus hence, virtual mediums have become efficient in the face of the pandemic.

Due to the current regulations resulting from the pandemic, field visits were not possible. All data used in this research were gathered using online mediums.

3.2 RESEARCH DESIGN/STRATEGY

This research is "people focused" and intended to influence change on the livelihoods of local farmers in Central Kalimantan. This is called a social constructionist research. The research adopted a qualitative approach using both secondary and primary data through online mediums. Secondary data was gathered from the body of existing literature with relevance to this research while Primary data was gathered using semi-structures Key informant interviews and semi-structured market interviews. Data gathered from the field was processed using grounded theory method and analysed using Chain map, causal Diagram, and infused SWOT/PESTEC. Final conclusions and recommendations were given using the CANVAS business model, the theory of change and value chain map. Each step mentioned above will be explained in detail. Below is an overview of the research design/strategy.

Source: Researchers Design.

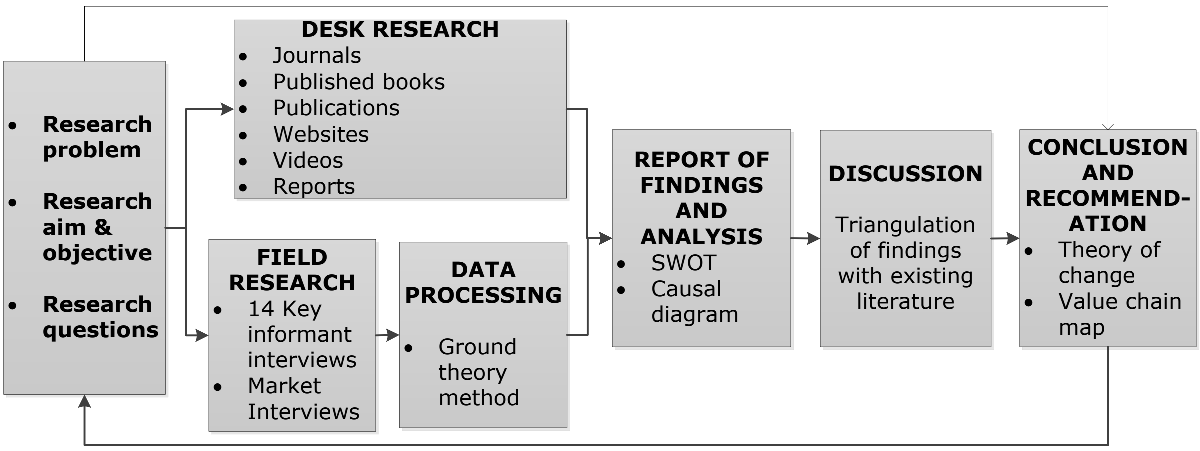


Figure 8: Research Design.

3.3 SELECTION OF STUDY AREA

Central Kalimantan is located along the Borneo Island and is one of the 5 Indonesian provinces in Kalimantan Island. The province has a total land area of 153 564.5 km^2 and a total forest area of 15 324 842.97 ha (Central Kalimantan in Figures, 2020). Central Kalimantan has about 1 762 983 people occupying 13 regencies and 1 municipality namely: Barito Selatan, Barito Utara, Kapuas, Kotawaringin Barat, Kotawaringin Timur, Barito Timur, Murung Raya, Gunung Mas, Pulang Pisau, Lamandau, Sukamara, Katingan, Seruyan and Palangka Raya Municipality. The province has an average temperature of 26 degrees Celsius (Central Kalimantan In Figures, 2020).

Source: Google maps

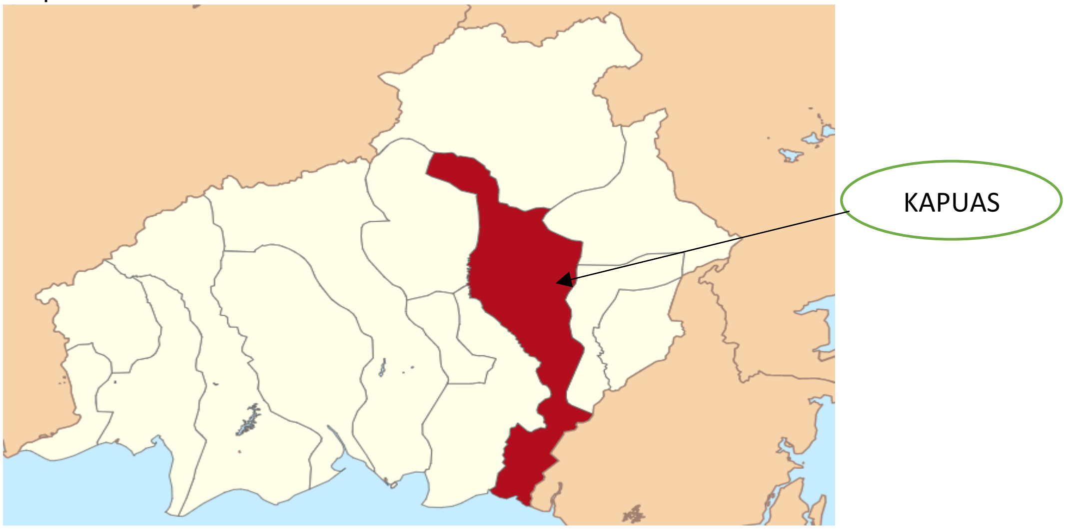


Figure 9: Study Area

Kapuas has a total land area of 14,999km^2 with a total of 17 subdistricts and 216 villages making it the province with the highest number of villages in Central Kalimantan. About 260,195 people inhabit Kapuas. The regency has the highest concentration of peatlands in the province with a total of 124,306 ha of peatlands with about 9% of the area irrigated. The total forest and water area occupy 1 340 947.58 ha (Central Kalimantan in Figures, 2020).

This study will further focus on Batagu sub-district in Kapuas district, where Sago is currently being used by small-holder farmers. Most parts of the area of Batagu sub-district is in Kapuas Kahayan Forest Management area. This study area is chosen to represent the whole province.

3.4 DATA COLLECTION AND PROCESSING

3.4.1 DESK RESEARCH

Desk research was used to collect secondary data on existing literature. This method was essential to establish a solid background information relating to the research. Literature relating to peatland degradation and paludiculture were given to justify the importance of the research. Existing literature relating to data answering the research questions were also gathered from peer reviewed journals, published books, reports, videos and websites were the materials used in extracting data from literature. The researcher made use of online search engines such as google scholar and Greeni in gathering information from literature.

3.4.2 FIELD RESEARCH

Field research was simulated online due to the restriction on movement because of COVID-19 regulations. This research method was used to collect primary data from informants and respondents on the field. The researcher adopted semi-structured interviewing method which entails asking a set of open-ended questions using an interview checklist. This method of interviewing was a reliable method for conducting this research because it left room for probing questions to enable the researcher to get a clearer picture of the information being gathered from each interviewee. The interviews were divided into key informant interviews and market interviews.

Due to the researcher's unfamiliarity with the study area and the Indonesian language, a translator was consulted to assist the researcher in translating online interviews conducted in Indonesian local language (Bahasa). The translator who is from Indonesia also gave the researcher some insight about the cultural context of the country in which the study was conducted.

3.5 SAMPLE SELECTION METHOD

The research involved a large population size (Indonesia and EU). To select a sample for the EU market interviews, stratified random sampling method was used. To achieve this, EU countries were grouped into zones: north, east, south, and west and the researcher randomly selected a minimum of two countries from each geographical zone. The researcher further carried out an internet survey of potential starch utilising companies in each country selected using categories namely: bakery, pasta, conglomerate, starch solutions, supermarkets/distributors, and bio companies.

Random sampling method was used to select a sample for the Indonesian market. Companies in Indonesia were randomly selected using categories: noodle companies, sago processing companies, starch solutions, distributors, and conglomerates.

The sample selection method used to select key informants is the snowball method which is characterised by having a lead informant and getting a chain of recommendations from each informant. The selection categories for key informant interviews were sago chain actors, sago chain supporters, experts, and researchers.

Key Informant interviews: A total of 14 key informants from the EU and Indonesia were interviewed. 9 key informants from Indonesia were interviewed to find out the current sago value chain in Kapuas district of Central Kalimantan, the production capacity, uses for sago starch, challenges in the chain, processing methods, and stakeholders in the chain. These informants consisted of sago processors, sago supporters, sago experts and sago researchers.

A total of 5 key informants from EU were also interviewed to discover the requirements necessary for chain development in the area with linkages in the European market and strategies to implement them. The interviewees consisted of business experts, starch experts and researchers. All interviews were conducted virtually using google meet, skype, Microsoft teams, WhatsApp, and mobile calling. The figure below gives an overview of methodology used in conducting the key informant interview however, a more detailed description can be found in annex 1.

Table 3: Key Informants

Population	sample	Sampling/ interview method	Area	Sample size
Sago chain actors	Sago producers/processors	Snowball/ Mobile call	Bataguh sub-district, Kapuas	2
Supporters	Forest management and local government	Snowball/ WhatsApp voice calls	Bataguh sub-district, Kapuas	3
Experts	Sago palm experts, starch experts, business experts and value chain experts	Snowball/google meet, Microsoft teams & skype	Netherlands/ Indonesia	6
Sago researchers	Past and present researchers on sago	Snowball/ Mobile call &skype	Netherlands/ Indonesia	3

Source: Researchers Compilation

Indonesia and EU Market interviews: Electronic mails, mobile calls, WhatsApp calls, social media (twitter and LinkedIn) and website contact forms were used to initiate contact with potential interviewees from the Indonesian and EU market. The table below gives an overview of the companies contacted and a detailed list of the companies, their location, contact method and response can be found in Annex 2.

Table 4: Market Interviews

Population	Sample	Sampling method	Unit
Indonesian market	noodle companies, sago processing companies, starch solutions, distributors, & conglomerates	Simple random sampling	7
EU market	Food production companies, supermarket chains	Stratified random sampling	16

Source: Researchers Compilation.

3.6 DATA ANALYSIS

Online Interviews from various key informants were analysed using grounded theory method. This involves highlighting key information relevant in answering each research question from each respondent. All key information was analysed to find similarities and contradictions after which a conclusion of finding is made on each research question. This method was also used to analyse Market interviews. The table below gives a summary of the data analysis methods used in answering each research question. Analysis tools such as causal diagram, SWOT, Value chain map, Business model CANVAS and theory of change were also used.

Table 5: Data Analysis Table

Research question	concept	Information source	Analysis tool
What is the current situation of sago value chain in Central Kalimantan?			
What is the current sago palm/starch production methods and capacity?	Value chain analysis	Key informant interviews	Grounded theory
How is the product processed and used?	Value chain analysis	Key informant interviews	Grounded theory
Who are the stakeholders including gender in the sago value chain and their costs and value share?	Value chain analysis	Key informant interviews	Grounded theory/stakeholder matrix/chain map
What is the governance structure in the chain	Value Chain analysis	Key informant interviews	Grounded theory/Chain map
What are the challenges concerning sago production in Central Kalimantan?	Value chain analysis	Key informant interviews	Grounded theory/Causal diagram & SWOT
What are the best market opportunities for sago and how can these opportunities improve sago value Chain in Central Kalimantan?			

What is the market demand for Sago in Indonesia and the E.U?	Market linkages	Key informant interviews, market interview and literature review	Grounded theory
What are the market requirements of both and how can farmers meet requirements?	Market linkages	Key informant interviews/market interviews and literature review	Grounded theory
Which of the two markets (Indonesia and EU) are more favourable to encourage sago production?	Market linkages	Key informant interviews and Literature review	Grounded theory
What strategies can be implemented to improve Sago palm value chain and maintain peat condition in Central Kalimantan?	Sustainability	Key informant interviews and literature review	Grounded theory/CANVAS business model/theory of change

3.7 RESEARCH LIMITATIONS

These are the limitation the researcher encountered during the research.

- Due to the researchers unfamiliarity with the study area and the current COVID-19 restriction on free movement (which deprived the researcher from visiting the study area), the researcher encountered a lot of difficulties understanding the cultural context of the study area.
- Due to online use, there was very little use of observation which challenged the validity of the data most times.
- Language barrier. Some of the informants spoke in a different dialect from my translator. It was also difficult communicating with some markets due to language limitations.
- My translator is also a researcher hence, time clashes with his own interviews and other commitments made some interviews a little rushed and limited my sample size.
- Poor network connection hindered the free flow of some of the interviews.
- Only few of the markets agreed to have an interview. Other means of contact were tried repeatedly yet it yielded no results.
- Some of the recording devices failed hence some of the recordings were difficult to use however, note taking came in handy and was sufficient for data reporting and analysis.
- Some of the informants were irritated and hesitant to give information. They claimed they have given complain several times before.
- Validity of some data such as quantifiable data from local processors are questionable due to poor documentation and literacy level of these interviewees.

