RAMPVIEWER

A Collaborative Approach to Economic Palm Fruit Farming Fairness in the Global South

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Group 2

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June 2023

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Abstract

We build a platform designed to empower local farmers in the palm fruit oil industry by providing them with access to pricing information and predictive capabilities. By leveraging cloud services and web design, our platform enables farmers to make informed decisions and maximize their profits. It contributes to poverty reduction and economic growth by aligning with Sustainable Development Goals (SDGs) 1 and 3. Additionally, it benefits RAMP owners by offering insights into competitors' prices, supporting service workers with real-time updates, aiding researchers in their studies, and promoting responsible website management. Overall, the platform aims to make a positive impact on farmers' livelihoods, market efficiency, and sustainable agricultural practices.

1 Introduction

This document outlines the development of a platform aimed at addressing the price analytics of crude palm oil from Sarawak, with Macklin Ak Limpan as a resource person. The use case originated from the challenges faced by multiple stakeholders involved in the palm fruit oil industry. Farmers, who are the primary end users, face challenges in estimating the purchase price of their crude palm oil fruit at various collection points called RAMPs due to limited resources. The existing RAMPs only provide daily fluctuation prices at their own collection points, leaving farmers unsure about the best time to sell their produce. This uncertainty can significantly impact farmers’ profits. On the other hand, RAMP owners can also benefit from our product by accessing competitors' price information to adjust their pricing strategies and maintain competitiveness. Sections 2 and 4 delve into the specific challenges faced by stakeholders, while Section 3 highlights the societal contribution of our platform. In Section 5, we outline the anticipated challenges during the product design process.

Section 6 concludes our design requirements using the MoSCoW method, considering our needs and overcoming obstacles. In Section 7, we offer a comprehensive overview of our technological infrastructure, implementation, and the visual representation of our final product. Our infrastructure is designed to accommodate even low-end devices, ensuring accessibility for all users. With web technology's excellent compatibility across different devices, our website can be accessed by a wide range of users, regardless of their device specifications. In Section 8, we present the evaluation and design of our platform, delving into current impact, future goals, challenges encountered, and the potential for further development. This section provides a comprehensive assessment of our progress, highlighting the benefits, limitations, and opportunities for improvement within our project.

2 Stakeholder Analysis

The first, and perhaps most important, stakeholder we will discuss is the farmers who are our end users. Our goal is to assist local farmers in obtaining the best prices for their palm fruit oil, aligning with SDG 1 (No Poverty). By empowering farmers with access to pricing

information and predictive capabilities, we contribute to poverty reduction and enhance food security.

Given that most of the Regional Agricultural Marketing Points (RAMPs) are located far away, it would be highly beneficial for the farmers to be able to predict which RAMPs to visit in advance. By providing them with this information, we can offer valuable assistance, contributing to SDG 9 (Industry, Innovation, and Infrastructure). By leveraging technology and innovation, we enable farmers to optimize their sales strategies, save time, and get good valuable resources.

Another key stakeholder is the RAMP owners. Although our website is not specifically designed to aid them directly, they may derive benefits from accessing information about the prices offered by their competitors. This knowledge can enable RAMP owners to make necessary adjustments to their pricing strategies and stay competitive in the market, supporting SDG 8 (Decent Work and Economic Growth). By facilitating fair competition and market efficiency, we contribute to the growth and sustainability of the agricultural industry.

Furthermore, our fieldwork has revealed the existence of service workers who are responsible for transporting the farmers' fruit to the RAMPs. These service workers serve as intermediaries, relaying information about the agreed-upon prices to us. Their role is vital in helping us update the prices on the website accurately and in a timely manner. It is important to establish effective communication channels with the service workers, ensuring they have access to a tool/person that can allow them to provide real-time price updates easily. By supporting the service workers' access to technology and empowering their participation, we contribute to SDG 9 (Industry, Innovation, and Infrastructure) and SDG 10 (Reduced Inequalities).

