UNIVERSITI PUTRA MALAYSIA

COVID-19 AND FLOODING: IMPACT ON RUMINANT PRODUCTION AMONG LADANG ANGKAT FARMS UVH UPM

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COVID-19 AND FLOODING: IMPACT ON RUMINANT PRODUCTION AMONG LADANG ANGKAT FARMS UVH UPM

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A project paper submitted to the
Faculty of Veterinary Medicine, Universiti Putra Malaysia (UPM)
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CERTIFICATION

It is hereby certified that we have read this project entitled “Covid-19 and Flooding: Impact on ruminant production among Ladang Angkat Farms UVH UPM”, by Meiyappan Raja A/L Kathiresan @ Kannan and in our opinion, it is satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the course VPD 4999- Final Year Project.

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DEDICATION

This thesis is especially dedicated to:

My parents

Kathiresan and Nagammai

My respected supervisor

Dr. Sharifah Salmah Syed Hussain

My respected Co-supervisor

Dr. Sadiq Muhammed Babatunde

And

Fellow DVM friends

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My first thanks would go to the Almighty. The guidance I had from the beginning till the completion of this Final Year Project is through the blessings of the Almighty.

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List of Abbreviations

No.	Abbreviations	Complete Name
1	GDP	Gross Domestic Products
2	COVID-19	Coronavirus Disease in the year 2019
3	UPM	University Putra Malaysia
4	UVH	University Veterinary Hospital
5	NCBUR	National Communication and Biennial Update Report
6	MCO	Movement Control Order
7	IDR	Import Dependency Ration
8	DOSM	Department Of Statistics Malaysia
9	MSMEs	Micro, Small and Medium Enterprises

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek Tahun Akhir.

COVID-19 dan banjir: Kesan kepada produksi ruminant pada ladang ruminant, Ladang Angkat UVH UPM, Serdang Selangor

oleh

Meiyappan Raja A/L Kathiresan @ Kannan

2022

Penyelia: Dr. Sharifah Salmah Syed Hussain, Dr Sadiq Mohammed Babatunde

Penduduk Malaysia yang berjumlah 32.7 juta orang memerlukan bekalan makanan yang stabil seperti daging dan sayur-sayuran. Di Malaysia, industri ternakan haiwan menyumbang satu per sepuluh (1/10) dari Keluaran Dalam Negara Kasar (KDNK) dalam sektor pertanian, manakala keseluruhan sektor ini menyumbang 8.9% daripada KDNK negara setakat 2015. Produksi ruminan, di mana 56.3% adalah ladang lembu pedaging, merupakan sebahagian terbesar ladang ternakan yang berdaftar di kawasan Barat Malaysia. Baru-baru ini, penternak ruminan di negeri Selangor terjejas dengan dua insiden besar yang berlaku dalam tempoh yang singkat iaitu wabak COVID-19 yang bermula pada November 2019 dan banjir kilat pada Disember 2021. Objektif kajian ini adalah untuk menentukan kesan COVID-19 dan banjir 2021 terhadap pengeluaran produk ruminan di Ladang Angkat Farms UVH, UPM. Kajian melalui tinjauan keratan rentas berasaskan soal selidik telah dijalankan menggunakan temu bual bersemuka, panggilan telefon dan borang atas talian. 11 responden daripada 16 Ladang Ladang Angkat mengambil bahagian dan data dianalisis menggunakan analisis deskriptif serta kualitatif. Kajian menunjukkan 10 daripada 11 responden terjejas oleh COVID-19 dan dua daripada 11 responden terjejas akibat banjir. Majoriti penternak mengalami kerugian besar, dalam hasil dan jualan (10 ladang), masalah mendapatkan buruh

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upahan (8 ladang), menerima perkhidmatan veterinar (8 ladang) dan memperoleh makanan untuk ternakan mereka (5 ladang). Di samping itu, penternak mengharapkan bantuan daripada kerajaan dalam bentuk subsidi, khususnya untuk makanan haiwan, serta panduan tentang cara menguruskan ladang mereka selepas bencana besar ini. Daripada ini dapat disimpulkan bahawa terdapat kesan negatif daripada wabak dan banjir terhadap penternak ruminan. Penemuan awal daripada kajian ini mencadangkan bahawa penyelidikan lanjutan yang melibatkan ekonomi, buruh yang diupah, bahan makanan dan perkhidmatan veterinar adalah sangat wajar. Untuk menjamin keselamatan makanan negara, pihak berkepentingan yang terlibat dalam industri ini perlu diperlengkapkan dengan baik dalam menghadapi peristiwa bencana pada masa depan.

Kata kunci: COVID-19, banjir, impak, produksi ruminan, penternak

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ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfillment of the course VPD 4999 – Final Year Project.

COVID-19 and floods: impacts on ruminant production, in ruminant farms Ladang Angkat UVH UPM, Serdang, Selangor

by

Meiyappan Raja A/L Kathiresan @ Kannan

2022

Supervisor: Dr. Sharifah Salmah Syed Hussain, Dr Sadiq Mohammed Babatunde

The Malaysian population of 32.7 million people requires a steady supply of agricultural products like meat and staple foods. In Malaysia, the livestock industry contributes one tenth (1/10) of the agriculture sector Gross Domestic Product (GDP) whereas the entire sector contributes 8.9% of national GDP as of 2015. Ruminant producers, of whom 56.3% are beef cattle farms, account for the biggest share of registered livestock farms in West Malaysia. Recently, ruminant farmers in the state of Selangor were affected by two major incidents which happened within a short duration of each other namely being COVID-19 pandemic which began in November 2019 and the flash floods in December 2021. The objectives of this study were to determine the impacts of COVID-19 and 2021 floods on ruminant productions in Ladang Angkat Farms UVH, UPM. A questionnaire based cross sectional survey study was conducted using face to face interviews, phone calls and online forms. 11 respondents from 11 out of 17 Ladang Angkat Farms participated and data were analyzed using qualitative descriptive analysis. The study showed that 10 out of the 11 respondents were affected by COVID-19 and two out of the 11 respondents were affected by the floods. Most of the farmers experienced substantial loss of revenue and sales (10 farms), trouble acquiring hired labour (8 farms), receiving veterinary care (8 farms) and acquiring feed for their livestock (5 farms). In addition, the farmers expected assistance from the government in the form of subsidies, particularly for animal feed, as well as guidance on how to run their farms after these major events. From this it can be concluded that there are negative impacts from the pandemic and the floods on ruminant farmers. Preliminary findings from this study suggest that further

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research involving economics, hired labour, feed stuff and veterinary services are greatly warranted. To secure the country's food security, stakeholders involved in this industry need to be well equipped in facing future catastrophic events.