4.0 RESEARCH FINDINGS AND ANALYSIS

This section is made up of findings from the field, desk study and the researcher's analysis of these findings.

4.1 SAGO PRODUCTION METHODS AND CAPACITY

This answers the question relating to how much sago palm and sago starch are produced in the focus area and the various methods of production.

4.1.1 SAGO PALM PRODUCTION CAPACITY AND METHODS

During the field study, it was discovered that two major production methods for sago palm in Bataguh sub-district of Kapuas are natural growing methods and planted sago. Two key informants stated that most of the sago palms grown in Kapuas grows naturally however, few of these palms are planted. A sago professional who was also interviewed stated that though sago palms have become one of the major crops dominating peat forests in Kapuas, the palms were originally from Papua and planted in Central Kalimantan.

The research revealed that sago palm production in Kapuas district of Central Kalimantan is relatively low compared to other provinces like Sumatra and Papua. With the study area in view, the region dominated by sago palms is Bataguh sub-district covered mostly by peatlands. According to the head of forest management in the area, the total peatland in the area is about 300hectares with sago covering about 95% of the peatland area which the researcher estimated to be 285 hectares. 3 interviewees in the area however confirmed that most of the peatland areas gets lost to bush fires which affects productivity. The informants mentioned that these bush fires are caused by accidents from cooking and cigarette smoking near forest areas. Industrialization from big corporations also contribute to peatland burning. This affects the production of sago palms in the area. Below is a photo captured from a video provided by one of the informants showing sago palms in the sub-district.

Source: Capturing TPID Bataguh (Proses Pembuatan Sagu), (2020)

Figure 10: Sago plantation in Bataguh Sub-district

4.1.2 SAGO STARCH PRODUCTION METHOD AND CAPACITY:

According to two respondents in Bataguh sub-district, sago starch is produced either through traditional methods or semi-modern methods. In traditional starch production, sago palm farmers extract the starch in the forest after felling the tree using a knife or axe. In this method, processing is done in the forest and the pith is smashed using their feet.

In the modern method, chainsaws are used to fell trees which are cut into 1metre logs and dragged to processing plants via rivers or canals using engine boats. Once at the processing plant, the bark is removed with an axe and the pith is grinded using a coconut grinding machine. After extracting the wet starch, the starch is dried to produce dry starch. In both methods, water from the river is used in processing and sun drying is the only drying method used in the sub-district.

> *"Despite the abundance of sago palms growing on peatlands in the area, the starch production capacity is very minor. There are a lot of sago trees which they don't use and most of the palms in the bush are left to die"*
>
> *-(Informant 4, 2020)*

This was revealed by one of the key informants who had previously conducted research on sago production in the area. In a mobile call interview with two processors in Bataguh, it was revealed that a range of 5-8 trees could be harvested per week for processing however, processing is done according to demand. These processors stated that one sago tree can produce 65kg of dry starch and 85kg of dry starch respectively however two other key informants stated that one tree could produce up to 250- 300kg of dry starch.

To give an estimate of the current production capacity, the researcher selected the lower average of the average of harvested trees per week (6) and multiplied it by the number of weeks in a month (4). The result was multiplied by the quantity of starch in KG's to give the quantity of starch produced by each farmer monthly.

- (6 x 4) x 65= 1560kg
- (6 x 4) x 85= 2040kg

The above indicates that both processors produce a total of 3,600kg of sago starch monthly and an annual production capacity of 43,200kg (18720kg and 24480kg for each processors). It is however important to note that all sago trees do not produce the exact quantity of starch and producers do not produce starch regularly hence these figures are not totally valid but can be used as a representation of the reality of starch production capacity in the district.

It was revealed that 5 processors exist in the area. It could be estimated that a total of 9000 kg of starch gets produced per month from all 5 processors and 108,000kg gets produced annually. Certain factors however affect the efficient production of starch such as palm size, and frequency of harvest hence, the validity of these numbers is questionable.

4.2 SAGO STARCH PROCESSING AND USES

This section answers questions relating to the processing methods for sago starch and their uses as revealed during the field study.

4.2.1 SAGO STARCH PROCESSING

Sago starch is processed in two ways in Bataguh sub-district. Traditional processing and semi-modern processing. While both methods are effective in producing starch, the traditional method produces less starch than the semi-modern method. From findings, the semi-modern method is the most common type for commercial processing in the area however, machinery used in processing is not very developed. Harvesting and debarking tools used are chainsaw, knife, and axe. A coconut grinding machine to grind sago pulp and a manual pressing machine (to strain water from the starch) are the processing equipment used. The processors stated that converting wet to dry starch is still done traditionally through sun drying however, some of the wet starch gets processed into other value-added products.

4.2.2 SAGO STARCH USES

According to several interviewees, sago starch in the subdistrict has various uses ranging from its use in making noodles from the wet starch to making cookies during Ramadan. In the course of the research, it was discovered that sago could be used in making a rice substitute called rice analog which involves mixing sago with other starches and passing it through a machine that shapes the mixture into rice-looking grains. The researcher found literature that corresponded with this finding stating that the invention is still gaining popularity (Budijanto, 2015). Sago starch could also be used in making food flavourings, traditional delicacies like bakso, Chendol, Laksa (a type of glass noodle), empek-empek and sago sugar. Sago can also be utilised in other industries as a raw material for bioethanol, bioplastic, Cosmetics, glue and can be used in lactic acid culturing.

4.3 STAKEHOLDERS INCLUDING GENDER AND VALUE SHARE IN THE SAGO VALUE CHAIN

This section answers questions about the current actors in the chain, their supporters, gender and their cost analysis, profit, and value share.

4.3.1 SAGO CHAIN FUNCTIONS AND ACTORS

Input supply: Based on research findings, there is no major input supplier in Bataguh sub-district. Sago plants majorly grows on their own in the forest through asexual reproduction and are sustained from the suckers which grows from mother plants.

Producers: Sago palms in Bataguh are mostly not planted rather, they grow on their own in the forests however, these lands are owned by people who are termed farmers in the region. Some of these sago farmers also process sago commercially and buy sago trees from other landowners.

Processors: Findings showed that a total of 5 processors exist in Kapuas Kahayan district of Central Kalimantan. This is slight increase from the number given by a previous interviewee who mentioned that a total of 4 processors existed in the area as of 2019 when the interviewee conducted research in the area. It was discovered that the popular processing method in Kapuas is the semi-modern method which makes use of manual labour and poor mechanised machinery. The processors however do not process everyday as most of them have the dual function of producing and processing. As mentioned by one of the processors:

"I process according to demand; however, I visit the forest like 3 times per week and take 3 days to process the palms."

-(Informant, 10)

Collectors: The research discovered that there is only one collector in Bataguh sub-district. The middleman who collects in the district works at Banjar Masin Regency -a neighbouring regency located in South Kalimantan where a big sago processing plant is located-. The collector has the responsibility of collecting dry starch although, he sometimes buys sago logs which are sold by the farmers at very cheap prices and transported to Banjar Masin for sale. Efforts made by the researcher to be given access to the middleman were not granted by interviewees.

Manufacturers: Locally, transformation of sago starch into other valuable products are the sole function of women in the local chain. Products such as wet and dry cakes, cookies, drinks, and noodles are some of the products that are manufactured using sago starch. A women group called PKK is actively involved in facilitating women to make value added products from sago. It was revealed that the company in Banjar Masin and Java also made value added products. The interviewees claimed not to know the names of these companies.

Retailers: Retailing is the function of the women in the sago palm value chain in Bataguh. From findings, wives and daughters of sago farmers who also belong to PKK have the function of selling sago starch and other products made from sago in the market. Sago is packed in 1kg packaging and carried to the market where they are sold to individual buyers. The male processors however sell sago starch to bigger markets Banjar Masin.

Consuming: Consumers consists of individuals who buy sago from the markets in Bataguh and those who consume the value-added products made from sago. It was also revealed that some of the sago sold to Banjar Masin ends up in the international markets.

Below is a stakeholder matrix showing the actors, their functions, and roles.

Table 6: Stakeholders Matrix

FUNCTION	ACTORS	ROLES
INPUT SUPPLY	-	• Palms are grown wild with limited maintenance.
PRODUCING	Farmers (Family farm)	• Maintains already existing sago palm forest. •
PROCESSING	Farmer	• Harvests sago palm from the forest and cuts them into smaller 1 metre logs for easy transportation. • Transports logs from forest to processing plant • Removes tree bark from the logs and grinds pith. • Extracts starch from the grinded pith together with the family. • In cases where the starch extraction is done traditionally in the forest, the farmer, his wife, and children are responsible for grinding pith.
	Farmers wives	• Extracts starch from the grinded pith together with family. • Responsible for processing wet starch to dry starch through sun drying.
COLLECTING	Middlemen	• Collects starch from processors in the district for sale to Banjar Masin in South Kalimantan. • Buys sago logs from farmers. • Transports starch to Banjar Masin.
MANUFACTURING	Farmers wives/company in Banjar Masin	• Manufactures products from sago starch such as bubbles (drinks), laska (food), Chendol (drink), and Santang (a chewey snack).

		• Packages products for sale especially during festive periods.
RETAILING	Farmers wives	• Sells manufactured products to individuals at the market. • Sells manufactured products to bulk purchasers for festivity purposes. • Sells wet and dry starch in small plastic packages at the markets.
CONSUMING	Individuals in the community.	• Consume sago starch produce • Market drivers. • Determines quality preferences

Source: Researchers Compilation from Findings (2020).

4.3.2 SAGO CHAIN SUPPORTERS

Several supporters who perform supporting roles along the sago value chain were identified based on the interviews. Among the supporters highlighted are the Indonesian Federal Government, the Peatland Restoration Body (BRG), the Forest Management Unit (KPKH) of Central Kalimantan, UNEP, Research institutes, SMAGAPALA, PKK women group and environmental/support groups. Below is a matrix showing the supporters and their supporting roles in the chain.

Table 7: Supporters matrix

SUPPORTER	FUNCTION
Indonesian government	• Sets policies that affects sago chain stakeholders. • Gives funding for environmental projects including those concerning peatlands and utilization of peatland crops • Encourages the use of sago for food security.
Peatland restoration body (BRG)	• Supports the utilisation of sago in peatland restoration • Supports research of peatland crops like sago.
Forest management unit (KPKH)	• Oversees peatland rehabilitation using sago palm in the area • Works for
Support groups/environmental defenders	• Activists for peatland restoration using sago
PKK Women Group	• Promoting sago products outside the villages • Capacity building for local women.
Research institutions	• Carry out scientific research on sago varieties. • Invent new uses and applications for sago starch. • Carry out research on the marketability of sago value chains.
SMAGAPALA	• Capacity building and development of sago farmers
Kemitraan and UNEP	• Collaborate to provide trainings on how to develop sago • Provide training on peatland conservation and rehabilitation

Source: Researchers Compilation from Findings (2020).

4.3.3 GENDER IN SAGO VALUE CHAIN

Five key informants from the district gave the same report about gender roles in the chain. Findings showed that gender roles existed in the value chain and women have the role of manufacturing food products from processed starch in the chain. Women are also active participants in the processing of sago into starch.

It was also discovered that one women group is very active in Kapuas. A women group specialising in marketing of sago produce and community building through women empowerment programmes called Permbedayaan Kesejahteraan Kalvarge (PKK) which also exist in other villages in Indonesia are actively involved in sago processing in the district. Other functions which are more labour intensive like harvesting the sago palms, debarking the palms, pith grinding using machine, and transportation are left for the men in the chain. The figure below shows some of the products made by Bataguh women and marketed by PKK women group in the district.

Source: Fatur et al. (2019)

Figure 11: Cookies and Wet Cake Produced by Bataguh Women and Marketed by PKK Women Group.

4.3.4 COST ANALYSIS AND VALUE SHARE

The researcher set out to discover and analyse the profitability of the sago business for local farmers and discovered that it is difficult to make a proper analysis from the numbers provided. Each interviewee mentioned a different selling price at different times. This shows that sago prices in the area is not regulated and purely driven by demand however, the cost figures provided seemed more realistic. Costs gathered during the research are listed in annex 3 of this document.

Sago costs: From the five sago processors in the district, two were interviewed. The interviewees mentioned that they incurred variable costs on buying sago trees, and packaging materials. The fixed costs incurred are on their processing machines, boats, harvesting tools and warehouse for storing processed sago starch. The processors also incurred maintenance and running costs on buying Petrol to fuel their boats and grinding machines (used in transporting sago to the processing site) and servicing. Further probing showed that most of the processing is carried out in the processors homes where their machines are located. Below is a list of variable costs incurred by both processors however, a more detailed outline of the costs from both producers are stated in annex 4.