Next, we have current or future researchers, particularly those associated with universities, who may require RAMP prices for predictive modelling or other related engineering tasks. By providing reliable and up-to-date price data, we can support researchers in conducting their studies and contributing to the overall advancement of the industry, aligning with SDG 17 (Partnerships for the Goals).

Lastly, one of the stakeholders would be the website owners. As of now, it is unclear who will be in charge of managing and maintaining the website. This potential stakeholder will play a critical role in ensuring the platform's smooth operation, security, and regular updates.

3 Societal Contribution

The societal contribution of our platform directly relates to several Sustainable Development Goals (SDGs) established by the United Nations, reflecting our commitment to addressing global challenges and promoting sustainable development.

SDG 1: No Poverty - By providing farmers with access to crucial pricing information and real-time price predictions, our platform empowers them to make informed decisions and

maximize their profits. This economic empowerment contributes to poverty reduction and improves the livelihoods of farmers, ultimately working towards the goal of eradicating poverty.

SDG 2: Zero Hunger - Our platform plays a role in ensuring food security by enabling farmers to optimize their sales strategies and make better use of their resources. By maximizing their profits, farmers have the means to invest in their agricultural practices, improve productivity, and contribute to a sustainable and sufficient food supply.

SDG 8: Decent Work and Economic Growth - By facilitating access to reliable pricing information and predictive capabilities, our platform supports the economic growth of farmers. They can negotiate better deals and optimize their time and resources, leading to increased productivity, improved livelihoods, and the creation of decent work opportunities in the agricultural sector.

SDG 9: Industry, Innovation, and Infrastructure - Our platform hopes to progress the initial goal of using advanced algorithms and machine learning by having a place to gather data for future accurate price predictions in real time. The use of technology and innovation enables us to contribute to the development of sustainable agricultural practices, enhancing market efficiency, and fostering infrastructure advancements in the agricultural sector.

SDG 17: Partnerships for the Goals - Collaboration between academia, industry, and government is integral to the success of our platform. By fostering partnerships and knowledge-sharing, we contribute to evidence-based policymaking, market analysis, and the development of strategies that drive agricultural growth, ensure food security, and promote sustainable development.

By empowering farmers, supporting sustainable agricultural practices, and fostering collaboration, we aim to make a positive impact on poverty reduction, food security, economic growth, innovation, and the overall well-being of communities.

4 Use Case Scenario Script

Farmer's Pricing Optimization:
Scenario: John is a small-scale palm oil farmer in Sarawak. He wants to maximise his profits by selling his palm fruit oil at the best possible price. He utilizes the platform to access real-time pricing information and predictive capabilities. By analyzing the data provided by the platform, John can leverage our design to determine a better day and RAMP to sell his palm fruit oil, ensuring he gets the highest possible price for his produce.

RAMP Owner's Market Analysis:
Scenario: Sarah owns a RAMP in Sarawak and wants to stay competitive in the market. She uses the platform to access information about competitors' prices. By comparing the pricing trends and fluctuations in the market, Sarah can make informed decisions about adjusting her pricing strategy. This allows her to offer competitive prices to farmers, attracting more business to her RAMP and supporting SDG 8 (Decent Work and Economic Growth).

Service Worker's Real-Time Updates:
Scenario: Ahmad is a service worker responsible for transporting palm fruit from farmers to the RAMPs. He uses the platform to provide real-time updates on the agreed-upon prices to ensure accurate information is available for farmers. By having easy access to a tool or person that allows him to update prices in real-time, Ahmad helps maintain transparency and efficiency in the pricing system, contributing to SDG 9 (Industry, Innovation, and Infrastructure) and SDG 10 (Reduced Inequalities).

Researcher's Predictive Modeling:
Scenario: Emma is a researcher at a local university studying the palm oil industry. She requires reliable and up-to-date price data for her predictive modelling tasks. Emma utilizes the platform to access historical and real-time price information, allowing her to analyze market trends, forecast future prices, and contribute to the overall advancement of the industry. The availability of accurate data supports evidence-based research and aligns with SDG 17 (Partnerships for the Goals).

