

MajuNet

ICT4D Project: Information Management System for Repackaging Business

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1 INTRODUCTION

Ongoing innovations in the field of computer science and Information Communication Technology (ICT) has rapidly grown into a critical component for societal and economic progress. ICT for Development (ICT4D) is a multidisciplinary research domain that integrates different fields of study areas: computer science, information systems and development studies [1]. The main purpose of ICT4D is to improve a certain societal context by developing ICT solutions that are sustainable. A key aspect is the multidisciplinary approach of the ICT4D domain, due to the fact that technology has to be designed in a way that it is able to operate in complex social, political, economic and cultural context [2]. In order to fight poverty, improve healthcare, provide better education and nurture gender equality in developing countries, ICT is considered as an important tool to achieve sustainable development goals (SDG) as introduced by the United Nations [3]. ICT4D is especially focusing on SDG 9c, 'Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020' [4]. In this regard, the VU Amsterdam and University Malaysia of Sarawak (UNIMAS) initiated a one-month program, ICT4D in the field, to improve rural areas in Sarawak. Several use cases were investigated by multiple interdisciplinary teams of VU Amsterdam and UNIMAS students to tackle real life challenges. Local Kampung, Pinggan Jaya and Muhibbah, were visited for field research, and to gain local insights in their nowadays challenges. By engaging the community we obtained interesting information that was used to formulate use cases. These cases were transformed into practical ICT solutions in order to stimulate local development. This paper discusses the process and deliverables of the MajuNet use case, in which a management information system was built to stimulate economic development in local Sarawakian villages.

2 NAME

The name of the web-application is "MajuNet". The Malay word "Maju" stands for 'progress' and 'move forward' [5]. This word was chosen since the system intends to stimulate economic development among women in Kampung Pinggan Jaya and Kampung Muhibbah, both are small villages located near Kuching, Sarawak. The English

word "Net" was used as an abbreviation for network and is used due to the web-application's connective purpose between the involved stakeholders.

3 SUMMARY OF KEY IDEA

The main purpose of the system is supporting the Women's Institute (WI) in repackaging local products from Sarawak. The WI is the central stakeholder that employs women from Kampung Pinggan Jaya and Kampung Muhibbah. They will repack and rebrand the local product popiah simpul, that will be exported by a third party, AlphaBees, to Singapore. The system supports the WI in scheduling women and keep track of the financials from requested orders.

In the future, it is intended to expand the system with advanced dashboard functionalities that allows for data analysis. Moreover, interactive functionalities that allows for communication between all involved parties through the web-application is part of the extension.

4 ACTORS AND GOALS

The actors involved in the use case of MajuNet are the Women's Institute, AlphaBees, the producer, a UNIMAS project team and the government.

4.1 Sarawak Federation of Women's Institute

Sarawak Federation of Women's Institute is an NGO that was founded in 1962 and is currently one of the biggest women's organization in Sarawak [6]. One of the objectives of the Women's Institute is to provide women, aged older than 15 years old, the opportunity to connect and work together through various projects. WI supports women regardless of religion, political beliefs or ethnicity. These projects are intended to benefit the women, the communities and the country as a whole. They also motivate women, specifically those in the rural areas, to effectively participate in the development of the community [7]. Through the movement of the WI, unity, understanding and friendship has been developed among all races in Sarawak. These women share the same desire to elevate the status of women in Sarawak [8]. The WI was managed in the beginning by Ms. Elizabeth O'Kelly, who administered WI under the Department of Agriculture [8] in Serian, under the name

of Sarawak Women's Association (PPWS). When Ms. Elizabeth O'Kelly received funding from the Asia Foundation through the Technical Co-operation Department of Britain, the PPWS movement developed in Kuching. In 1965, Ms. Elizabeth O'Kelly's handed the PPWS over to a Local Administrator Secretary, Mrs. Rugayah Majid. At that time, the PPWS was set up to help women to improve and elevate their living standards, especially women in rural communities. One of the initiatives of PPWS in the 60's was to help women in rural areas to get water supply from villages. This was done by helping them with money and technical assistance from the department of Medicine and Health of the Government and the World Village Women's Association. Besides water supply projects. With the use of media, such as newsletters the PPWS was introduced to people outside the city and the name changed into Women's Institute.)