Table 8: Cost Table

Variable costs	Processor 1 (IDR)	Processor 2 (IDR)

	Produces an estimated 1560kg of dry starch monthly (65kg dry starch/tree)	Produces an estimated 2040kg of dry starch monthly
Sago tree (1)	65,000	150 000
Petrol	100 000	200 000/day
Packaging materials	35 000/100pieces	3000/piece (50kg packaging)
Labour	-	500 000/day (for four workers)

Source: Research Findings (2020).

The above costs are findings from the two processors who were interviewed. Further probing by the researcher revealed that the second processor sources sago trees from the deeper parts of the forest where the logs have a larger circumference. This explains the cost disparity in sago tree cost and petrol cost. The processors stated that they visit the farms a maximum of 3 times weekly and take three days to process. The following were discovered to be their selling price however, these selling prices vary from time to time.

Table 9: Processors Selling Prices

PRODUCT	PROCESSOR 1 (IDR)	PROCESSOR 2 (IDR)
Wet starch	3,500	3,500
Dry starch	17,000	4,500

Source: Research Findings (2020).

The researcher discovered that sago can be sold in different ways. The palm can be sold as a whole tree and cut into shorter 1metre logs for easy transportation while the wet starch can be sold after it is extracted from the palm. In the two ways stated above, the price is very low. Drying the starch increases its profitability hence, local farmers prefer to dry the starch before selling. Two of the interviewees from the district stated that sago prices fluctuate based on factors such as demand.

To carry out a cost and benefit analysis, the researcher calculated only variable costs by finding out how much is costs to produce 1kg of dry starch. To calculated this, the researcher divided each cost by the total quantity of starch in Kg to produce the final costs for 1kg and subtracted the costs from the selling price.

Table 10: Cost and Benefit Analysis

	Full cost (IDR)	Cost /kg (IDR)	Selling prices (IDR)	Margin (IDR)
PROCESSOR 1				
Tree	65,000	1,000		
Petrol	100,000	1,538		
Packaging	35,000	350		
Family labour	125,000	1,923		
Total costs	325,000	4,811		
Selling Price			17,000	
Profit/loss				12,189
PROCESSOR 2				
Tree	150,000	1,764		
Petrol	200,000	2,352.9		
Packaging	3000	60		
Family Labour	125,000/person	1,470		
Total costs	478,000	5,646		

Selling price	4,500	
Profit/loss		-1,146

Source: Research Findings

The above calculations cannot be established as valid however, they are representations of the current situation in Bataguh district of Kapuas, Central Kalimantan.

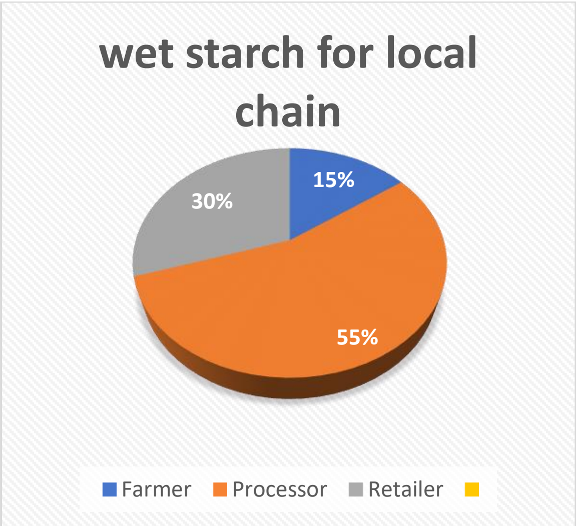
Value Share: The researcher calculated the added value and value share on each actor in both chains. To get the price for 1kg of starch as a tree, the researcher calculated the price of each tree divided by the number of Kg's per tree. The researcher took the lowest price for trees and calculated how much each Kg in the tree will cost the processor. This amounted to IDR 769. This was used in calculating the value share of wet and dry starch in the chain. To get the selling price for dry starch in calculating the value share, the researcher calculated the average selling price of both processors to get an average price of IDR10,750.

Table 11: Value Share for wet and dry starch in the Local Chain

Actors	Revenue/kg (IDR)	Added value (price received by actor – price paid by actor) (IDR)	Value share (Added value X 100/Final retail price)
Wet starch			
Farmer	769	769	15%
Processor	3,500	2,731	55%
Retailer	5,000	1,500	30%
Dry starch			
Farmer	769	769	5%
Processor	10,750	9,981	71%
Retailer	14,000	3,250	23%

Source: Researchers analysis from findings.

Source: Researchers analysis from findings.



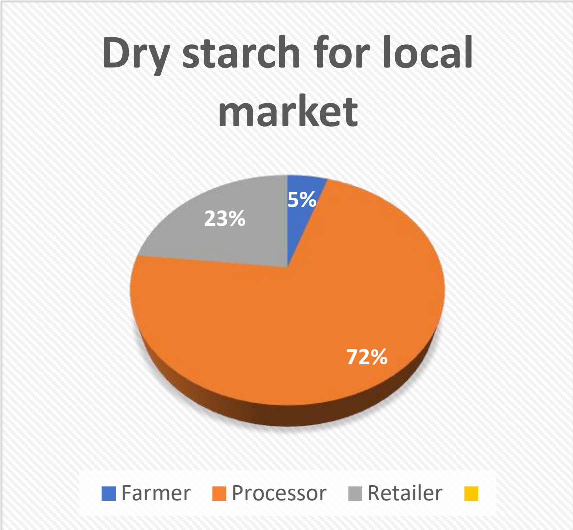


Figure 12: Actors Value Share in the Wet and Dry Local Chain

From the analysis above, the processor adds the highest value to the product in the chain however, this does not assure that the processors make the highest margin in the chain. Other actors in the manufacturing role of the local chain were not added in the share because the researcher was unable to investigate their costs and income.

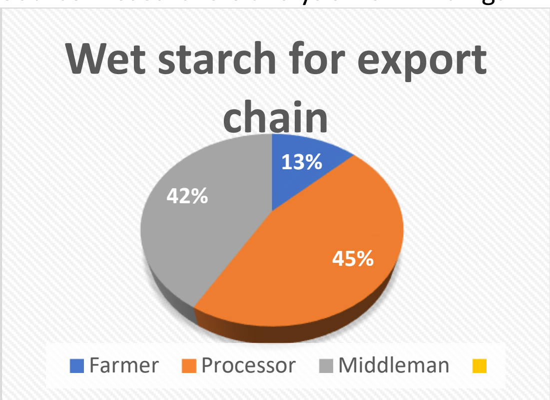
Table 12: Value share for wet and dry starch in Export chain

Actors	Revenue/kg (IDR)	Added value (price received by actor – price paid by actor) (IDR)	Value share (Added value X 100/Final retail price)
Wet starch			
Farmer	769	769	13%
Processor	3500	2731	46%
Middlemen	6000	2500	42%
Dry starch			
Farmer	769	769	4%
Processor	3500	2731	15%
Middleman	18000	14500	81%

Source: Researchers analysis from findings

From the analysis above, the processor adds the most value to sago starch among the actors represented. Below is a chart showing the value share.

Source: Researchers analysis from findings.



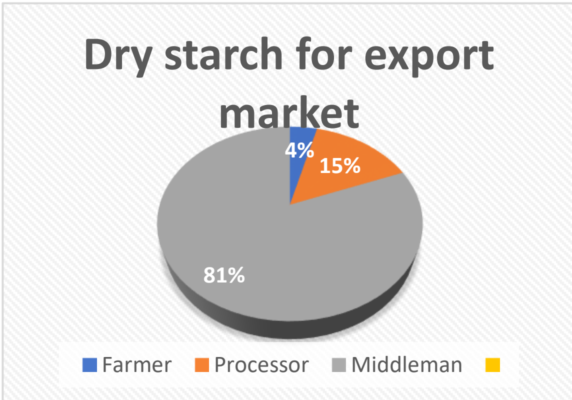


Figure 13: Actors Value Share in the Wet and Dry Export Chain

4.4 GOVERNANCE STRUCTURE IN THE CHAIN

Finding revealed that two chains exist in the district with the same vertical governance structure. The local chain where sago is sold locally in the markets is driven by price. This type of governance is called market governance. This is also the case for the export chain where price drives the market between the processors and the middlemen however, the researcher discovered that most times, a relationship develops between the processor and middleman which encourages the middleman to pay upfront for future supplies from processors. This method of governance is called a relational governance. Based on findings, 90% of sago starch is sold to Banjar Masin (South Kalimantan) through middleman meaning that Banjar Masin is the major market driving the starch industry in Bataguh. This leaves the producers with little room for price bargain hence they are price takers in the chain. The other 10% of sago starch is sold locally and a part of it is used in the manufacturing of value-added products like cakes, cookies and drinks which are sold locally.

Horizontally, the chain supporters provide supporting services such as research, and extension services which encourages the development of the chain however, it was observed that there is no representation of some supporting roles such as finance.

Information flow: Limited information flows among actors and supporters in the chain. Middlemen in the area hoard information from the producers which forces the processors to accept available prices. Communication between middleman and processors takes place through physical contact. The local chain is very limited and has no organisation. Supporters like the FMU and SMAGAPALA provide extension services and capacity building.

Chain coordination/relationship: Findings showed that the chain coordination is weak. Actors in the chain act independently of one another and only come together at the point of sale. It was also discovered that there is no producer/processor organisation currently for sago starch producers in the area however, a women group with extension and marketing function exists in helping local women improve their products and gain market access through trainings and advertising at exhibitions.

Product flow: Product flows upstream from the producer to local and international consumers. In both chains, some of the product is converted into value added products while the rest is sold in their raw form. Specific quantities however could not be determined.

Current value chain in Bataguh sub-district of Kapuas, Central Kalimantan.
Having gathered information regarding the value chain in Bataguh, the researcher constructed a Value Chain map reflecting the current value chain in the sub-district. Information about the stakeholders, their supporters, product flow, information flow and value share are represented in the map below.

Source: Findings from processors, supporters, and past researchers.

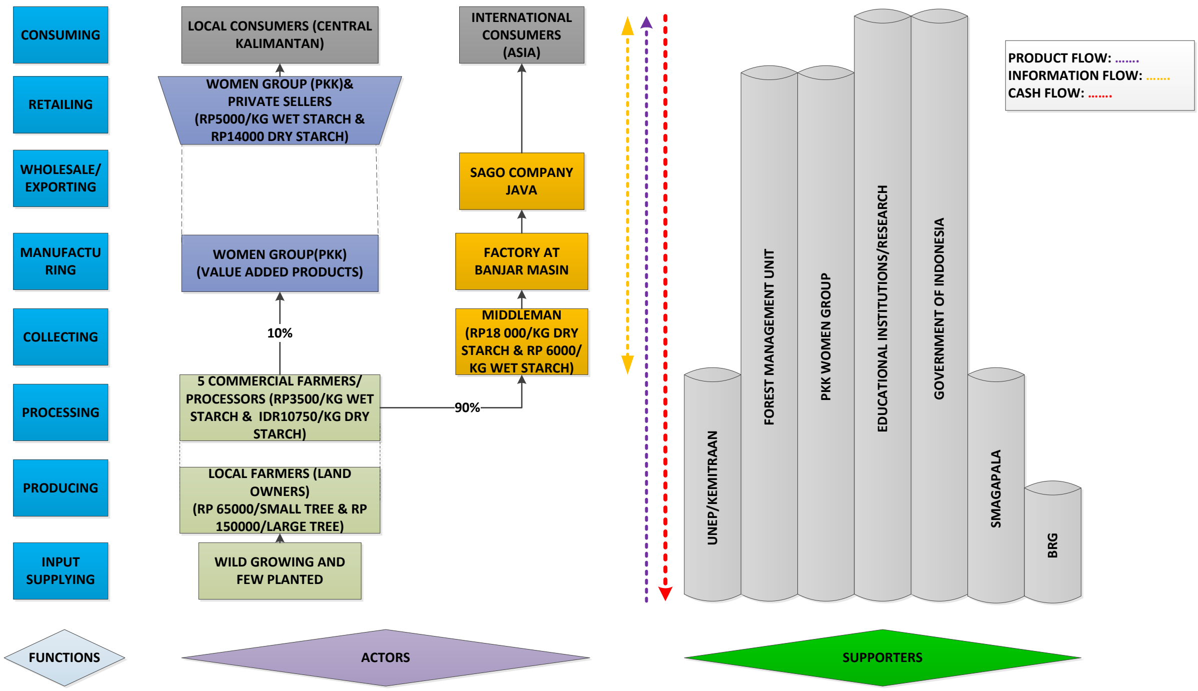


Figure 14: Sago Value Chain Map

4.5 CONSTRAINTS OF SAGO VALUE CHAIN IN THE REGION

During the research, the researcher discovered several challenges hindering sago value chain in Kapuas. Among them are problems relating to the production, processing, quality, and marketing of the product. Other limitations were also discovered such as environmental, financial, and social limitations. Below is a report of the various challenges which will be analysed using a causal diagram and infused SWOT/PESTEC tool.