Website Owner's Maintenance and Updates:
Scenario: The website owner, Alex, is responsible for managing and maintaining the platform. Alex ensures the website operates smoothly, adheres to sustainable practices, and maintains security measures. Regular updates are made to provide the latest features and data for the stakeholders. By incorporating responsible practices in website management, such as energy-efficient infrastructure and responsible data handling, Alex contributes to overall sustainability goals.

5 Feasibility and Sustainability

The immediate obstacles that had to be overcome are classifiable into three groups: availability of information, project scope, and usability. Lastly, the reasoning behind the direction of the product is given.

5.1 Information Availability

To perform any kind of analysis on the potential pricing of crude palm oil fruit requires data. This data from local RAMPs is not available and might deviate severely from the online data regarding the worldwide trading of refined crude palm oil. The usage of global data might introduce inconsistencies with the local prices and possibly have negative outcomes for the farmers producing the fruits. More specifically, the local prices of the fruit bunch are not reflected in the global data for crude palm oil since it is refined crude palm oil. Additionally, if a RAMP has no nearby competitors, it influences the buying price of fruits. Lastly, global markets often move slower and are unaffected by local price fluctuations.

5.2 Project Scope

The project scope as disclosed by the use case brief mentions predicting the future pricing of palm fruits using artificial intelligence (AI). However, the project is severely constrained by time. It has to be researched, developed, and finalised within four weeks. This constrains the potential approaches and technical features that can be tested and implemented. Both the aforementioned information availability problem and the lack of time immediately void the idea of AI. This decision does not take into consideration if using AI would be a functionally viable option.

5.3 Usability

The operability of technology in the global south is vastly different from the Western world. Technological knowledge, experience, and resources are limited. This restricts the development of the product and enforces the delivery of a minimalistic but functional product that can overcome these differences. Achieving the development of such a product is difficult and will require multiple iterations and discussions with local farmers and the resource agent. Additionally, creating a usable technological product is bound by its visual representation and ease of use. This visualisation of the product for users is restricted to the habitual tendencies of different cultures. A “hamburger” dropdown menu or a settings page using a cog might be ingrained in the Western culture but these icons are often brought up from years of experience. The visualisation of the product must align with the (lack of) experience of the expected users. A perfect example of habitual tendencies is the addition of the dashed lines for lack of data and the bright red flashing “NEW” to reflect updated data.

5.4 Economical Aspect

The economical aspect of the product is limited to providing farmers and service workers with free information about the prices of the refineries. There are no intentions of monetising the product. The product is optimised to conform to lightweight running requirements such as very limited hosting costs (only after a specific amount of traffic) and no domain costs. Any additions to the RAMPs available can be made using a specific pin code. To maintain the platform, all that is required is to keep the RAMPs that are available up to date.

In contrast to the low costs, the platform provides the local farmers and service workers with the potential to increase revenue through minimal and reduced effort. This is based on the price difference per RAMP varying significantly.

5.5 Project Realisation

The overall feasibility of such a project is severely limited by the factors mentioned above. However, to produce a functional product by the end of the four weeks the following decisions were taken:

- Minimise the product scope.
- Minimise the product load (user interface, connections, etc.).
- Incremental deliveries. Product scope is only allowed to increase *after* the meeting with the resource person.
- Opt for “good enough” over perfection.
- Decisions by the resource person are final (e.g. changes to UI).

These decisions prevent personal ‘Western’ bias in the product and optimise our agile approach to present a deliverable every week and ensure *a functional state* by the end of the project even if not all features were developed. With these decisions in mind and the extensive interview conducted, the resolution was to build a lightweight web platform that could allow for immediate data collection and perform minor price predictions based on the limited availability of data.