Keywords: COVID-19, floods, impacts, ruminant production, farmers

1.0 INTRODUCTION

In many regions of the world, agriculture is a key economic driver. The world's population of seven billion people requires a steady supply of agricultural products like meat and staple foods. Instability in a country's socioeconomic structure and human population could result from food insecurity. Livestock refers to animals primarily reared for commodities such as milk, meat, eggs, leather, and wool. The livestock industry contributes 40% of the world's income under the agricultural sector (Nabarro & Wannous,2014). In Malaysia, the livestock industry contributes one-tenth of the agriculture sector Gross Domestic Product (GDP) whereas the entire sector contributes 8.9% of national GDP as of 2015 (Malaysian NC3 BUR2,2015). Nonruminants account for the majority of livestock in Malaysia, with chicken having a 95.9% market share. However, ruminant producers, of whom 56.3% are beef cattle farms, account for the biggest share of registered livestock farms in West Malaysia. Now these ruminant farmers were affected by two major incidents which happened within a short duration of each other namely being COVID-19 pandemic which began in November of 2019 November and the flash floods in 2021 in the state of Selangor.

Since coronavirus disease 2019 (COVID-19) spread so quickly, there is a unique problem in reducing morbidity directly caused by COVID-19 while also limiting the harmful effects of necessary prophylactic measures. Both developed and emerging economies have had to make this decision. While tracking the morbidity of COVID-19 has advanced significantly on a worldwide scale, there has been less progress made in estimating the disruption of COVID-19, particularly in Malaysia and in more rural, unorganized sectors like agriculture where real-time data is scarce. Selangor was one of the first states in Malaysia to identify a COVID-19 case (January 5th, 2020). As a result, the nation quickly mobilized preventative measures, including the closure of airports, restaurants, schools, and places of worship as well as the restriction of foreign travel and the imposition of curfews, after the first wave of 22 cases occurred from this single source. COVID-19 cases and deaths have slowly risen, though slower than most countries, with reported confirmed cases of 4,834,560 and deaths at 36,363 as of

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September 27, 2022. Disruptions of such preventive measures on the ruminant livestock supply chain and market is less clear.

The second issue the ruminant farmers in Selangor faced during the pandemic was the unprecedented 2021 floods which caused severe loss in terms of lives of livestock and damages to machinery and loss of land among others. The flood affected specific districts within Selangor. Flood among other natural disasters is very costly to recover. Flood disasters will have an impact on the psychology of the victims, the socio-economy and also food security (Hazran et al., 2017). These smallholder farming systems are also often less resilient to shocks and have fewer support structures in place to decrease the impact and increase the rate of recovery. Shocks referring to the COVID-19 pandemic and the 2021 flood. For example, a flood occurred in India causing the milk production from cattle to drop from 4650L to 3720L which translated to a drop in sales from 1.684 lakhs to 1.34 lakhs in the year 2018 (Santhi et al., 2019)

There is limited information on impact of Covid-19 and flooding on ruminant production in Ladang Angkat farms UVH UPM. And findings from this study will help stakeholders including farm owners to better understand how to help improve the ruminant industry after such a catastrophe. Findings from this study will also help to prepare stakeholders for future events. A survey was developed to identify these impacts as they relate to agricultural production, economic, and socioeconomic domains.

1.2 Justification

No previous study has been conducted on the impact of pandemic on ruminant farms. As seen earlier there were studies done in other states and other countries but not in Selangor for the impacts of the flood that occurred in the year 2021. There was also no data of the impacts of these two catastrophic events on Ladang Angkat farms. Thus, this research carries value for the country and all other involved stakeholders so they would be better prepared for future events.

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1.3 Research Objectives

To understand the Ladang Angkat farmer's perspectives on the impacts of COVID-19 and 2021 flooding

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2.0 LITERATURE REVIEW

2.1 Ruminant production in Malaysia

The ruminant production is a subset within the livestock production industry, which is part of the agriculture sector, which plays a crucial role in the development of the country. It is both directly and indirectly related to other industrial sectors (Rashidi et al., 2021). The growth in the year 2020 for Malaysia's GDP and MSMEs as well as non-MSMEs was -5.5%, - 7.3% and -4.4% respectively this was due to the COVID-19 Pandemic and global lockdown which also affected our nation's ability to import certain products that have high IDR. Though the growth improved to 3.1%, 1% and 4.4% respectively in the year 2021 it has not returned to the growth rate pre-pandemic as seen in Figure 1.

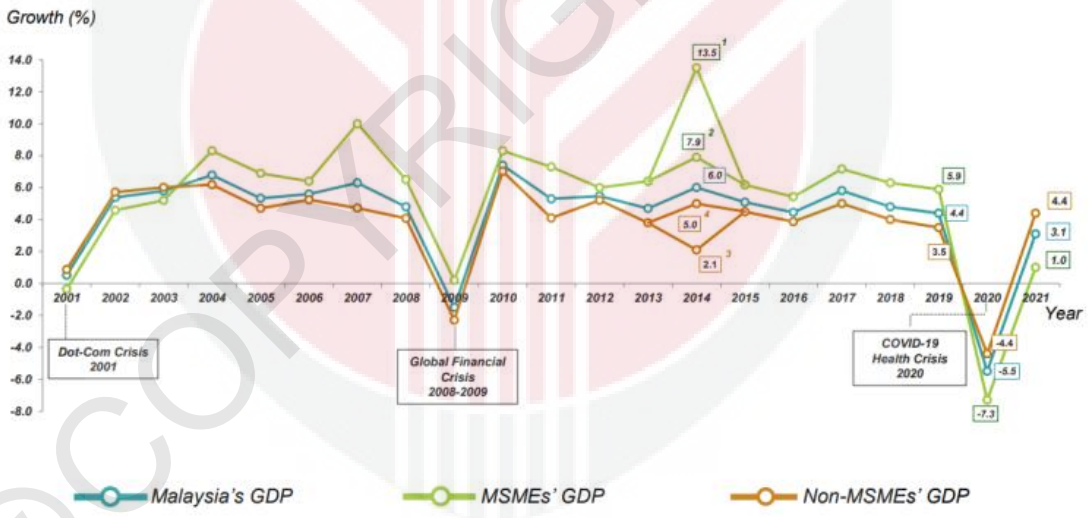

Figure 1: GDP for Malaysia, MSMEs' and Non-MSMEs' for 2001- 2021 annual percentage change. Note. From Micro, Small and Medium Enterprises (MSMEs') Performance 2021, Department of Statistics Malaysia, 2021.