Production Constraints: Challenges relating to the production of sago were linked to environmental challenges with issues such as bush fires and deforestation being the main cause of production limitations. Two of the interviewees in Bataguh stated that deforestation of sago forests is one hindering factor that affects sago palm plantations. Going further, they mentioned that 2 big corporations are currently making plans to clear up a section of the sago forest for industrial purposes. The interviewees however refused to give further details concerning the corporations or what they intend doing with the space.

Bush fires which enables deforestation was also highlighted as one of the major challenges in the region. Three interviewees mentioned that bush fires have become a regular occurrence specially during dry seasons when peatlands become dry making them prone to fires. In the words of one interviewee:

"About 22000 hectares of peatland in the area has been burnt."

-(Informant 6, 2020)

The interviewee mentioned that these bush fires are mostly caused by accidents from smoking and cooking however, industrial burning also contributes to peatland burning where sago palms are affected.

A sago professional from a University in Bogor who was interviewed also mentioned that in sago plantations, when the water level of transport canals along the peatland goes below 40 centimetres, the peatlands becomes dry and are prone to fires. This eventually causes loss of sago forests and carbon emission.

Processing constraints: The major challenges mentioned in relation to processing are poor processing facilities and poor financing to provide the necessary processing equipment. One of the interviewees mentioned that processing is still done traditionally which limits the quantity and quality of sago processed into starch weekly. During the research, a former district head and chain supporter who was interviewed stated that processors in the area had constantly sought for Dana Desa, (a village fund of IDR 1,000,000,000 given to each village for community development). The intention is to use this fund in improving their processing however, the fund has remained difficult to access.

Quality constraints: The quality of sago starch in Central Kalimantan is relatively poor according to research outcomes. According to one of the interviewees:

"Sago starch in Kapuas has poor quality compared to those of other major producers like Riau. This has caused poor competitive power among the farmers in the province who sell their product at very poor prices."

-(Informant 7,2020)

Based on findings, sago starch is processed using water from the river. The wastewater from sago processing is dumped back into the river while the fibre from the pith is left for chickens to feed on. Using poor water quality affects the colour of the final product. Going further, due to the unavailability of starch drying machinery which converts wet starch to dry starch, sago starch is usually sundried. This causes the starch to be dried in the open exposing it to microorganisms and dirt which affects the quality of the starch. During the rainy seasons, it becomes more difficult to dry starch because of the rains and this affects the drying process and causes loss. The interviewee further stated:

"The quality of the sago is bad but with better markets, there can be improvement."

-(Informant 7, 2020)

Market constraints: Market challenges seemed to be the biggest challenge of sago value chain in the district. While the local market flourish during festive seasons like Ramadan where sago products are manufactured as celebration treats, the larger market remains relatively poor with very low prices for sago. According to the interviewees, the poor markets has led to poor quality and poor price for the farmers who also do the processing.

Socio-Cultural Limitations on Sago Production: An expert on sago informed the researcher during an interview that some of the challenges of sago production in Indonesia is a cultural belief that some foods are to be relegated to the underprivileged. Sago starch is one of such foods that has been neglected and reserved for the perceived poor in the society hence, several individuals shy away from this starch source and embrace other starch sources instead which are mostly imported. He stated:

"During the green revolution in 1960's Indonesia, most people think that eating rice is for the rich while the local food like sago are for the poor people. Many Indonesians till today eat rice because of this."

-(Informant 2, 2020)

Going further, the interviewee mentioned that other starch sources like wheat starch were more popular than sago starch in Indonesia and were thus imported more regularly from countries like Australia and the US. An additional socio-cultural issue is the country's growing dependency on rice as a staple. According to the sago expert,

"Most people in Indonesia do not know the usefulness of sago. It is a big challenge. The staple food in Indonesia is rice and we have to import because we need more rice. It is indeed ironic."

-(Informant 2, 2020)

Another social challenge mentioned by one interviewee and one market respondent from Indonesia is the issue of mistaking tapioca starch for sago starch. According to the interviewee, many consumers in Indonesia do not know the difference between both starches because of their similarities. The researcher also discovered during a visit to an Asian supermarket in the Netherlands that value added products sampled as sago were made from tapioca starch.

Figure 15: Samples of Tapioca Starch Sold as Sago

To analyse some of the challenges affecting the development of sago value chain in Kapuas, the researcher used a causal diagram to highlight some of these problems and trace their causes.

Source: Findings from research

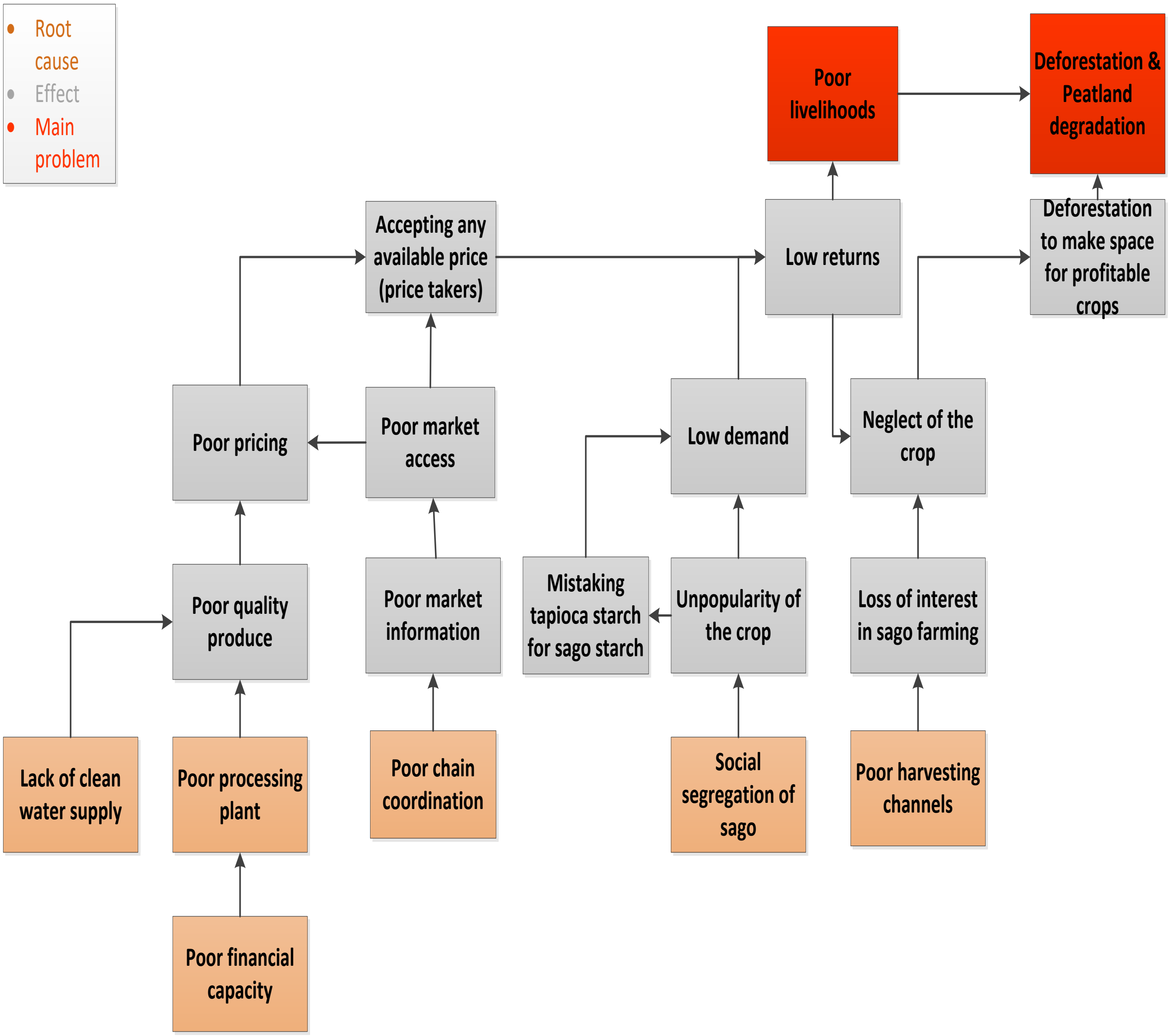


Figure 16: Causal diagram

Table 13: Infused SWOT & PESTEC

	STRENGHT	WEAKNESS	0PPORTUNITIES	THREATS
POLITICAL	❖ Recommended by the government for peatland conservation and rehabilitation.	❖ Low financial support from the government to improve sago value chain.	❖	❖
ECONOMICAL	❖ Sago grows wild. It does not require strict cultivation to continue growing. ❖ Possesses low glycaemic index and gluten free starch	❖ Sago palm takes about 8-15 years to grow from sprouting to harvest. ❖ There is low global demand for sago starch	❖ Opportunities for carbon credits by engaging in carbon farming practices.	❖
SOCIAL/ CULTURAL	❖ Representation of both genders in sago starch production ❖ Sago businesses are family owned. ❖ Cherished during festivities	❖ Discrimination of the starch as food by the financially privileged in Indonesia.	❖ Opportunities for use in food security	❖ Confusing other starches like tapioca to be sago starch is a threat to effective marketing of sago starch.
TECHNOLOGICAL	❖ Availability of traditional processing machinery.	❖ Poor processing plants available for starch extraction and drying. ❖ Poor transport methods. ❖ Traditional harvesting and processing equipment's are not sufficient for proper production.	❖ Opportunities for innovative use of sago starch in	❖ Emissions from processing machinery could be a threat on the carbon footprint in the sago value chain
ENVIRONMENTAL	❖ Grows well on peatland areas. ❖ Useful in the rehabilitation of degraded peatlands. ❖ Can withstand flooding and salinity.		❖ Sago forests can improve biodiversity and ecosystem service. ❖ Has potential in the mitigation of greenhouse gases.	❖ Climate conditions hinders starch drying. ❖ Nature of peat soil hinders effective harvesting

Source: Findings from research

4.6 MARKET DEMAND FOR SAGO IN INDONESIA AND EUROPEAN UNION

This section shows the findings regarding the market analysis and linkages for sago in Indonesia and the European union.

4.6.1 MARKET DEMAND FOR SAGO IN INDONESIA

A total of 7 companies in Indonesia were contacted to discover the market demand and prospects for sago in Indonesia but only 3 gave positive feedbacks and none granted an interview. The markets consisted of food conglomerates, sago starch distributors and starch companies. One company, a sago processing company mentioned that while they have interest in sago, their concentration is on sago farms in Papua where their processing plant is located. Another respondent, a sago distributor mentioned that there were prospects for sago produce although, the respondent was more interested in selling sago to the researcher than he was about buying sago. A third company into starch solutions during a mobile call was asked by the researcher how likely it is that their company would invest in sago. On a scale of 1-5, the company representative gave a three meaning that there is a 50% chance that they would likely invest in sago. Other companies contacted either declared that they had no interest in speaking with the researcher or they never replied the researcher.

Key informants from Indonesia however stated that there are opportunities in using sago as a food crop for food security. Considering the growing population in Indonesia, its application in food products is being encouraged by the Indonesian government. One interviewee mentioned that some policies have been set by the Indonesian government which encourages the use of sago in Restaurants and hotels.

4.6.2 MARKET DEMAND FOR SAGO IN THE EU

Findings from the research showed that sago is relatively unpopular in the European union. 14 potential markets were contacted for an interview which consisted of conglomerates, confectionaries, bakeries, and retail stores (supermarket) from 9 EU countries. 2 Asian shops located in the Netherlands were also consulted. Only one respondent granted an interview and stated that there could be a possibility to invest in sago if certain requirements are met. Many other companies that were contacted either did not reply the researcher or refused to grant an interview.

During an interview with a sago professional, the interviewee stated that the demand for sago is highest in Asia and Oceania. There is also demand for sago in the United states of America albeit, very low however, there is no demand for sago in the European Union. A starch expert stated during an interview that while sago starch has great properties for various applications, potato starch which is produced in the European union and is affordable compared to other starches could be a competition that could hinder the potentials for the penetration of sago starch in the EU market. A detailed table showing the responses from the field regarding sago demand from Indonesian and EU markets can be found in annex 2.

4.7 REQUIREMENTS FOR SAGO STARCH

This section shows what the requirements for starch are from findings in the field and literature and how farmers can fulfil these requirements.

4.7.1 REQUIREMENTS FOR INDONESIA

Sago starch companies in Indonesia requires sago that meets stipulated parameters however, starch for the export market and the local market has different standards. Starch with a maximum moisture content of 15%, starch content of 8.3% and a fibre content of 0.5% are the requirements for starch in the national market. One sago expert interviewed stated that halal certification and BPOM certification are some of the necessary certifications for food products in Indonesia.