The schedule of the product development is as followed:

- Week 1: Web platform operational including a database.
- Week 2: Introduce a minimal viable product that is operable through a user interface.
- Week 3: Introduce price predictions and optimise the user interface.
- Week 4: Finalise product, add pincode security and potential admin functionality.

6 MoSCoW Requirements

MoSCoW requirements is a prioritisation technique that categorises features into 4 categories:

1. Must have: for all critical features to have a deliverable product.
2. Should have: features that are important if time warrants it.
3. Could have: been desirable but not necessary.
4. Won’t have: features that have been agreed upon that will not be appropriate to develop for the current deliverable.

We also introduce non-functional requirements that are relevant to the usability of our product.

Must have

- Display the price for each grade of fruit bunch bought by the RAMPs.
- Show the price(s) of different RAMPs (Index): Display price of FFB (buyer / user)
- Homepage shows all RAMPs and their prices and highlights the current known best price(s) at the bottom of the website.
- Each RAMP has a page with more detailed information about the historical price.
    - History of prices (graph)
    - Weekly average
    - Price ranking (per grade)
- The user can submit prices per grade per RAMP using a pin code.

Should have

- Home page has x day high prices (best price from last x days).

Could have

- Map view of where the RAMPs are located.
- Highlight RAMPs with historically highest prices.
- Static analysis of the dataset to predict future price changes.
- A public visitor count on the home page.
- RAMPs can upload prices (with the indication that these prices are from the market, not the consumer).
- User Authentication.
- RAMP Authentication.

Won’t have

- Artificial Intelligence predicting price points.

Non-functional

- Usable on slow internet connection (network load of website < 100kb).
- Usable on low-end devices (backwards compatibility).

7 Product Design

To explain our product in detail, we are going to start with an overview of how the parts of our project communicate with each other and how they are set up in the first part, “Technological Infrastructure”. The second part goes over the implementation of the various services and the tools we used to assist us in building our software and infrastructure. Finally, we show the user interface of our product and explain in detail what each screen tells the user.

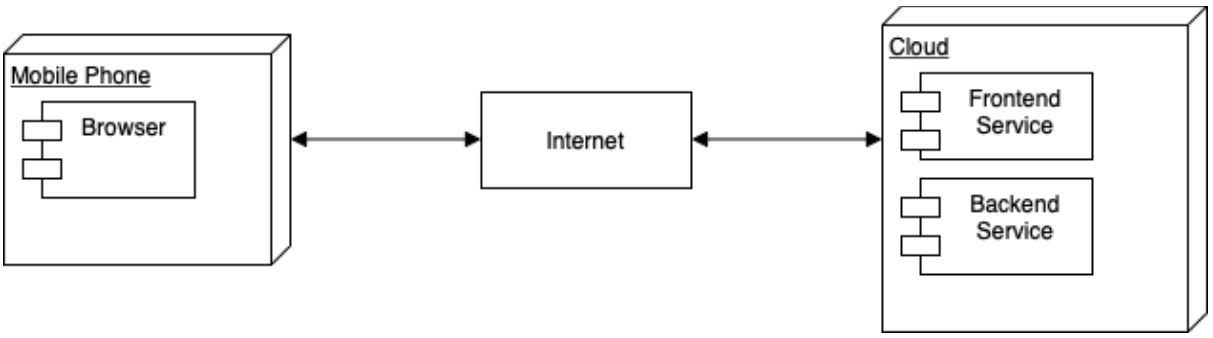

Figure 1: Technological Infrastructure

7.1 Technological Infrastructure

The infrastructure in this project consists of the end-user's mobile phone and the cloud. End-users use the browser on their phone to access our website through the internet. The browser is widely used even on low-end devices and web technology has good compatibility with different devices, this allows all users to access our website. This project adopted a serverless approach for better maintainability, we have two services that are deployed on the Cloud, one is a frontend service that returns website on user query to be rendered on user’s browser as user interface, another is a backend service which functions as an API for the data in the database. Static file serving and API endpoints are all included in the backend service. All services are deployed in Google Cloud’s Singapore location, which is physically close to the end-user in Malaysia, to reduce transmission delay and provide a better user experience.