In general, it reduced. The ruminant industry in Malaysia had a self-sufficiency ratio of 10.7% (mutton), 18.9% (beef), 56.7% (milk) respectively as of the year 2021 and the import dependency of these products are 89.4%, 81.6%, and 62.9% respectively. From this it can be said the country is still highly dependent (IDR exceeds 50%) on imports of

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these products (DOSM, 2021). And this negative growth and high dependency has translated into RM 327.1 billion loss and food insecurity. Before the pandemic the livestock sector was seeing a gradual uniform growth in its contributions to the nations GDP which approximately 5%.

2.2 COVID-19 Pandemic in Malaysia and globally

COVID-19 has had a lasting impact on economic stability, local and global public health resources, and most importantly the health of people. According to the Food and Agriculture Organizations (2020), COVID-19 will impact agriculture in its two key areas: supply and demand for food. These two areas are directly related to food security. Food security is therefore also at risk. Stephens et al., (2020) further noted that the impact, coupled with labor, throughput, and/or storage limitations, could significantly reduce demand for restaurants and commercial foodservice, resulting in many farmers discarding their products. Quarantine or restricted movement orders affect the ability of customers to purchase these products and the ability of farmers to access outlets to sell them.

As the impact of COVID-19 is significant for the global market, it has also indirectly affected all players involved in agricultural production, imposing significant restrictions on them; therefore, hampering them from producing and making a profit. In 2018, the agricultural sector exports and imports were RM114,451 million and RM93,313 million respectively. All foreign trade in agricultural products recorded an increase in imports of around RM95,222 million while exports decreased by RM126,492 million year-on-year. It has also been reported that the pandemic is directly or indirectly affecting farmers income. For example, market prices for poultry and aquaculture fell from RM10.50 (a few months before the 1st MCO) to RM10 during the 1st MCO (Rashidi et al., 2021). However, the impact on ruminant production in particular is poorly understood. The number of unemployed people and the rate has increased during the year 2020 to 711 000 and 4.5% respectively which has continued to increase throughout 2021 with a steady range of 700 000 and above as seen in Figure 2. This could be due to employers or in this instances farmer not being able to pay their employees salary thus forced to fire

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them or the workers falling ill easily due to the COVID-19 virus and lack access to proper health care.

Globally, World Merchandise trade is believed to decline by 13% to 22% due to COVID-19 (Poudel et al., 2020). Different agricultural sectors such as crop, livestock and fishery have been hit hard by pandemic. In China, COVID-19 has caused higher impact on livestock farming due to limited access to animal feed and shortage of labor. Travel ban in many countries has affected delivery of breeding stock of poultry. The International Poultry Council (IPC) has warned that there will be no breeding stock and hatching eggs if such travel restriction is prolonged (Poudel et al., 2020). Fish is an important source of protein and energy and accounts for more than 20% of animal protein for 3 million people. Fishing activities have been reduced in different parts of Africa, Asia and Europe due to sanitary measures (physical distancing), limited supply of inputs and labor shortage. Fish farmers are unable to sell their harvest as well as there is difficulty in aquaculture production due to lack of feed.

Agriculture produces are mostly perishable in nature, so farmers are compelled to store their unsold produce for longer period of time which leads to reduction in food quality as well as increase in cost of production. The supply of milk and dairy products has been hit hardest by COVID-19. Dairy farmers are compelled to dump milk and milk products after remarkable decrease in supply of milk and closure of milk processing company. Dairy farmers in America estimate that farmers nationwide are dumping nearly four million litres of milk each day. In Nepal, dairy product of worth RM 700,000 has been damaged and dairy product in stock of worth RM 1.6 million seems to be on the verge of deterioration. Due to global trade disturbance, farmers are facing the shortage of agricultural inputs like seed, fertilizer and pesticides. China is one of the major fertilizer producer and exporter in the world. The lockdown in China have severely affected the international fertilizer trade (Poudel et al., 2020). Pandemic have affected the planting of spring crops like maize, sunflower, spring wheat, barley, canola and open field vegetable. Thus, import dependent countries such as Malaysia seem to be highly affected by pandemic. Regarding the high rate of transmission of COVID-19, workers health and labor shortage have been major issue in agricultural industry. Workers in low- and middle-income countries lack proper health services and social protection and due to

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little saving or no saving, many informal workers in agriculture are obligated to work despite the self-isolation protocol during COVID-19 pandemic. Hence, these workers are at high risk of corona virus. Most of the farm producers are facing the manpower shortage. Travel bans have made the shortage of seasonal and informal farm workers. There is a rapid increase in employment losses around the world. International Labor Organization (ILO) estimated that COVID-19 has affected the 81% (2.7 billion workers) global work force due to full or partial closure of the workplace.

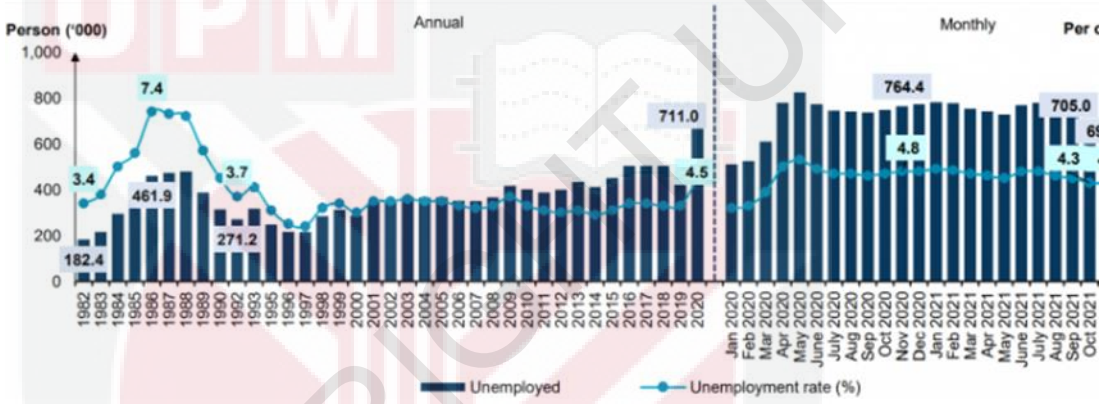

Figure 2: Unemployed persons and unemployment rate, 1982 - 2020 and January 2020 - November 2021. Note. From Special Report on Impacts of Floods in Malaysia 2021, Department of Statistics Malaysia, 2022.