4.7.2 REQUIREMENTS FOR THE EU

Findings from two interviews revealed that several requirements must be met for food products to enter the EU. The requirements include certifications, quality requirements and import duties. One of the interviewees stated that HACCP and IFS certificate are important certifications required for food products to possess before they can be successfully imported to the EU which was supported by another interviewee who stated that food safety certificates like HACCP and Good Manufacturing Practices are requirements for the EU market. For farmers to meet these requirements, it is important that they get certified by organising themselves because these certifications are costly.

The research also revealed that import and export duties and tax systems should be considered when importing food products into the EU. Also, a more reliable, efficient, and quick transport system should be used to avoid the products staying too long on transit which could affect the quality of the product.

From Literature, the researcher discovered that there is no specification for sago starch for the EU market however, considering the similar properties between sago and cassava starch, the researcher discovered some requirements on cassava flour which includes the following:

- A maximum moisture content of 13% and maximum ash of 3.0%.
- Free from abnormal flavours, odours, living insects and filths that can be hazardous to human health.
- Free from contaminants and pesticide residue.
- Packaged in clean containers.
- Labelled accordingly with the name of product and information.

(Codex Alimentarius, 2013).

4.8 COMPARISON OF BOTH MARKETS

The researcher was unable to successfully secure market interviews within stipulated time hence, the reliability of the market survey cannot be endorsed however, findings from key informant interviews showed that the Indonesian market is currently more favourable for sago production than the European market.

4.9 STRATEGIES FOR IMPROVING SAGO VALUE CHAIN

The researcher discovered some strategies that can improve sago value chains in relation to its marketing in EU and Indonesia. One business expert mentioned that one way to improve the chain is to find opportunities for markets taking certain factors into consideration:

"If you look for market opportunities, you can start from the bottom to the top or from the top-down. From the top-down, you look for the legal formalities to enter the EU, the basic requirements, and what the product can do for the market."

-(Informant 3, 2020)

This strategy mentioned by the key informant aligns with Porter (1989) who states that products need to have competitive advantage using strategies such as price, product, and segmentation. Some of the strategies mentioned by the interviewees are creation of government policies to encourage sago consumption, business diversification, segmentation to establish the niche market, value addition, organising producers into groups for production efficiency and marketing.

Creating government policies: One sago professional stated that a policy in Meranti encourages all hotels in the region to use sago in their restaurants. This was started as an initiative to boost local consumption of the produce in the area which can be adopted in other parts of Indonesia.

Business proposition/diversification: Findings revealed business diversification strategies by one sago company in Papua. The company has a restaurant that makes value added products from sago. According to the interviewee, all foods made in the restaurant are made from sago. This is one strategy worth adopting in Kapuas.

Niche market Identification/segmentation: One of the interviewees mentioned that analysing the characteristics of sago starch and finding a niche market for it is one strategy that can be used in marketing products made from sago.

Value addition: Using sago starch in the production of other value products by discovering ways in which it can be used is another strategy that can improve demand for the product. It is also important to understand how similar or different it is to other starches; if it can be substituted with other starch sources when being utilised for value added products.

Processor organisations: One interviewee stated that producer/processor organisations are efficient in promoting value chains that can enable marketing easier.

Marketing: A sago expert stated in an interview that marketing is an efficient strategy in accessing markets. The interviewee mentioned that this strategy has proven to work and mentioned that in the heat of the COVID-19 pandemic, online marketing and sales using a local online app called "desa app" caused online sale of sago in Riau Island to skyrocket.

KIT (2008) however mentioned that strategies necessary to improve value chains are strengthening chain coordination, building market institutions, and creating useful policies.

4.9.1 DETERMINANTS FOR MARKETABILITY OF SAGO STARCH USING MARKET MIX

The researcher interviewed two business experts in the EU who stated that for sago starch to be marketable, it requires certain characteristics. Among them are the price, starch quality, starch characteristics and the ability for the starch to be used in diverse applications. In his words,

"In comparison with other starches, it is necessary for sago starch to have competitive advantage over other starches to enable successful marketability of the product."

-(Informant 5,2020)

Price: Sago starch could excel in the European market if the price is lower compared to the price of other popular starches like potato and wheat starch.

Starch characteristics/properties (Product): The characteristics and properties of starch can determine its usefulness mostly in industrial applications. Some of these characteristics are a high starch viscosity, good gelatinization, and starch granules that are relatively large. These properties produce starches that are more sought after in industrial applications. It was also discovered from an interviewee that Sago starch has a low glycaemic index and is free from gluten making it beneficial for diabetics and those with gluten intolerance.

Starch quality/safety: Findings from two informants revealed that starch quality and safety is an important determinant for the marketability of sago starch. One of the informants stated:

"*Good separation process to have starch that is as pure as possible, and a pure colour are some of the quality parameters checked by companies."*

-(Informant 5, 2020)

Diversification of application (Promotion): one of the informants mentioned that for sago to have an edge in the international starch market, its application needs to be diverse. He mentioned that it should possess properties that can give it competitive advantage in the international starch market.

4.9.2 POTENTIALS FOR SAGO STARCH IN THE EU MARKET

The researcher having acquired limited data on the market survey set out to find other strategies for analysing the potential for sago starch in the EU market. This was done using parameters like price in checking the potentials for sago starch. The researcher gathered findings concerning production cost, import and export duties, shipping costs and certification costs. These costs were broken down to find how much it cost to create starch from production level to import level. The researcher discovered the following from literature.

1. Starch from Indonesia attracts an import duty of 95euro/1000kg (European commission, 1999). This applies to all European countries except Switzerland, Iceland, Liechtenstein, and Norway. It was not clear to the researcher why these countries were exempted.
2. There is a 0% export cost for goods from Indonesia to the EU (Informant from the Directorate General of Tax, Ministry of Finance Indonesia, 2020)
3. Shipping cost from Indonesia to the EU (Netherlands) costs an average of 1890.42 euros for a full 20ft container (33000kg) and takes between 19-24 days to get to its destination. (Movehub, 2020).
4. ISO 220000 certification costs IDR 5 000 00 (286 EUR) in Indonesia (Kementerian Perindustrian Republik Indonesia, 2020).

The researcher calculated the costs of importing one Kg of starch by dividing each cost listed above by the total number of kgs. The total cost of only one processor was used in this calculation to limit complexities. Cost of producing one KG of starch by second processor is 0.32 EUR. The second processor was chosen because his costs are higher. Below is a detail of the findings and analysis listed in tabular form.

Table 14: Estimated cost of importing 1kg of sago flour to the EU

	Full cost (EUR)	**Cost /KG (EUR)**	**Estimated Annual cost (total cost/kg x [24,480kg] total kg produced annually) EUR**	**Estimated costs for importing 1kg of dry starch (Total costs/ total number of KG)**
EU Import duty	95/1000kg	0.095	2,326	
Export duty	0	0	0	
Shipping cost	1,890.42	0.057	1,395	
Estimated Cost of producing sago	7,906	0.32	7,834	
ISO Certification (2 mandays)	286/year	286	286	
Miscellaneous Costs (2% of production cost)	157	157	157	
Total	-	-	11,998	
Estimated costs for importing 1kg of dry starch (Total costs/ Total number of KG)	-	-	-	**0.49EUR**

The above calculations show that it costs an estimated 0.49EUR (excluding fixed costs on production level) to import 1kg of sago starch into the EU. The researcher set out to compare the costs in relation to the prices of other starches in the market and discovered that starch prices in the EU varied based on the degree of value addition however, some prices that were discovered on online stores in the EU ranged between 3.5EUR to 18EUR for maize, tapioca, potato and wheat starch. This shows that sago starch has potential in penetrating the EU market through price differentiation.

4.10 SUMMARY OF FINDINGS

Having conducted field study to gather data that answers questions that the research set to discover; the table below gives a summary of findings that answers each research question.

Table 15: Summary of Findings

RESEARCH QUESTION	FINDINGS
What is the current situation of sago value chain in Central Kalimantan?	
What is the current sago palm/starch production methods and capacity?	• An estimated 285hectares of land in Bataguh has sago palms growing on them however, extra palms grow sparingly but the researcher did not get data on how much extra palm grows. • An estimated 43,200kg of starch is produced from two processors in the district annually.
How is the product processed and used?	• Processors in the area make use of semi modern processing methods which involves undeveloped and manually powered machinery. Sago starch is sundried. • The product is used in making local noodles and drinks however, an interesting discovery is its use in making rice substitute called rice analog.
Who are the stakeholders including gender in the sago value chain and what are their costs and value share?	• The stakeholders consist of 5 producers/processors, one middleman, a company at Banjar Masin, One company at Java and women manufacturers at local level. Supporters are also present providing extension services and capacity building. • Women in the chain have the role of manufacturing value added products from sago. • The processors add the most value to sago products. The manufacturing role could not be analysed due to limited information from the field.
What is the governance structure in the chain	• The chain lacks coordination and there is poor relationship among actors and poor information flow.
What are the challenges concerning sago production in Central Kalimantan?	• Poor production caused by deforestation and peat fires • Poor processing plants • Poor quality produce • Poor market access • Social and cultural issues causing segregation of the crop • Mistaking tapioca starch for sago
What are the best market opportunities for sago and how can these opportunities improve sago value Chain in Central Kalimantan?	

What is the market demand for Sago in Indonesia and the E.U?	• Market demand for sago starch in EU is quite poor • There is a fair demand for sago starch in Indonesia
What are the market requirements of both and how can farmers meet requirements?	• Food safety and quality requirements are necessary for both markets. • Farmers can meet this by organising themselves and getting certifications
Which of the two markets (Indonesia and EU) are more favourable to encourage sago production?	• The Indonesian market is more profitable however, there could still be potentials for the EU market based on price. • It cost an estimate of 0.46EUR to import 1kg dried sago starch to the EU which could be a debate for its potential.
What strategies can be implemented to improve Sago palm value chain and maintain peat condition in Central Kalimantan?	• Creation of government policies to encourage sago consumption • Business proposition and product diversification • Segmentation to establish a niche market based on starch qualities • Value addition • Processor organisations to improve coordination and information flow in the chain • Marketing of produce to increase market linkages

Source: Findings from the field (2020)

5.0 DISCUSSION

5.1 SAGO VALUE CHAIN IN CENTRAL KALIMANTAN

Findings from field study showed that Sago palm plantations in Bataguh sub-district of Kapuas in Central Kalimantan are wild grown palms most of which are neither cultivated nor maintained. The forest covers a total of 285 ha of peatland in the area and equally grows on non-peat soil. Sartika (2019) states that sago grows on 3,190 ha of total land area in Bataguh subdistrict occupying 7.1% of total land area and an additional 1,360ha of forested area. This shows that there is more space for sago palm cultivation than is currently being exploited which is encouraged by the Indonesian government who encourage paludiculture crops on wetlands (Forest Peoples Programme, 2011).

A monthly production 9000kg (9 tons) of dry starch is a poor production capacity compared to other current processing facilities in Indonesia and Malaysia which produces about 22,000 tons to 99,200 tons monthly as reported by Jong (2018). Kapuas poor production could be because of poor processing infrastructure which limits productivity of starch extraction or perhaps, it could be that the diameter and length of sago palms harvested in the region could be at the lower end of the varied range of 25-60cm in diameter and 10-18metre in length as documented by Jong (2018). Jong (2018) also mentions that small processing factories which existed in 1980s Malaysia produced less than 30tons of dry starch monthly which is similar to the case in current day Bataguh however, production scaled up to 500-1000mtons in a few years after more modern processing plants were constructed. It is thus important to note that planned cultivation of sago plantations like those of Sarawak and Sumatra with processing facilities that could produce better quality and quantity of starch could be beneficial for commercial purposes to benefit the environment and the livelihoods of local farmers in Kapuas.

Furthermore, it can be assumed from findings that one reason for the low production of Sago starch in the district could be because of the few number of processors who produce sago commercially. In comparison with sago production in Riau, where an estimated 7500mt of sago is produced monthly, an average of 55 processing factories exists (Jong, 2018). This could mean that more sago processors need to be involved in sago processing in Kapuas district to increase production capacity however, efficient machinery such as the rotary sieve mentioned earlier could equally improve production capacity and quality despite the few number of processors.

An interesting finding during the research was the use of sago in making a rice substitute food product called rice analog. Given that rice is a staple among the Indonesian people, this food substitute was developed by researchers from Bogor as stated by Bulijannto and Yuliana, (2015) and is still undergoing research. This justifies the potentials for sago to be used as a raw material in value added products which could be used in tackling food security issues not just in Indonesia but also in other developing countries. It also helps to exploit the potentials for developing business partnerships in Innovative department of food industry and encouraging small holder farmers to invest in sago as a raw material for value added products in accordance with Good Agricultural Practices Bulijannro and Yuliana, (2015). Jong (2018) further states that the rotary sieve, a new machine technology invented in 2010 can be used in efficiently extracting starch from sago fibres which can be beneficial for sago farmers however, more efficient drying machinery is also needed to ensure that starch is properly dried for improved quality of the Bataguh starch industry.