7.2 Implementation

As seen in the infrastructure diagram, our application has two parts: the front end and the back end. The front end gets the relevant data from the back end and renders the user interface, which displays the data in a user-friendly way and allows them to submit new data through a special page. The back end services requests from the front end through the use of an API, which validates all requests so the system cannot be put into an invalid state or be

exploited. The back end also does any operations that must be done by a trusted party like database reads and writes.

We use Google Cloud Platform as our cloud provider, as they have many technologies available for both the front end and the back end. Google Cloud Platform offers a suite of tools specifically for making apps and web apps called Firebase, wherever possible we are using Firebase technology because of its streamlined process.

8.2.1 Front end

The front end is served by Firebase Hosting, which is a product that hosts static sites. This means that all content is generated at compile time allowing for the insanely fast and lightweight delivery of files because there is no back end involved in showing the (empty) user interface. Firebase hosting distributes the files globally and uses the servers closest to the user to reduce latency. Reducing the amount of data transferred to the user's device to load your website is critical for low bandwidth and high latency scenarios as the entire content of the website fits into fewer round-trips to the server as TCP starts with a tiny window size and scales its window size each time it receives a successful acknowledgement, making the first few round-trips contain significantly fewer data than subsequent round-trips. Decreasing the amount of round-trips means less waiting for high latency connections to return the signals which means the website loads faster. The way we are building the user interface is with preact, which is a lightweight alternative to react, one of the most popular user interface-building tools on the web. Preact makes some different choices in their implementation resulting in 4 KB of JavaScript when minified and gzipped compared to 32 KB for react.

Another factor contributing to faster loading times is pre-rendering of the home page instead of using javascript to render the page which is what we use for pages other than the home page, which means the home page content can be viewed by the user before the JavaScript is loaded. JavaScript handles the interactivity on the page and navigation to other pages. But it needs to be loaded, parsed, and executed which all take significant time.

A site that can be viewed quickly on low connectivity is a great way to keep the website accessible and users engaged. If the website is unresponsive to user inputs the engagement and accessibility dwindles. A cause of this is JavaScript being relatively slow to initiate. This is where the smaller size of preact really matters, as fewer KBs of JavaScript means less downloading, less parsing, less execution, and a broader audience.

Another technique used to reduce the amount of data needed to render a page is code-splitting for routes, which involves creating one main JavaScript and CSS bundle and one for each route in the web app, this ensures only the data needed for a particular route is loaded when this route is accessed by loading the main bundles once and loading the parts required for the route that is being accessed. When another page is loaded the main bundles are already loaded and only the JavaScript and CSS bundles that are needed for this new page are loaded resulting in fast loading times for both the home page and any subsequent pages.

Overall, all these approaches ensure that the website will be accessible to any user with a slow internet connection. More importantly, it is very responsive and respects the patience of

the user. A study from Google showed that “53% of visits are likely to be abandoned if pages take longer than 3 seconds to load”[1]

In the case of the global south where frustration around slow and malfunctioning technology can arise quickly, we deem these adjustments to be successful in passing the first main hurdle, accessing the website.

8.2.1 Back end

As previously mentioned, we are using Google Cloud Platform for our cloud. Google Cloud has many different available locations. It is necessary to choose one location to minimise cost. We ended up settling for the *asia-southeast1* (Singapore) region as we tested the latency to all Google Cloud datacenters and *asia-southeast1* had the lowest latency to Malaysia, where our users are located. We used Cloud Functions for Firebase as our framework of choice, which integrates tightly into the Firebase ecosystem by allowing easy access to other services with automatic authentication. Despite this tight integration, it is built upon express.js, which is a ubiquitous Node.js web server with tens of millions of weekly downloads and fantastic community support. This allows us to keep a low cost by potentially switching service providers. Furthermore, the immense community support is crucial for any other stakeholder or interested party to continue and maintain the current back end.