2.3 Flood disaster in Malaysia and globally

Next important event is the floods. According to FAO (2019), the croplands, pastures, and forests that cover these instances farmers are gradually becoming more vulnerable to climate change as a result of increased climatic variability. In some areas, the frequency and severity of flood disasters have increased as a result of abnormal changes in air temperature and heavy rainfall. Climate change has also increased the amount of rainfall that exceeds the drainage systems in areas that are not susceptible to flooding, bringing floods to areas that are not. Flooding occurs when the level of water exceeds the drainage capabilities (Hazran et al., 2017). For instance, in Malaysia the flood that hit this nation late 2021 to early 2022 has caused a total loss of RM 6.1 billion

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and in particular RM 90.6 million loss in agriculture and livestock, and the total loss to the state of Selangor due to this flood was RM 3.1 billion.

Another example, the people of Kerala, India, endured a severe flood for a week in 2018, one of the worst floods ever recorded, similar to reports of the Selangor flood in 2021. Because of the weighty precipitation, which was over 164%, the standard downpour brought about completely filling dams made all hindrances opened and caused over flooding. Over 483 people perished, affecting one sixth of the population. According to (Santhi et al., 2019) 57,000 hectares of agricultural crops have been destroyed. This clearly demonstrates the devastating effects that floods can have on the livestock and agricultural industries.

Another example of a flood that occur in Indonesia, Kalimantan the area affected was a floating net cage aquaculture in a village, they significant number of their net cages and fishes accounting to almost RM 40,000. The degree of damage is seen figure 3.

Figure 3: Before and after the floods in Kalimantan; number of cages has reduced significantly. Note. From The Impact of Floods on Fish Cultivation Business in Floating Net Cages in Sungai Alang Village, Karang Intan District, Banjar Regency, I. Febrianty, 202, Journal of Economics, Finance and Management Studies South Kalimantan, 4(8), p. 1353

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3.0 MATERIAL AND METHODS

3.1 Study design and sample population

A cross-sectional study was conducted over a period of six weeks using an in-depth physical interview following current COVID-19 protocols, and for those farms which could not conduct a physical interview were then interviewed via phone calls. The target audience are ruminant farmers under the state of Selangor. The sample frame was drawn from the database of smallholder farms that are registered in the Ladang Angkat program of UVH, UPM. The regions where the farms are located are illustrated in Figure 4. This study was approved by the human ethics committee UPM (HECUPM) with the reference number JKEUPM-2022-470.

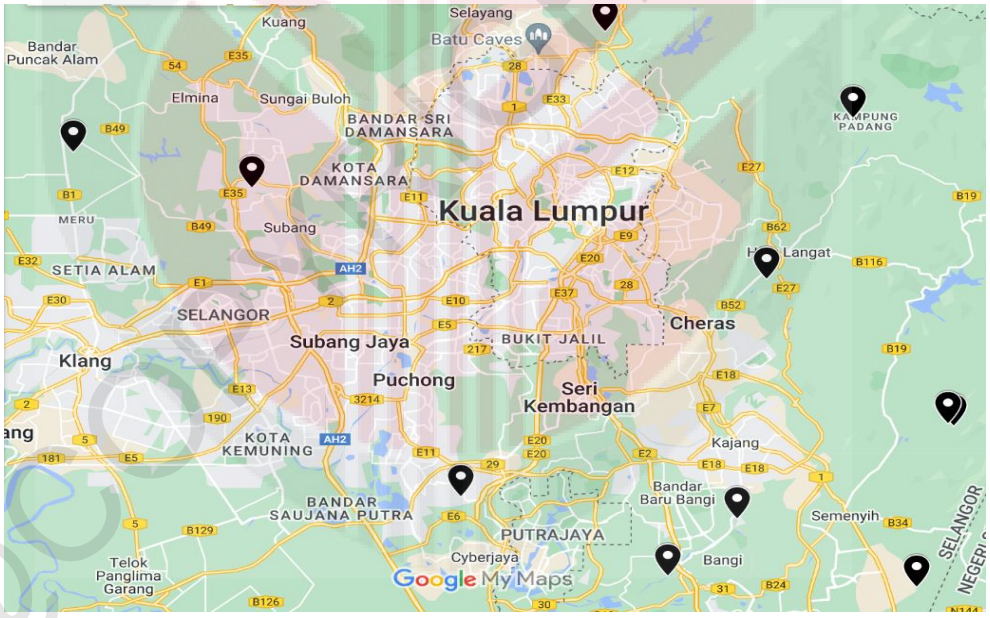

Figure 4. Distributions of the Ladang Angkat farms in Selangor

Once the sample was drawn and the location of the farms confirmed, from these 11 farms eight surveys were conducted physically while three were via phone call interview. The data from which the sample farms were drawn included owner name, contact information and location of the farm. The identity of the respondents remained anonymous to

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everyone except to the researcher and was maintained that way by ensuring the individual contact information and the survey questions have no link to the identity of the farm. Upon arrival the respondents were informed as an introduction to the survey that it was completely voluntary, that the information they shared will not be linked to their identity in any way. They were also informed that they were free to withdraw at any time when the survey was conducted. These were all written in the consent form where the respondents will sign if they agree to the survey.

3.2 Survey design

Overall, the content of the survey was designed to determine the impacts of both flood and the COVID-19 pandemic towards these Ladang Angkat farms in Selangor. The survey includes one (1) main open-ended question and 12 closed ended question comprising of multiple-choice questions as well as a few sub questions pertaining to five (5) sub parts which includes demographics (Part 1), impacts of Covid-19 on ruminant production (Part 2), impacts of 2021 floods on ruminant production (Part 3) and their expectation or plans (Part 4). The questions were asked in such manner to allow the respondents to explain themselves, the effects of the flood and the pandemic.