Exploring the sago value chain and its supporters in Kapuas more deeply, it can be seen from findings that certain chain supporters like financial institutions are absent in the value chain. Perhaps, machinery such as the rotary sieve mentioned earlier, or even less expensive machines could be accessed if financial institutions are active supporters in the sago value chain in Kapuas. According to Diamond et al. (2014), Value chains ought to have supporters who provide extension services, financial services, input services and many other services that can enable better chain coordination from the supply of input upstream to the consumer. It is also important that building value chains should involve the inclusion of various stakeholders and supporters to initiate public private partnership in the chain to help chain actors link to buyers (Diamond et al, 2014). These supporters are important in providing services that will enable chain development. While the processors in Kapuas seek the Dena Dasa fund, an alternative to accessing funding is through loans from financial institutions. One way to improve horizontal governance is through organizing processors into groups as stated by KIT (2008). This gives them power in the chain and enables them to interact with other powerful stakeholders.

Considering the role of women as stakeholders in value chains is also important to ensure that women are actively represented in chain activities and development for the purpose of gender equality and women empowerment (Risgaard, 2010). In Kapuas, women are involved in chain activities and are better organized than many other actors in the chain through the PKK cooperative who help these women market their produce. This could be a point of reference for the processors in the chain to adopt strategies that have worked for the women who get marketing opportunities and grants from governmental institutions through the women group however, a better coordination is still required among the actors in the chain.

Research findings shows poor coordination among chain actors with each actor acting independently of themselves and only making contact at the point of sale. While processors have high interest in the chain, they are less powerful because they do not make policies nor have sufficient financial capacity to influence change in the chain. This can be because of poor relationship and coordination among processors in the chain. An important step in value chains development is ensuring that chain coordination and relationship are improved. This could ensure that there is reciprocal interdependency among actors like Bijman et al (2011) stated. Bijman et al. (2011) continues that cooperatives are one way to bring actors in one function of the chain together to improve their coordination. This can be the steppingstone for sago starch producers in Bataguh sub-district to cooperate and increase their power in the chain in order to have better information flow and improved market access.

Having stated all these above, one needs to scope into the challenges that has hindered the sago value chain development. From findings, production, processing, quality, and market access were the most prominent challenges identified by sago chain actors. Other challenges such as financial, environmental, and social limitations were also highlighted. Among the challenges, poor market access seemed to be the most striking issue faced by sago starch producers in the district who stated that poor markets have led to low inflow of revenue which has directly affected the quality of their produce.

In a study conducted in South Sulawesi Indonesia, Metaragakusuma et al (2017) mentions that the market demand for sago starch increased even though production had suffered a significant decrease by 86% within 8 years. This is a surprise as research findings takes a different turn to reveal that market demand for sago starch is low in Kapuas. It could be that geographical location has a role to play in this however, considering how developed transport technology and road connections are, transportation of goods from place to place has breached the gap of distance. Metaragakusuma et al (2017) further states that the decrease in production could be because sago farmers neglect the crop to plant other profitable crops which has driven the demand for sago even higher. Such opportunities can be explored by districts like Kapuas who have lower demand for sago however, it becomes clear that they do not have information about such opportunities.

With the above in view, it can be assumed that a lack of market information is one of the major causes of poor market access hence interventions are needed to improve information flow among actors in Kapuas district of Central Kalimantan. Having access to market information and by extension, market access nonetheless comes with its requirements. Requirements such as a steady product flow and quality demands are two most important requirement demanded by markets which should be met.

This takes us back to the discussion on production capacity and reinforces the need for sustainable production flows to accommodate potential markets.

5.2 MARKET OPPORTUNITIES FOR SAGO

Findings showed that the market demand for sago starch in the EU is very low. In comparison with other international markets like Japan which has the highest demand for sago starch in the international scene (Janssen and Widaretna, 2018), the documented demand for sago in the EU is poorly represented in literature.

Looking at the starch market in the EU, it is evident that the dominating starches in the EU markets according to import and export statistics on OEC (2020) are potato starch, wheat starch, maize starch, and tapioca. This could be because the European market has been in the business of utilizing wheat, maize, and potato starch since the 18th century probably because these crops are produced locally in the EU (Starch Europe, 2020). Maybe the properties of sago starch do not measure up to that of wheat and potato starch however, looking at the properties and characteristics of these starches, Nail and Sarkar (2001) states that sago starch can be used as an alternative for potato starch. Also, considering the nutritional properties of sago starch as a low glycaemic and gluten free starch discovered during the study and backed by Maya et al (2020), Nounmusig et al. (2018) and Kumari et al. (2019) it is apparent that sago starch possesses characteristics that makes it not just an alternative to other starches like potato and even tapioca but an even better choice because of its potentials in food security (Budijanto and Yuliana, 2015) and peatland rehabilitation (Abd-Aziz, 2002).

The Indonesian market on the other hand has a fair demand of sago starch as shown by the results. This agrees with literature as mentioned by Janssen and Widaretna (2018) who states that sago production and utilization has been on the rise over the last decade relating the reason to the governments interest in promoting sago as a crop with high potentials. It can be seen from findings and literature that the demand for sago had declined during the green revolution when there was a shift to rice as a staple in Indonesia (Wadis (2014); Pradipta (2019) however, with a growing need to feed Indonesia's growing population, the demand for sago has begun to rise again.

Some of the factors that may have inspired the recent promotion of sago-based products in Indonesia and an increase in its demand is the increasing need to import other food products like rice and wheat flour to meet local food demand (Girsang, 2017). Findings from the interview and literature sources shows that sago starch has started to gain new potentials in Indonesia's food industry. From its uses in the manufacturing of value-added products like rice analog, there is potential for local demand of sago to replace the high demand of other staples like paddy that has remained on the rise since the green revolution.

Findings showed that Requirements for starch in the EU market and the Indonesian markets are similar. Starch requirements in the EU need to abide by certain laws which encourages food safety and quality. Among these are laws guarding against contaminants and mycotoxins, laws encouraging traceability and laws regarding additives and processing aides (Starch Europe, 2020). These are also like the laws in Indonesia albeit, less stringent, the Indonesian requirements for starch ensures safety requirements are met.

In comparing both markets, findings showed that the EU market has a lower demand for sago starch than the Indonesian market where sago starch is already being utilized. It is interesting to note that over 40% of the world starch trade takes place between Asia and the EU with a trade value of 17.7billion USD and 17.6 billion USD respectively (OEC, 2020). As of 2018, Indonesia was the second highest importer of starch in the world only after China with 396million USD worth of starch mostly Imported from Thailand, China, and Australia as of 2018 (OEC, 2020). Topping the list of starches imported in Indonesia is wheat starch according to ITC (2020). This shows that there is very high demand for starch in Indonesia that could give opportunities for sago starch to be explored. The EU on the other hand had a total starch import value of 1,259,032million USD as of 2019 (ITC, 2020) with wheat being the highest import however, other starches such as maize starch and potato starch were equally high contenders in the starch market.

From the analysis above, it can be stated that the Indonesian market poses more opportunities for sago starch however, the European market still needs to be explored. While wheat starch has the highest demand in both markets probably due to its use in the pastry and pasta industry other starch sources like sago are gaining popularity because of the gluten level of wheat starch. Konuma (2012) highlights the possibility of mixing sago starch with wheat starch in making cookies while (Poeloengasih, 2017) states the possibility of sago starch to replace gelatine for vegetarian consumers. These are all opportunities that need to be explored.

5.3 STRATEGIES FOR IMPROVING SAGO VALUE CHAIN IN BATAGUH

Findings from the field study indicate that there may be several strategies to improve the value chain of sago and its associated production. These strategies include creating government policies that encourages sago consumption, Business proposition/diversification, segmentation to establish a niche market, value addition, processor organisations and marketing are strategies that could improve sago value chain. According to KIT (2008), strategies to improve value chains are strengthening chain relations, building market institutions, and fostering chain partnership through policy implications. These strategies highlighted by KIT (2008) align with strategies discovered during the field data collection however, KIT (2008) argues that some of these strategies could be detrimental if not well handled. As an example, forming farmer groups and bypassing a middleman could be disadvantageous if strategies for marketing, quality management and market communication are not effectively set up. This shows that one must look deeply into the essentials of each strategy to enable its efficiency and effectiveness.

One outstanding way to improve sago value chain is to create strategies that improve opportunities for market linkages. This can be done using the market penetration strategy according to Porter (1989) which is Price, product, place, and people. Sago can penetrate the market through targeting of specific consumers such as diabetics and gluten intolerant population individuals Maya et al (2020), Nounmusig et al. (2018) due to the qualities it possesses.

5.4 PROPOSED BUSINESS PLAN AND ITS IMPACT

Having analysed the issues therein, the researcher proposes a new business model for the local processors with new value propositions, key customers, key channels, and revenue streams.

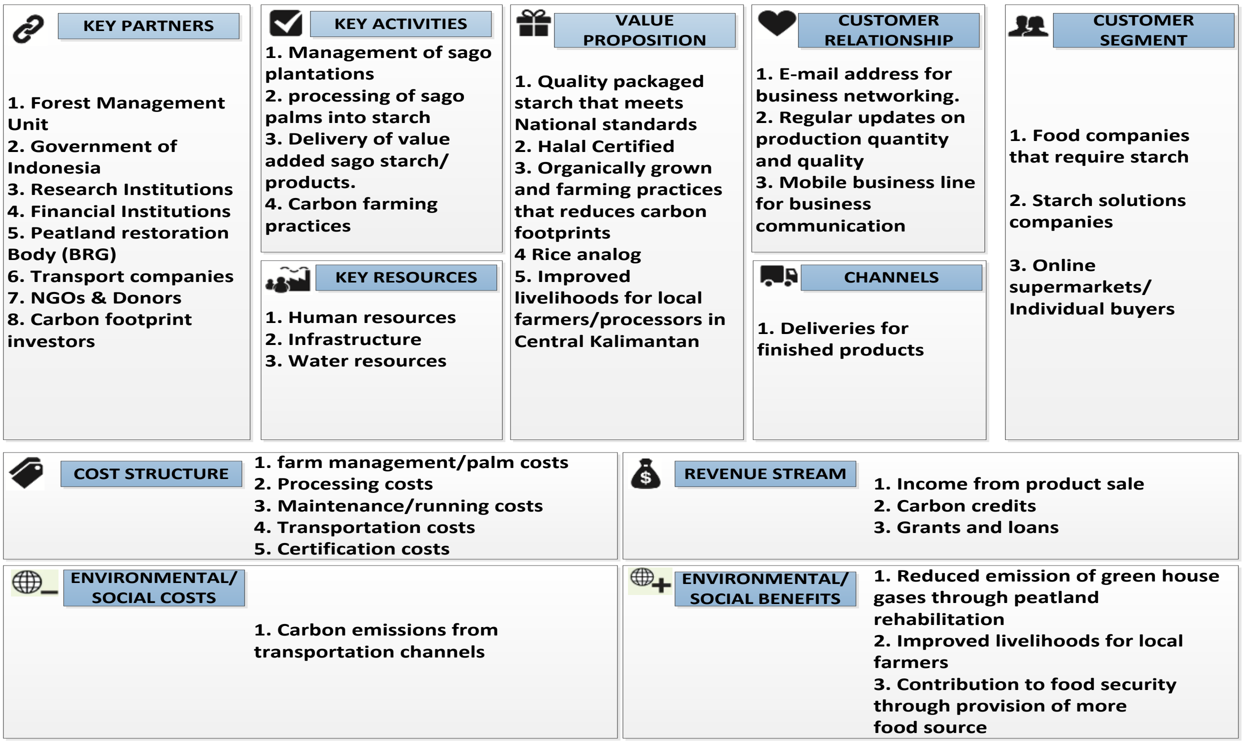


Figure 17: Proposed CANVAS Business Model

The researcher proposes a new value chain for sago that will result from strategies suggested in the new business model. In this new chain, sago farmers can sell directly to the sago starch company at Banjar Masin through their cooperative and gain higher margin in the chain. They can also sell and market their produce using online platforms. The PKK women group who add value to these products can also market and sell their value-added products online which gives better opportunities to women in the chain.