Our database is powered by Cloud Firestore, a document-based database by Google Cloud and Firebase. Its straightforward integration with Cloud Functions for Firebase would allow for future feature expansion such as real-time updates to clients. However, to keep the JavaScript bundle size low, these options are currently not explored.

7.3 Visualisation

The main objective of the use case is to display the prices of the three RAMPs that are located far away from each other. By having this platform, the service person can update the prices every day, and the latest prices will be displayed to the local farmers. They can use the platform to decide which RAMP to sell their fruits to.

[1] https://blog.google/products/ads-commerce/the-need-for-mobile-speed/

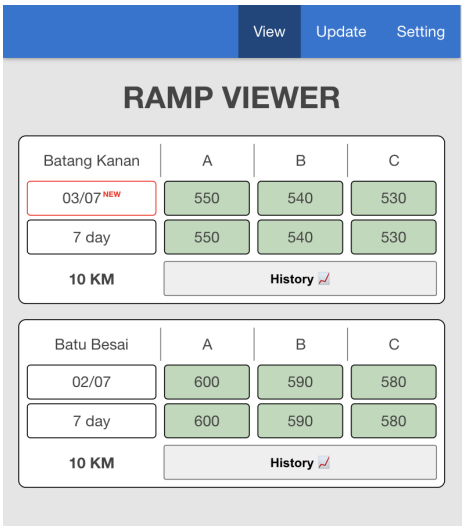

Figure 2: RAMP view Page

Our proposed user interface of the page consists of three RAMPs with three different prices, Grades A, B and C. On top of the page is the visitors' count, which will display weekly unique users that visited the website. Macklin suggested this counter be added to the platform to determine whether the website is being used by the stockholder or not. The date on the top left of the screen is the current date when the price was updated last.

In each of the sections, the names of the RAMPs, the price of each grade and the average price of the last 7 days are displayed. If the price of the day is higher than yesterday's price, the price box will turn green and vice versa, it will turn red. This will ease the visitor to view the best price of the fruit bunch. The distance between the local farmer and the loading RAMPs is shown in the bottomleft of the sections so that they can decide on which RAMPs they are able to deliver the fruit bunch. The word 'New' will blink red if the price has been updated and will continue blinking for 12 hours. Macklin also suggested this feature to draw the attention of the visitors, informing them that there are the latest changes and to avoid them missing them.

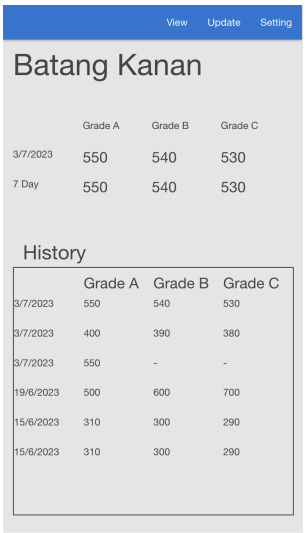

Figure 3: Detail Page

There is also a history button at the bottom of the section, this will redirect the user to the detail page shown in Figure 3. This will enable the visitors to keep track of the prices in the last seven days. The platform uses light colour schemes, contrasting, and neutral colours to show simplicity and help to emphasise the information displayed in the platform, which is the current prices of the fruit bunch.

8 Evaluation and Discussion

While our product has achieved significant milestones in addressing the challenges faced by farmers and delivering a user-centric design, there are areas where we faced limitations and could be further improved in the future. One such limitation was the absence of artificial intelligence (AI) capabilities to predict price points, which was categorized as a "Won't have" feature. Although AI could have provided valuable insights, time constraints and data availability hindered its implementation within the project scope.

Despite these limitations, the current version of our product has proven to be highly helpful to farmers by providing real-time pricing information and historical data for informed decision-making. It has positively impacted poverty reduction, food security, and sustainable agricultural practices, aligning with SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), SDG 10 (Reduced Inequalities), and SDG 17 (Partnerships for the Goals).