In the first section the farmers' demographics and managing practices will be recorded, including management system, ruminant species, and intention of having livestock. For the second part, the impact of the pandemic is collected by using one main open-ended question then followed by closed ended questions consisting of multiple-choice questions, multiple response questions, and etc. The impact of the flood was collected by using one main open-ended question then followed by a series of closed ended questions and Likert scale questions similar to Part 2. For the final part multiple choice questions and open-ended questions were mostly used. Although the survey was conducted in September 2022 the question in the survey focused during the time period of the pandemic which includes the year 2020 to 2021 whereas for the flood it focused during the period of that particular flood only.

A summary of the questionnaire structure in terms of design, questions, sections and possible responses is provided in Appendix 1. Of the total sample of 20 potential

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respondents, 17 were approached, 11 agreed to participate in the survey, and six (6) farms declined. The survey was launched on 7th September 2022.

3.3 Data analysis

All the data collected from the survey was analyzed in two ways which was descriptive analysis for the farm demographics and thematic analysis for the qualitative data. Thematic analysis is a qualitative data analysis method that involves reading through a data set (such as transcripts from in depth interviews or focus groups) in case the responses of the farmers and identifying patterns across the data to derive themes.

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4. RESULTS AND DISCUSSION

4.1 Respondents' demographics

Results from this survey represent a total of 11 farmers with all 11 completing the farm demographics. Ninety-one percent (91%) of respondents were male (n=10) and nine percent (9%) were females (n=1). The first question in the survey wais: The type of livestock managed. Which are displayed in Figure 5.

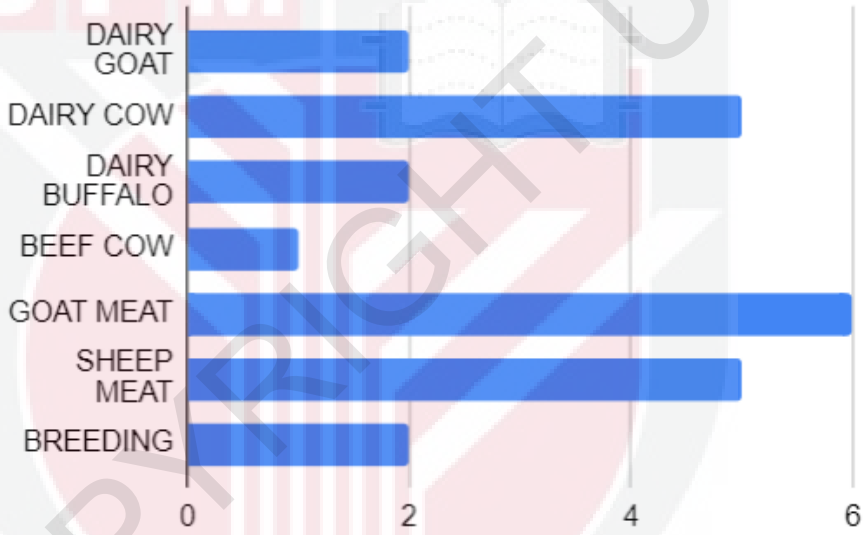

Figure 5. Distribution of livestock among farms

From the graph above, the mode is goat farming for meat (6 farms), followed by sheep farming for meat (5 farms) and dairy cattle farming (5 farm), followed by dairy goat, dairy buffalo and breeding 2 farms each. Majority of the farms (7) have a mixture of livestock. Whereas 4 farms only have one type of livestock which are buffalo dairy (1 farm), sheep meat (1 farm) and dairy cattle (2 farms).

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Next question was the type of management system the farmers use to rear their livestock, which is displayed in the Figure 6.

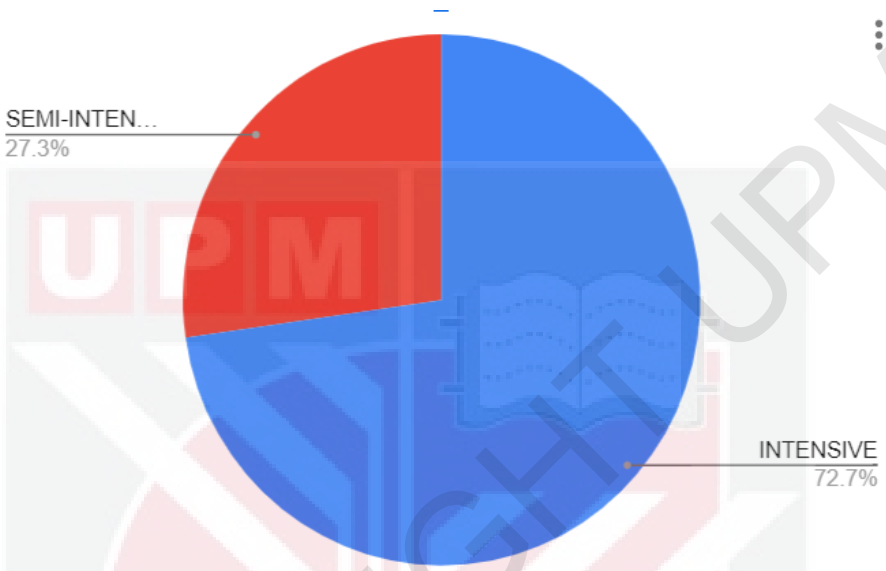

Figure 6. The distribution of management systems among the farms

As shown above 27.3% (3 farms) manage their farms semi-intensively whereas the remaining 72.7% (8 farms) manage their farms intensively. This could be due to the fact intensive farming requires less farmland and has a higher stocking density compared to semi-intensive. There were no farms that managed their livestock extensively.

Next question was about the water source the farmer uses for their livestock. This question was asked in relation to part 3 in the survey to see if the location of the farms had a relation to the tendency of being flooded. The expectation was to see farms that take water from the rivers and lakes that accumulate water would be experiencing floods. The data is shown in Figure 7.