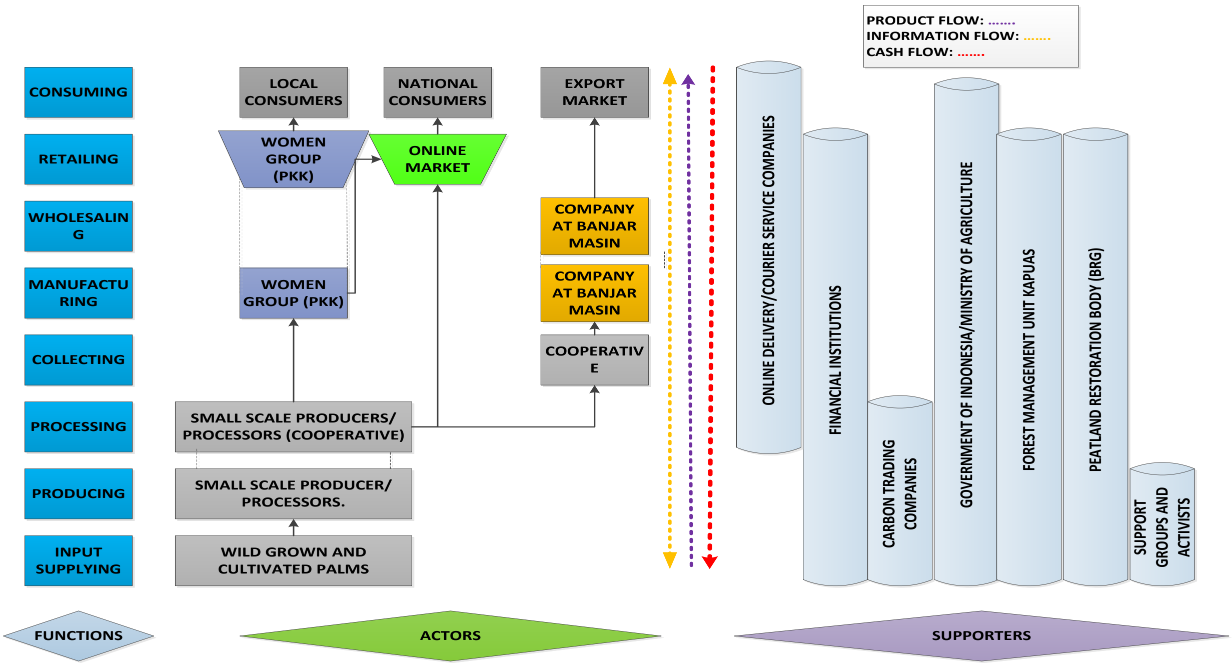


Figure 18: Proposed Value Chain

This research intended to impact the 3p (people, planet, and prosperity) and contribute to the UN’s sustainable development goals 1, 2, 13 which are: No poverty, zero hunger and Climate action. These impacts are explained below.

People: This research focused on sago starch and its use in the food industry and various uses were discovered which could increase food production and food security in Indonesia and other parts of the world. Applying the strategies in relation to the findings would not only increase production and market access in the future but also enlighten consumers on the health benefits of the product and encourage its consumption.

Planet: Peatland degradation and the carbon emission rate from these degraded peatlands justified why this research is important. Having concluded, the interventions from this research will work towards improving the marketability of sago and its products. An improved market access will cause the demand for sago products to rise which will cause local farmers to invest in the crop. Investing in the crop will mean less degradation for the planting of other profitable crops and cause the locals to maintain peatlands in Central Kalimantan.

Prosperity: The income of a people has a lot of effect on their livelihood. Local farmers in Kapuas district of Central Kalimantan engage in many activities that harms the environment for the sake of an improved income however, profit can be made through more sustainable means. This research and its recommendations have implications for locals in the areas to make better profit while utilizing resources effectively and maintaining a good and healthy environment.

5.5 REFLECTION ON THE RESEARCH PROCESS

Conducting research in a country where I have never been to, do not speak the language, nor understand the culture of its people was one of the most challenging moments of my study as a master's student at VHL. Initially, I had been very optimistic about the research particularly because it involves issues concerning social and environmental sustainability however, things did not go as I had envisaged and for every step of the journey, I encountered numerous challenges including limitations resulting from having to conduct research during a pandemic with laws limiting free movement.

Reflection on the topic selection: I had discussed with my mentor earlier in the year about the possibility of conducting a research within the Netherlands and got a positive feedback to conduct a research under the supervision of Dr. Peter Van Der Meer. Having previously conducted a class research on sago in South Kalimantan, I had felt that I had the necessary background knowledge to begin. Several meetings with Peter and Dr. Aritta Suwarno (a researcher and representative of the research commissioner) revealed that it would be more beneficial to focus on Central Kalimantan instead and work towards improving their Value chain by searching for opportunities for market linkages in Indonesia. Considering that I am studying in Europe, the idea of searching for market linkages in the EU was a welcome idea and this area was added to my scope. Several more meetings birthed the research topic which I have conducted.

Reflection on the research design: Designing the research was quite challenging. As someone who has never conducted any form of applied research in the past (except those done during the coursework), it took a lot of effort understanding the components of the research and how to design a proper research. Online lectures, textbooks, YouTube videos and explanations from those who have conducted research in the past were some of the guidance that gave me a deeper understanding on how the research should be designed.

Conducting research during a pandemic: Before the start of the applied research, I had previously had the opportunity of conducting research online due to the pandemic during previous modules (mini thesis). I had felt that the experience gained from the research conducted during the coursework was sufficient to give highlights of what to expect but my expectations were cut short when I started the field study. The inability to use observation as a method of gathering data had effect on my research because I had to ask questions which would have been easily observed had I visited the field physically. Asking a lot of questions sometimes irked the interviewees and this made me feel uncomfortable. Spot interviewing would have also been beneficial for market interviews if the opportunity for physical contact was present.

Reflection on the methodology: This research was conducted using literature and interviews. The survey method was irrelevant due to the limited number of sago farmers in the area which I had gotten a hint on from Dr. Aritta. One prominent method used in selecting samples during my research was snowball Method. Because of the unfamiliarity of the research area and the topic in general to me, most of the interviewees were recommended by colleagues, lecturers, and friends. Other methods used were internet survey to find markets. This was the most challenging part as no market accepted to grant an interview. I had tried various platforms and strategies including opening a twitter account to send messages (as I did not have any already), contacting staff of various companies through LinkedIn, using company contact forms, e-mails, and calls. Most of these methods proved futile so I constructed a short checklist of about 7 questions yet none of the markets answered any. My supervisor however stepped in and gave some recommendations which yielded some result but more towards key information.

Reflection on the interviews: 5 key informants from Indonesia who did not speak English were interviewed. The interviews were conducted in Bahasa and I sought the assistance of my colleague and fellow researcher (Ghofur Mohammad) to be my interpreter which he willingly obliged. The interviews were easy to organize because of the sample method used (snowball) but challenges such as poor internet connections during some of the interviews obstructed communication flow. During the interviews, I made detailed jottings which ended up being very beneficial for me because I realized later that my recordings had failed (some of them were not clear while some were clear only on my end). Sometimes, the interviewees were irked by my questions and I had to ask them in different ways and even conduct extra interviews at other times to allow them some time with hopes to find them in a better mood next time. The market interviews unfortunately did not happen because none of the markets accepted an interview however,

Reflection on validity and reliability of results: The validity of some findings particularly those concerning numerical figures from Central Kalimantan were questionable. Every actor gave an almost different figure each time I asked a question concerning cost and price. When I expressed my skepticism to one of the informants whom I had developed good communication with (using WhatsApp chats translated by google translate), the informant stated that sago prices are never static and fluctuate very often depending on demand, needs and seasons. This key informant was also very helpful in providing me extra information and clearing my doubts on data which I had felt were not valid. Other findings however from both Indonesia and EU key informants can be termed reliable because most of the information came from more than one respondent and were also represented in literature.

On report writing: Inability to conduct market interviews caused a delay in my report writing. I had gotten recommendations from my supervisor on interview connections however, I resorted to stopping any pending interviews two weeks before final submission. The limited time I had made my work tasking because I became labored compiling my report within a short time that my writing and health began to suffer as I stayed awake most times working on finalizing my report. I learnt

In general terms, the research process was a learning step where I gained new experiences daily. You never know all in research. I have learnt that every research is unique; for every research, you need to apply new strategies, new skills, separate yourself from the things you already know and be as objective as possible.

6.0 CONCLUSION

This research set out analyse the existing sago value chain in Central Kalimantan to find out the challenges hindering the value chain and discouraging local farmers from investing in the crop. Literature showed that some of these challenges are related to poor marketing of the product due to its unprofitability for local farmers which has caused local farmers to neglect the crop to plant more profitable crops. The implication of this is degradation of peatland that causes the emission of greenhouse gases that is detrimental to the environment. Based on the research questions, it can be concluded that:

1. The research discovered that the current value chain in Kapuas is not very developed.

- The production and processing methods used are relatively poor which affects the quality and production capacity of sago starch in the region.
- Semi-modern processing methods are used in the chain and opportunities exist for its use in value added products which is not completely being utilised in the district.
- The stakeholders in the chain consist of processors who double as producers, a middleman, women who perform the role of manufacturing and retail and an export company however, the processor has the highest value share in the starch chain.
- The governance structure is market for the local chain and market/relational for the export chain with poor market information along in the chain.
- Challenges hindering the value chain are production challenges, poor chain coordination, poor quality produce, poor processing which leads to the difficulty in gaining access to markets.

It was also discovered that the coordination in the chain is quite poor with women in the chain having better coordination due to an existing group that ensures that financial and marketing demands are met. This leads to the presumption that some of the challenges limiting the value chain is not exactly the unavailability of the market in Indonesia but poor coordination in the chain that has constrained market access in the district.

2. The research discovered that the best market opportunities for sago is the Indonesian market however, through marketing, opportunities still exist in the EU.

- There is a fairly good market demand for the product in the Indonesian space, the demand for the product in the European union is quite poor and could be improved using penetration strategies such as price, promotion, value addition and market segmentation however, efforts to meet up the requirements of the markets is one area to be given special attention.
- The market requirements include standards on food quality and food safety and farmers/processors can meet these requirements through getting certified.
- The Indonesia market is more favourable that the EU market due to its higher demand for starch and its awareness of the starch crop.
- Strategies that can improve the chain is improving chain coordination, establishing market institutions, and improving chain partnership. To achieve this, farmers need to come together to improve their coordination to enable better marketing through value addition. This can be done in partnership with supporting bodies in the chain and other groups like the PKK. Processors in the area can learn from these groups such as PKK women group by forming organisations that can help processors market their produce.

These listed above can enable the sago chain in Central Kalimantan to be improved which will benefit the livelihoods of local farmers, improve food security, and reduce deforestation and peatland degradation in the area.

7.0 RECOMMENDATION

Having gathered necessary data concerning sago starch production in Kapuas and analysed the findings, the researcher recommends that the commissioner follows a chain of short-term and long-term activities that will improve sago value chain in Kapuas district of central Kalimantan to enable better marketing of the product for improved livelihoods and environmental sustainability.

SHORT-TERM RECOMMENDATION: As a short-term intervention (to be carried out within a year), the researcher recommends that the commissioner primarily tackles the challenge of poor chain coordination by organizing the sago starch producers into one processor organization. This can be explored using the theory of change which is pictured below.

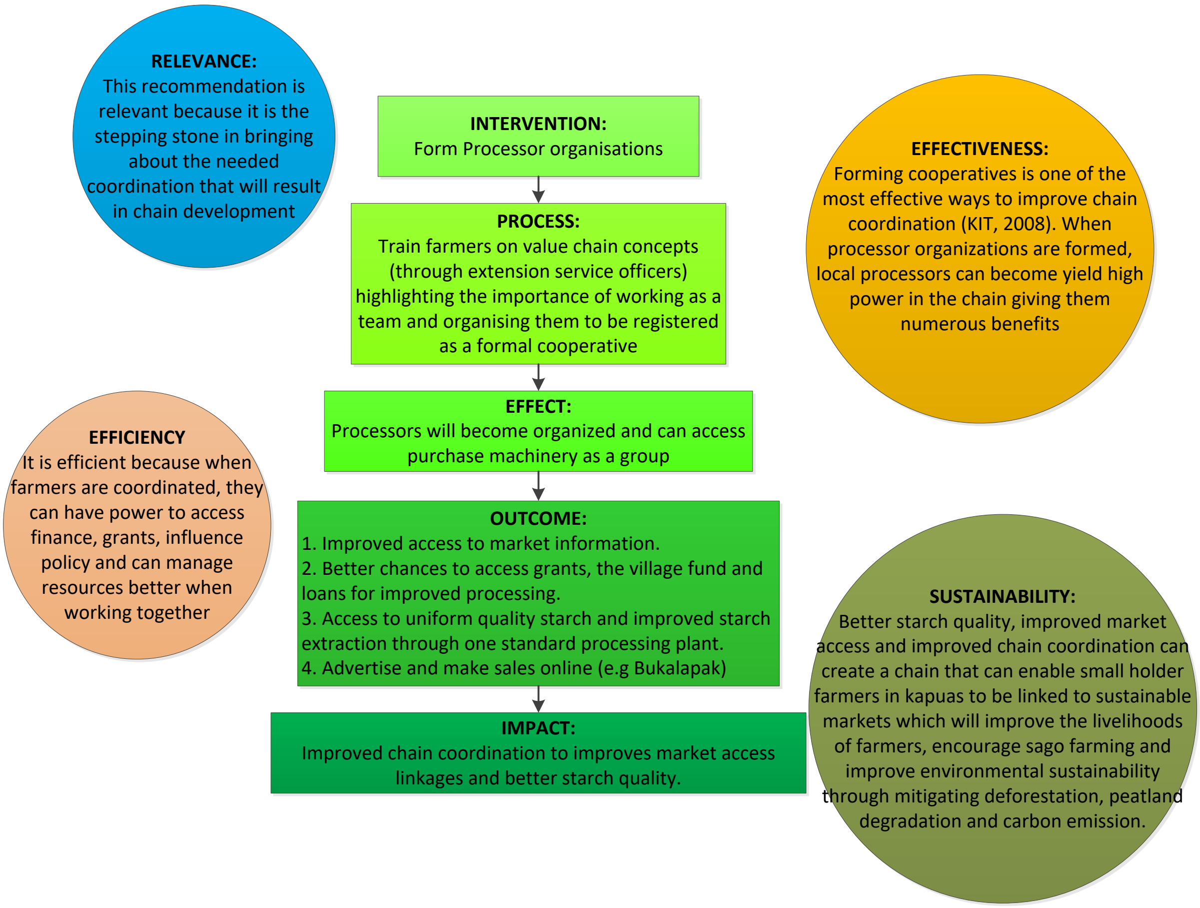


Figure 19: Short Term Recommendation

The researcher also recommends training on proper record keeping, branding, and packaging of sago starch produce for efficient marketing and creation of efficient communication channels like e-mail address and business mobile contact. These short-term recommendations will lead to the long-term recommendations which are stated below.