Looking ahead, with more time and resources, we envision further enhancements and expansions to our product. By incorporating AI capabilities, we could offer predictive models for future price changes, empowering farmers with even more accurate insights. Additionally, implementing user authentication and RAMP authentication would enhance security and ensure reliable data submission.

Furthermore, we are committed to enhancing the usability of our product on slow internet connections and low-end devices. Given more time, we would prioritize optimizing the platform to be lightweight and compatible with limited network resources. This would ensure seamless access and smooth functionality, particularly for users in regions where internet connectivity is a challenge.

In addition to improving usability, we foresee long-term sustainability by encouraging local adoption and data gathering. As the locals continue to utilize our product, we can accumulate valuable data that can serve as the foundation for developing a robust machine learning model. This data-driven approach would not only enhance the accuracy of our price predictions but also attract potential stakeholders, such as researchers, who can leverage the data for conducting in-depth studies on the palm oil industry.

In conclusion, while we have made significant progress in delivering a socially impactful and user-centric product, there is room for future growth and improvement. By addressing the limitations, incorporating AI capabilities, and optimizing usability, we can continue to

empower farmers, foster sustainable agricultural practices, and contribute to the United Nations' Sustainable Development Goals.

9 Acknowledgements

We would like to specifically thank Macklin Ak Limpan for functioning as our resource person. His quick communication and information have been crucial for the project. Furthermore, we would like to express extra appreciation towards Kaisan Kassim. Besides being a great project member and teammate, he functioned as an extra resource person smoothing out our communication with Macklin and setting up all the interviews.

Appendix

Interviews

During the course of the project, several interviews have been conducted and are summarised in section 6.2. The specific reasoning behind questions is outlined in the following section.

Questions and Reasoning

For the initial interview and after the use case presentation several questions were left unanswered. An overview of our most important questions that defined the approach, solution, and development of the product are listed below.

- Do you have records of local prices?
  - What is the frequency of the price data updates?

  - Are there any other ways of knowing the price besides going to the RAMP?
  - How does the price of palm fruit depend on seasons and/or events?
  - How large are the fluctuations between price updates?

This question aims to understand if we have access to historic price data. Sub-questions include investigating alternative methods of obtaining price information and exploring factors related to pricing.

- How does selling at a slightly higher price influence local living? How many tonnes do they usually sell?

The objective of this question is to understand the impact and advantages of our product on the local community. We aim to uncover how our product helps farmers achieve higher prices for their fruit.

- How frequent are the locations of RAMPs around towns?

The purpose of this question is to gather information on the accessibility of Rural Agricultural Marketplace (RAMP) locations in different towns. We seek to understand the convenience and availability of these marketplaces for farmers.

- Can you elaborate which digital technologies you and other farmers have access to?
  - What kind of phone do the farmers use? (What Operating System? What year did they come out?)

  - What kinds of browsers are commonly used by the farmers? (Chrome, Samsung Internet)
  - What is the bandwidth and latency of mobile data?

– What is a typical mobile data cap?

This question aims to thoroughly investigate the digital tools and technologies accessible to farmers, allowing us to design our product more effectively. We specifically inquire about the type of phone utilized, commonly used browsers, and factors such as mobile data bandwidth and latency.

- How experienced are farmers using digital technologies?

This question plays a crucial role in shaping our product design by evaluating the farmers' familiarity and proficiency with digital technologies. By understanding their level of expertise, we can determine the optimal user interface for our web design.

- How does the crude palm oil fruit lose its weight? How does it affect the FFB price?

This question examines the connection between weight loss in palm fruit and its effect on the pricing of Fresh Fruit Bunches (FFB). Our objective is to analyze the potential impact on farmers' income when they choose to harvest the fruit earlier, taking into account the possibility of weight loss during the waiting process to achieve optimized selling prices.