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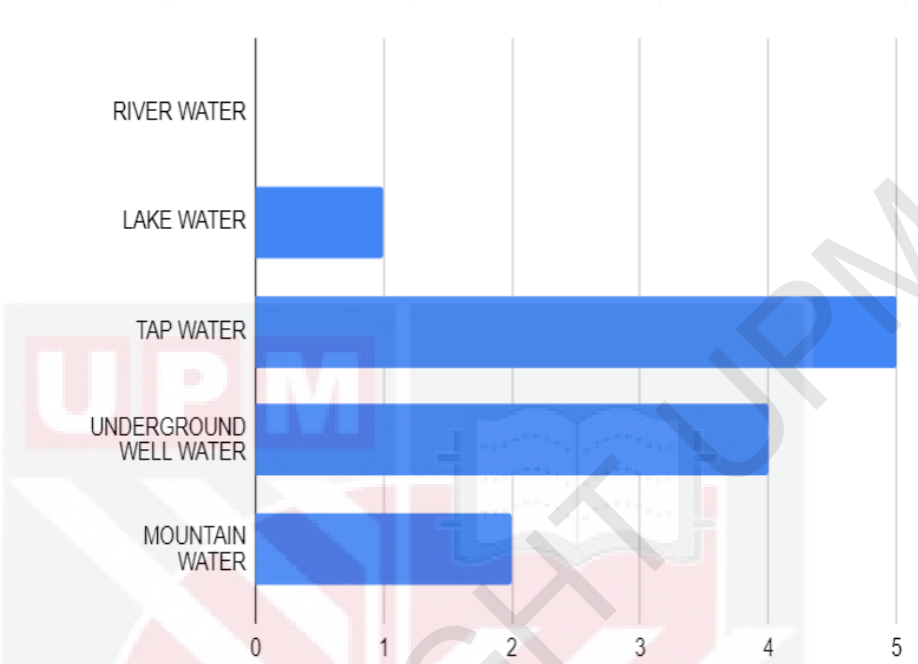

Figure 7. Distribution of water source farms use for livestock

As seen in Figure 7 above, only one farm used lake water as the source and this farm was located in an area that is not flood prone. No farms used river water as the source although there were two farms located near rivers these farms used tap water and underground well water respectively. It is these two farms that were affected by the floods in 2021. There are five farms that use tap water, four that use underground well water and two that use water from mountains. Consequently, there is some association to the location of farms in flood prone areas to being affected by the floods. The next question was where and how they market their products which received a mixture of responses. One farm used an online platform to market and publicize their products. Seven farms responded by stating selling direct to consumer was part of their methods for sales. Besides that, two farms sold to “middleman” as part of their sales strategy. One farm sold only to a dairy company that they have a joint venture with.

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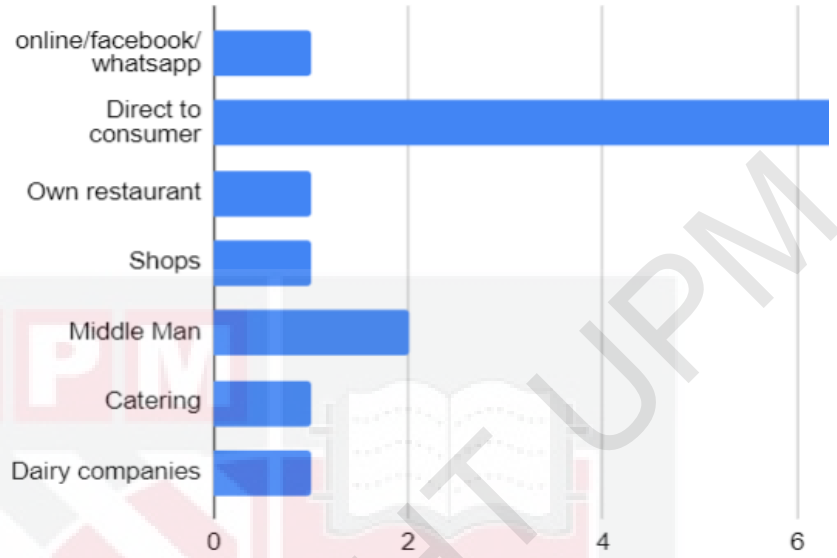

Figure 8. Distribution of method of sales

In Figure 8, from the 11 farms 7 farms have a mix of sales methods whereas 4 farms only have 1 method of sale which is online, direct to consumer, dairy company, middle man respectively. The farmers were also asked how long they were in the ruminant industry and whether it was their only source of income. 10 farms were in the industry for more than 8 years and from these only 5 farms have 1 to 3 other businesses besides ruminant production that provide income. 1 farmer was in ruminant production for 2-4 years and this farm also had 1 to 3 other businesses besides ruminant production. No farms had more than 4 businesses and no farmers were less than a year or 5 to 7 years in the ruminant production industry. The data that shows these 2 questions are in appendices 1.

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Table 1. Number of years in ruminant industry and number of businesses besides ruminant productions

Number of years in ruminant industry	Number of businesses besides ruminant productions	Number of farms
< 1year	0	0
	1-3	0
	4-6	0
	> 7	0
2-4 years	0	0
	1-3	1
	4-6	0
	> 7	0
5-7 years	0	0
	1-3	0
	4-6	0
	> 7	0
> 8 years	0	5
	1-3	5
	4-6	0
	> 7	0

The final question under demographics was how large the farms are, whereby the responses were three farms were more than 8 acres, five farms had an area of 2-4 acres, two farms had an area of <1 acre.

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4.2 Impacts of the COVID-19 pandemic

Q:1 Have you been affected by the COVID-19 pandemic?

Most of the respondents (excluding respondent 6) affirmed that they have been affected negatively by COVID-19 as reflected in the following statement.

"Yes, COVID-19 has affected my farming business in several ways" (Farmer 2)

"Sure, the pandemic made it difficult to do farming because of the lock down and restricted movement" (Farmer 4)

The responses to the aforementioned question revealed that farmers were affected by the pandemic in diverse ways, and the emerging themes were (1) specific challenges faced (2) severity of the challenges, and (3) measures taken

4.2.1 Specific Challenges faced by farmers

The most recurring problems mentioned by farmers were loss of revenue and obtaining hired labour. Meanwhile, problems related to obtaining transport facilities, veterinary care, and accessing feed and additives, replacement animals, and maintaining farm biosecurity were also reported. This theme is reflected in the following statement:

"My farming business was mainly affected because of loss of revenue and low profit due to the difficulty in getting new workers" (Farmer 1)

"We could not make good income due to low demand and problems with transporting milk to customers" (Farmer 4)

"COVID-19 made it difficult to hire new workers since the border was closed and most of our workers are from other countries" (Farmer 10).