LONG-TERM RECOMMENDATION: The researcher recommends the following long-term (after one year) interventions to the commissioner to improve the value chain of sago production in Central Kalimantan:

1. Value addition on sago such as creation of products like rice analog. This can be done in partnership with PKK women group.
2. Halal certification for sago starch produce to ensure National quality requirements are met.
3. Work to improve water and waste management.

4. Development of one central processing plant equipped with efficient machinery for cooperative members.
5. Provision of a transport system for delivery of produce by cooperative.
6. Advocate for government policies to encourage sago consumption that will create positive effects on the production.
7. Advocate for policies that will encourage carbon farming practices

These set of recommendations are intended to build a structure that will birth a well strategized business plan as the one proposed in the discussion (See figure 16). With the functioning of the business plan, a new value chain can begin to exist as proposed in figure 17.

7.1 RECOMMENDATIONS FOR FURTHER RESEARCH

The researcher opines that there could be potentials for sago starch to be used in the EU in other industries and thus recommends further research in accessing opportunities for market linkages in the textile industry, the paper industry, the pharmaceutical industry and the bioplastic and bioethanol industry.

Further research is also recommended to check the market demand for sago produce in other geographical areas like the USA and Oceania.

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ANNEXES

KEY INFORMANT	LOCATION	CONTACT METHOD	INTERVIEW MEDIUM	EXPERTISE	INTERVIEW LANGUAGE
Informant 1	EU	Snowball/E-mail	Microsoft teams	Business expert/value chain facilitator	English
Informant 2	Indonesia	Snowball/WhatsApp	Google meet	Sago expert	English
Informant 3	EU	E-mail	Microsoft teams/Physical	Business expert	English
Informant 4	Indonesia	Snowball/WhatsApp	Skype	Former researcher on sago	English
Informant 5	EU	Snowball/E-mail	Microsoft teams	Starch expert	English
Informant 6	Indonesia	Snowball/Mobile text messaging	WhatsApp voice call	Sago chain supporter	Bahasa
Informant 7	Indonesia	Snowball/Mobile Text messaging	WhatsApp voice call	Sago chain supporter	Bahasa
Informant 8	Indonesia	Snowball/Mobile text messaging and WhatsApp chat	WhatsApp voice call and WhatsApp chat	Sago chain supporter	Bahasa
Informant 9	Indonesia	Snowball/Mobile call	Mobile call	Sago producer/processor	Bahasa
Informant 10	Indonesia	Snowball/Mobile call	Mobile call	Sago Producer/processor	Bahasa
Informant 11	EU	Mobile call	Mobile call	Former intern at study area	English
Informant 12	Indonesia/EU	Snowball/WhatsApp	Mobile call	Researcher	English
Informant 13	EU	Snowball/E-mail and call	Microsoft teams	Value chain facilitator	English
Informant 14	Indonesia	Snowball/E-mail	Microsoft teams	Sago expert	English

KEY INFORMANT TABLE

ANEX 2. MARKET RESPONCES

COMPANY	COMPANY FUNCTION	LOCATION	CONTACT CHANNEL	REPLY
Company 1	Food conglomerate	Netherlands	Twitter and contact form	“We cannot grant interview, but we wish you well.” -paraphrased
Company 2	Pasta company	Spain	Call, contact form, email, twitter, and LinkedIn.	Replied twitter message and provided a number to call. Call did not connect, and my mail did not get replied.
Company 3	Confectionaries	Germany	Contact form and linked in.	“Request will be sent to appropriate department for later contact. Please no reminders.” -paraphrased
Company 4	Bakery	Denmark	Contact form	No reply
Company 5	Dairy conglomerate	Denmark	Contact form	No reply
Company 6	Conglomerate	Netherlands	Contact form, call, and twitter	“We cannot grant interview, but we wish you well.”-paraphrased Replied my twitter message providing a number which did not connect.
Company 7	Food company	Switzerland	Contact form and call.	No replies. Call was in a different language I could not understand so I did not go further.
Company 8	Supermarket chain	Germany	Call and email.	Answered call and asked me to send mail. Never replied mail.
Company 9	Starch solutions company	Indonesia	Call	I asked how likely they are to use starch on a scale of 1-5 and they said a 3. (50% chance)
Company 10	Conglomerate/food production company	Indonesia	Email/ contact form and call	“Cannot grant Interview.”-Paraphrased. Call did not connect.
Company 11	Food manufacturer and distributor	Indonesia	email	No reply
Company 12	Processing of sago, oil palm and other cash crops	Indonesia	email	No reply
Company 13	Supermarket	Cyprus	Email and LinkedIn	No interest as a supermarket chain.
Company 14	Food distributor/starch solutions	Poland	Contact form	No reply
Company 15	conglomerate	Indonesia	Contact form and call	No reply

Company 16	Pasta company	Italy	Contact form and email	Service is suspended due to COVID-19
Company 17	Bakery and catering company with delivery services	Czech Republic	E-mail	No reply
Company 18	Pasta company	Italy	E-mail	No reply
Company 19	Organic food importer and exporter	Spain	Contact form and E-mail	Asked for details but never replied me after.
Company 20	Sago processing company	Indonesia	Email (recommended)	Interested in sago but sources from the vast sago areas in Papua.
Company 21	Sago distributor	Indonesia	Call and email	Wanted to
Company 22	Value chain facilitating company	Netherlands	Call and Email. (recommended)	Have no knowledge about sago
Company 23	Value chain facilitating company	Netherlands	Email, Call and Contact form.	Had an interview. "there is possibility of being involved in sago value chain if product reaches certain marketable standards."- Paraphrased
Company 24	Asian Supermarket	Netherlands	Physical meeting	Have sufficient supply of sago. The researcher observed that all sago products were made from tapioca starch.

ANEX 3: SAGO GENERAL PRICES

PRODUCT	HIGH PRICE (IN RUPIAH)	LOW PRICE (IN RUPIAH)
1 sago tree (to foreigners)	500 000	400 000
1 sago tree	150 000	50 000
Wet starch (1 kg)	20000	3000
Dry starch (1 KG)	35000	4500

ANEX 4: SAGO COSTS FROM BOTH OPROCESSORS

Costs	Processor 1 (IDR)	Processor 2 (IDR)
	Produces estimated 1.7 tons of dry starch monthly. (65kg dry starch/tree)	Produces estimated 2.2 tons of dry starch monthly. (85kg dry starch/tree)
Variable costs		
Sago tree (1)	65,000	150 000
Petrol	100 000	200 000/day
Packaging materials	35 000/100pieces	3000/piece (50kg packaging)

Labour	-	500 000/day (for four workers)
Fixed costs		
Boat	15 000 000	20 000 000
Processing machine	7 000 000	5 000 000
Harvesting equipment	2 000 000	1 700 000
Storage house	-	70 000 000
Maintenance cost	500 000	2 000 000

ANEX 5: INTERVIEW CHECKLIST

5.1 CHECKLIST FOR FMU

1. Introduction
   i. Name of person, parastatal, unit, or organisation
   ii. Location
   iii. Functions/roles
2. Knowledge about sago palm and starch
   i. Sago palm/starch history
   ii. Sago palm/starch uses
3. Knowledge about production
   i. Production area/location
   ii. Size of production (palm)
   iii. Production method (palm)
   iv. Processing methods
   v. Product capacity (palm and starch)
4. Knowledge about stakeholders including gender
   i. Input supply
   ii. Producing
   iii. Processing
   iv. Manufacturing
   v. Consuming
   vi. Transportation
   vii. Role of men and role of women
5. Constraints in the chain
   i. Production challenge
   ii. Processing challenges
   iii. Quality challenges
   iv. Market challenges
6. Sago starch demand and Markets in central Kalimantan
7. Advice for improvement () and referral for further interviewing.

5.2 **CHECKLIST FOR LOCAL SAGO MILLERS/PROCESSORS**

1. Introduction
   i. Name of person/mill.
   ii. Location
   iii. Functions/roles
   iv. Knowledge about peat areas and burning
2. Production
   i. Growing
   ii. Nurturing

iii. Harvesting
iv. Transporting
v. Processing

3. Stakeholders
   i. Input supply and producing
   ii. Transporting and processing
   iii. Role of women in the chain
   iv. Any cooperative or group formed?
4. Processing
   i. Processing facility
   ii. Processing capacity
   iii. Processing equipment
   iv. Processing process (wet and dry)
   v. Employees
   vi. Packaging
5. Quality
   i. Water source
   ii. Any additives
   iii. Waste disposal
   iv. Packaging materials
6. Challenges
   i. Transport challenges
   ii. Processing challenges
   iii. Financial challenges
   iv. Human resource challenges
7. Market

5.3 CHECKLIST FOR RESEARCHERS/INTERNS

1. Introduction
   i. Name
   ii. Period and duration of visit to Indonesia
   iii. Purpose of visit
   iv. Nature of work during visit
2. Observations
   i. Observations about peatlands and peat degradation
   ii. Observation about sago farming system
   iii. Observation about processing mills
   iv. Observations about gender and youth inclusion in sago production
   v. Observations about the challenges of sago production and processing
   vi. Observations about the use of the crop in food including market
3. Knowledge about peatlands and sago production
   i. Peatland distribution
   ii. Sago plantation area
   iii. Sago processing plant
4. Challenges in the chain
5. Advice for improving sago production and referral/recommendation for possible market.

5.4 CHECKLIST FOR SAGO EXPERT

1. Introduction
   i. Name

   - ii. Parastatal/location
   - iii. Area of expertise
2. Research
   - i. Sago life span
   - ii. Sago uses
   - iii. Sago health and environmental benefits
3. Market requirements
   - i. Maintaining quality
   - ii. Various types of sago starch (wet or dry) and their shelf life
   - iii. Suitable packaging options
4. Challenges and Improving production
   - i. Challenges of sago production and processing
   - ii. Any strategy to improve production?
5. Advice for commercialising sago in undeveloped area and possible referral for market.

5.5 CHECKLIST FOR VALUE CHAIN/MARKET EXPERT

1. Introduction
   - i. Name
   - ii. Location
   - iii. Area of expertise
2. Market information (EU)
   - i. How to analyse the markets (EU)
   - ii. Quality requirements
   - iii. Need for certifications?
   - iv. EU import Duties
   - v. EU regulations
3. Getting local Indonesian farmers to comply with EU standards
   - i. Meeting EU quality
   - ii. Indonesian export duties
4. Challenges faced with such business ventures
   - i. Quality challenges
   - ii. Transport challenges
   - iii. Packaging challenges
5. Advice on opportunities for sago and possible referral for market.

5.6 CHECKLIST FOR EU MARKET

1. Products being produced at company
2. Starch needs/uses
3. Starches currently used
4. Awareness about sago starch
5. Possibility of interest for sago

5.7 CHECKLIST FOR INDONESIAN MARKET

1. Products being produced at company
2. Starch needs/uses
3. Starches currently used
4. Possibility of interest for sago

5.8 **CHECKLIST FOR BUSINESS EXPERT**

1. Introduction
2. Knowledge about the EU market
3. Knowledge about starch market in EU
4. Possible clients for starch in the EU
5. Potentials for a new product like sago
6. Market requirements for importation
7. Business advice

5.9 CHECKLIST FOR STARCH EXPERT