Summary of Interviews

9th of June

The goal of this meeting was a general overview and to answer several key questions to begin development on the product. Here is a summary of the responses obtained:
Local Price Records: The farmers do not maintain records of local prices. Currently, we only have limited historical price data presented in slides. However, they do have access to the most up-to-date prices available.
Frequency of Price Data Updates: The frequency of price data updates varies depending on the RAMP, but most often, it is done daily. Besides, each region has a reference price.

Alternative Ways of Knowing Prices: Besides visiting the RAMP, we can use a reference formula to determine the price.

Price Dependence on Seasons and Events: The price of palm fruit is highly influenced by the seasons. Farmers expressed the need for trend lines to properly visualize and display the price variations for different seasons and events.

Fluctuations Between Price Updates: The magnitude of price fluctuations depends on the grade of the fruit. In 2022/2021, one of the RAMPs used to provide the highest prices, with differences of up to 200 units compared to other RAMPs. Price differences can be significant, especially between weeks.

Shelf Life of Fruits: Palm fruits typically last a maximum of 3 days for a 5-acre area with 300 plants. However, they can be stored for up to 2 weeks before harvesting. Farmers prefer to sell the fruits immediately to avoid spoilage.

Frequency of RAMP Locations: For the resource agent, there are three RAMP locations available.

Access to Digital Technologies: In the Pantu area, there is network coverage, and local cafes have internet connections that farmers can utilize. Most small-scale farmers have smartphones, but some still use older Nokia phones for basic communication. Storage capacity on smartphones is often limited. Some farmers use "vivo" smartphones, and they can use Google Chrome. Mobile reception is generally limited, although most RAMP locations have coverage.

These insights from the interviews provide valuable information for further analysis and design considerations regarding the product's pricing features, data presentation, and digital technology accessibility for farmers in the local context.

19th of June

The main goal of this meeting was to receive feedback on the minimum viable product (MVP).

- MVP was approved by Macklin.
- The pincode is a good idea.
- The predictions based on weekly averages are a good idea.
- The layout could use some work.
- A distance metric to RAMPs would be nice.
- A new stakeholder was discovered: Service Workers.

Furthermore, Macklin mentioned that there is another stakeholder to consider: “Service workers”. Service workers operate as a delivery service for farmers that bring the harvest to the local RAMPs and these people are aware of the current prices. They are the most eligible people to make use of the platform by submitting data. Macklin will contact a person he knows and ask if he would be willing to submit these prices.

23rd of June

The main goal of this meeting was to receive feedback on the newly designed UI mockup.

- The design was a good improvement by Macklin.
- “Now” was changed to “Today”.
- The date timestamp was added.
- Alphabetical order of RAMPs.
- Flashing indicators for updated prices like lottery websites to catch attention.
- Graph requires a 7d, 1m, 6m, and 1y view.

26th of June

Meeting postponed to the 29th of June. Communication with Macklin through WhatsApp.

29th of June

The team discussed the final changes to the graphical interface and the prioritisation. The current implementation was approved. Target was set to have the RAMP adding and removing ready for the next meeting.

2nd of July

Showcases back end functionality for the pin code and RAMP adding and removing. Visualisation needs to be made for the next meeting and hopefully approved. The final stages of the project were discussed including the MoSCoW requirements and readjusted (able to submit only one price instead of three) where needed. The main goal of the last day would be to add a user interface for both RAMPs adding and adding prices of any date.

3rd of July

Final comments on the user interface on the changes for the submitting prices and adding/removing of RAMPs. The feedback from Macklin was that it is good. Character counts for RAMP names was discussed. Including the allowed space and dynamic resizing of the tables within the interface for numbers greater than 999. The last thing that needs to be done is adding the graph and the “NEW” icon flashing whenever a day is updated. The visitor count idea was removed and settled on Google Analytics which would provide Macklin with data and far more detailed analytics. Further communication was agreed to be through WhatsApp for the day.