The responses or findings from this specific question were similar to the findings by Rashidi et al., 2021 where majority of respondents in that research stated that their

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income has dropped from the ranges of > RM 1500 to RM 1000- RM 1500 and RM 0-RM 1000. The findings related to hiring labor, access to market, and feed in this research is in line with (Middendorf et al.,2021; Oladeji et al.,2021) where farmers indicated having no confidence that they would be able to hire workers due issues related to COVID-19 Farmers reported reduced access to inputs for livestock (e.g., water, labor, feed etc.) Impacts of COVID-19 Reduce access to market.

4.2.2 Severity of the challenges

Farmers also revealed the degree or severity of the challenges faced during the pandemic, which ranged from moderate to severe. The severity of the challenges was associated with hiring labor, loss of revenues, obtaining transport of products to market, and veterinary care. A typical example of the severity of loss of income is presented in the following response:

> *"I lost a lot of money and savings during COVID-19 due to several issues. Most transport facilities and foreign workers were not available. (Farmer 5).*

The findings are similar to a study by Oladeji et al., (2021) whereby COVID-19 restrictions and lockdowns negatively impacted access to markets for the sale of live birds and eggs. This resulted in fewer sales for over 2/3 of the poultry farmers.

4.2.3 Actions taken to resolve the challenges

The farmers used various measures to address the challenges faced during the pandemic, which were classified into (1) alternative methods of promoting farm business and product delivery (2) reduce production levels and resources.

4.2.3.1 Alternative methods of promoting farm business and product delivery

Farmers stated that they engaged in various methods of promoting their products via online sales and use of social media. Meanwhile, some farmers delivered their farm products directly to customers to address the issue of transportation. This emerging theme is presented in the following statements:

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“I switch to online sales on facebook, whatsapp groups and direct communication with customers” (Farmer 1)

“Since the onset of the pandemic, I have resorted to transporting my milk directly to customers and through restaurants. I don’t need to look for transport workers to sell my milk” (Farmer 5)

The action plan of the farmers in this research is similar to the findings by (Middendorf et al., 2021) whereby the action plan of farmers there was to sell their animals and downsize the farm to a manageable level and approach banks for funding.

4.2.3.2 Reducing production levels and allocated resources

Farmers adapted to the prevailing COVID-19 situation by reducing production levels, implying a reduction in the number of workers required. Production levels were reduced by focusing on specific feed, or by selling off some animals. Another measure taken were by growing own crops for feed and supplies, as well as fabricating their own equipment. The following responses exemplify the aforementioned theme.

“I had to reduce production levels and workers in order to sustain my farm” (Farmer 1)

“I now grow my crops for feed and supplies and make own equipment” (Farmer 2)

“What I did was to sell my cows, reduce workers, and grow my grass to reduce farm production to manageable levels” (Farmer 10)

“I focus on silage making, making sales through that while goats eat that silage, which is self-sustaining” (Farmer 6)

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4.3 Impacts of the floods

Question 1: Were you affected by the 2021 floods?

Only two farmers reported that they were affected by the 2021 floods that occurred in different areas in Selangor. Those reporting not being affected by the floods either resided or had their farms located in areas free from the disaster. Meanwhile, the two farmers that were affected by the floods conveyed the following message:

> *"Yes, my farm was affected by the flood and I am yet to recover from the loss" (Farmer 10)*

> *"The flood occurred very close to my farm and doing business was very difficult during that period" (Farmer 8)*

Since only two farmers were affected by the flood, only their responses were considered for the subsequent thematic analysis, which also yield three themes (1) physical and financial loss (2) emotional and Social Loss, and (3) actions taken

4.3.1 Physical and financial loss

One of the farmers highlighted several physical and environmental problems that emanated from the flood, which included loss of livestock, spread of livestock diseases, land loss, farm infrastructure, and financial instability. This theme is reflected in the following statement:

> *"I lost my animals and farm assets, farm equipment was destroyed, so I could not cope because all my savings were gone. In fact, my farmland was left in a bad shape after the flood" (Farmer 10)*

This is similar in the findings of a research by (Hazran et al., 2017) in Kelantan where majority of the farmers in that research had incurred a loss of more than RM 4000

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4.3.2 Emotional and social Impact

Apart from loss of farm assets, the other farmer posited being emotionally traumatized and attempted quitting livestock production. This can be gleaned from the following response:

> *"This is a natural disaster and out of our control. When I saw the condition of my farm, I wanted to stop farming and start something else. I was very down" (Farmer 8)*

This is similar to certain extent with the findings in (Hazran et al.,2017; Lattana et al., 2021; Irma et al.,2021) whereby the farmers stated that their emotion and psychology was deeply affected to a point where some turned to alternate revenue channels besides farming due to little support and motivation from the involved stakeholders

4.3.3 Actions taken to resolve the challenges

Both farmers employed distinct measures to address the challenges, and the emerging themes were (1) self-management (2) reduce production levels and resources.

4.3.3.1 Self-management

Farmer 8 engaged in self-management practices which both the farm owner and workers played critical roles in coping with the challenges. Specifically, this action entailed fixing the equipment, cleaning the farm, and taking care of their health and hygiene.

> *"I and my workers stayed at the farm for one month and cleaned the environment, and slowly get the machinery fixed one after the other" (Farmer 8)*

4.3.3.2 Reducing production levels and use of savings

Farmer 10 adapted to the situation by reducing production levels and used his savings to put the farm in order to resume normal operations. This action is reflected in the following statement;

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"By reducing the farm productions to manageable levels and using my saved money to repair the damaged farm equipment" (Farmer 10).

4.4 Future plans and strategies

Question 3: How can future similar events be prevented?

Farmers also recommended certain measures on how to prevent future similar events, which are broadly classified into (1) farmers' proactive measures (2) government intervention

4.4.1 Farmers' proactive measures

Farmers conveyed some proactive measures that could be taken to prevent the adverse effects of floods on their farm production and businesses. These actions include being self-sufficient in terms of production and building farms more strategically. The findings are highlighted in the following responses:

"I will recommend that farmers should build farmhouses more strategically, try to be more self-sufficient, so if supply lines are cut, one can still produce sales. (Farmer 2).

"Grow your own grass and feed and supplies, better to be self-sufficient". (Farmer3)

4.4.2 Government's intervention

In terms of the recommendations concerning the government, farmers suggested that government agencies should provide an early warning system and be more proactive rather than reactive. They also stated that the governments' role is to provide transportation, feeding, and labor resources, as well as ensuring efficient veterinary assistance. Examples of the related responses are as follows;

"Government should provide some sort of early warning system, compensation and subsidization until we are able to recover from the event" (Farmer 1).

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"Government should support in providing feed, transport for sale, hired labor" (Farmer 2)

"Allow for regular vet checkups or send the government vets" (Farmer 3).

The expectations of farmers in this research were similar to the findings and assistance given by the government whereby the sector that required the most assistance post pandemic and flood as the livestock sector (Lattana et al., 2021).

5.0 CONCLUSION AND RECOMMENDATION

To date, this is the first study to report the impact of Covid-19 and flood in Selangor among ruminant farmers in Selangor. In conclusion, the majority of the farmers in this preliminary study experienced substantial loss of revenue, trouble acquiring hired labour, receiving veterinary care, and acquiring feed for livestock. Thus, it can be concluded that there is negative impact on the ruminant farmers from the pandemic and the 2021 floods in Selangor. This study did have its limitations as well which includes a small number of respondents, some farmers were not responsive as well as not having good records of the degree of financial losses to the farm. Recommendations for future studies should include economics, labor, feed stuff and veterinary services. Participation and data from the Department of the Veterinary Services are crucial in ensuring better and larger sample size and information gathered. To secure the country's food security, stakeholders involved in this industry need to be well equipped in facing future catastrophic events.

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APPENDICES

Appendix 1. Summary of survey design and questions

Section name	Question No.	Question type	Possible responses
Farm demographics	Q 1.0	Where is your farm located	Open ended question
	Q 1.1	What type of livestock do you manage	Sheep Goat Dairy cattle Beef cattle Dairy buffalo Beef buffalo
	Q 1.2	Farm management systems	Intensive Semi-intensive extensive
	Q 1.3	What water source do you use	River Lake Tap water Underground well
	Q 1.4	Where do you market your products	Direct to consumer Dairy companies Meat processing facility Supermarket other
	Q 1.5	How long have you been in the ruminant industry	<1 year 2-4 years 5-7 years >8 years
	Q 1.6	How large is your farm	<1 acre 2-4 acre 5-7 acre >8 acre
	Q 1.7	Is ruminant farming your only source of income	Yes No

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	Q 1.8	How many non-ruminant sources of income do you have	0 1-3 4-6 >7
Impacts of COVID-19 on ruminant production	Q 2.0	Has COVID-19 impacted you?	Open ended question
	Q 2.1	Challenges faced during the pandemic	Obtaining hired labor Obtaining transport Receiving veterinary care Access to feed Obtaining replacement animals Maintaining biosecurity in farm Loss of revenue and sales Access to current information Access to communication
	Q 2.2	Severity of the challenges faced	For each challenge there is a Likert scale of 1 to 5, 1 being very severe and 5 being not affected
	Q 2.3	What did you do to overcome the challenges	Open ended question
	Q 2.4	How financially stable was your farm before the pandemic	Likert scale (1-5) 1 being very unstable and 5 being very stable
	Q 2.5	How financially stable was your farm after the pandemic	Likert scale (1-5) 1 being very unstable and 5 being very stable
	Q 2.6	Did you receive aid from the government	Yes No Maybe Don't know
	Q 2.7	If yes, what kind of aid did you receive	Open ended question
	Q 2.8	Did you receive aid from any NGO	Yes No Maybe Don't know

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	Q 2.9	If yes, what kind of aid did you receive	Open ended question
	Q 2.10	Were there any loss of life due to pandemic among workers and staff	Yes No Maybe Don't know
	Q 2.11	What type of diseases did you observe in your livestock before the pandemic	Respiratory disease GIT disease Dermatological disease Renal disease Reproductive diseases Musculoskeletal diseases Other
	Q 2.12	What type of diseases did you observe in your livestock after the pandemic	Respiratory disease GIT disease Dermatological disease Renal disease Reproductive diseases Musculoskeletal diseases Others
	Q 2.13	Has the usage of drugs for livestock increased in your farm during the pandemic	Yes No Maybe Don't know
	Q 2.14	If yes for the question above, what kind medicine have you used increasingly	Antibiotics Anti-inflammatory Antiparasitic analgesics/pain medication Hormone derivatives
Impacts of flooding on ruminant production in Ladang Angkat farms UVH UPM	Q 3.0	Has the floods impacted you?	Open ended questions
	Q 3.1	Has your farm experienced floods before	Yes No Maybe Don't know
	Q 3.2	Challenges faced during floods	Loss of livestock Disease spread among workers and staff Disease spread among

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			livestock Loss of land Farm infrastructure and asset damages Poor working condition Financial stability Social and emotional impact Loss of feed and storage Loss in sales revenue Accessibility to communication and electricity
	Q 3.3	Severity of the challenges faced	For each challenge there is a Likert scale of 1 to 5, 1 being very severe and 5 being not affected
	Q 3.4	What did you do to overcome the challenges	Open ended question
	Q 3.5	Did you receive any form of aid from the government	Yes No Maybe Do not know
	Q 3.6	If you answered yes, what kind of aid was given	Open ended question
	Q 3.7	Did you receive any form of aid from any NGO	Yes No Maybe Do not know
	Q 3.8	If you answered yes, what kind of aid was given	Open ended question
	Q 3.9	Were there any loss of life among workers and staff due to the floods	Yes No Maybe Do not know
	Q 3.10	What type of diseases did you observe in your livestock before the	Respiratory disease GIT disease Dermatological disease Renal disease

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		floods	Reproductive diseases Musculoskeletal diseases Other
	Q 3.11	What type of diseases did you observe in your livestock after the floods	Respiratory disease GIT disease Dermatological disease Renal disease Reproductive diseases Musculoskeletal diseases Other
	Q 3.12	Has the usage of drugs for livestock increased in your farm during the floods	Yes No Maybe Do not know
	Q 3.13	If yes for the question above, what kind medicine have you used increasingly	Antibiotics Anti-inflammatory Antiparasitic analgesics/pain medication Hormone derivatives
Expectations for the future	Q 4.0	What do you expect from the government for future events similar to these	pen ended question
	Q 4.1	What would your plans be in the future if events similar to these were to occur again	pen ended question
	Q 4.2	Would you be willing to be part of government mitigation efforts in the future	Yes No Maybe Do not know