Figure 1: PPWS projects in the 60's

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The goal of WI in the MajuNet case is to encourage women in becoming active on the labour market. Currently, many women in Kampung Pinggan Jaya and Kampung Muhhibah keep a role of housewife. As they have time and skills that can be used in a productive manner, WI is keen on using their skills in the repackaging business. Furthermore, WI's incentive is to stimulate the broader

economic development of the Kampung through these women. Figure 10 in Appendix C provides a more detailed overview of the role of WI in the repackaging process.

4.2 AlphaBees Asia

AlphaBees is an organization that specializes in importing, exporting and distributing local products from various countries, among which Sarawak, to Singapore. AlphaBees mission is to bridge the gap between people living abroad and the products they desire from their hometowns [9]. The goal of AlphaBees is to use their supply chain to export the repackaged product to Singapore. As containers are not always entirely full when they are shipped, AlphaBees wants to supplement the leftover space with the repackaged product. Given the constraint of the space in the container, AlphaBees is the initiator of the MajuNet supply chain. Figure 10 in Appendix C provides a more detailed overview of the role of AlphaBees in the repackaging process.

4.3 Producer (Awang)

The products will be provided by local Sarawakian organization(s). Due to the novelty of this project, no contracts have been written and deals are still to be made. It is intended to repackage popiah simpul, a local delicacy, that is produced by an organization named Awang. Awang has exported to Singapore in the past. They are able to meet the strict food regulations of the Singaporean government.

The goal of Awang is to sell high quality products to the WI. It is intended that WI will become a valued customer of Awang that provides a steady flow of revenue. It will also increase the visibility of the local Sarawakian product.

4.4 UNIMAS project team

A UNIMAS project team is involved as the initiator of the business plan. They are involved in several projects to improve rural areas near Kuching. Their interdisciplinary team enables them to extract and use knowledge from different fields. Furthermore, they have a vast local network that can be used to attract involvement of new stakeholders.

The goal of the UNIMAS team is to create a sustainable local business that is run by both Kampung in order to stimulate economic development. By using local people, products and facilities, they ensure involvement from all parties and create an incentive to keep the business sustainable.

4.5 Government

The government is initiating 8-month projects to stimulate economic development in the rural areas of Sarawak. As start-up costs must be made, the government was approached for initial funding.

The goal of the government is to set a list of development goals for both Kampung that are the direct result of the repackaging business. This allows the government to monitor the development in this area. Furthermore, that data can be used for development projects in other Kampung of this district.

4.6 Conceptualisation

4.6.1 Repackaging flowchart.

The process of the repackaging, see Figure 8 in Appendix A, goes as follows:

- (1) AlphaBees places order for a product at the Women's Institute
- (2) The Women's Institute receives the order from AlphaBees
- (3) The Women's Institute places order at the producer of the product
- (4) The producer receives order and gets paid by the Women's Institute
- (5) The producer produces the product and the Women's Institute prepares the raw packaging materials
- (6) The producer sends the product to the Green House, see Figure 2 and the Women's Institute recruits labour that is needed for the repackaging process
- (7) The Women's Institute receives the product from the producer at the Green House
- (8) The Women's Institute starts the repackaging with the women from the Kampung
- (9) The Women's Institute finishes the final product and informs AlphaBees to collect the final product
- (10) AlphaBees collects the final product and pays the Women's Institute
- (11) The Women's Institute pays the women of the Kampung for their working hours



Figure 2: Green House, location of repackaging

4.6.2 Dynamic Model.

The dynamic model is proposed to show relevant relationships between concepts that influence the repackaging process. The process

Table 1: Relevant Concepts

Producer	Packaging Material
Women's Institute	Packaging Producer
AlphaBees	Green House
Product	Labour
Repackaged Product	Buyer for Export

of repackaging is one that unravels over time and can be divided into four fundamental parts. At first an order request is placed by AlphaBees at WI, which then sends the request to the producer. After the producer accepts the request and delivers the product, the WI handles the repackaging of the products. These repackaged products will then be handled by AlphaBees, who exports them to Singapore. In Table 1 the relevant concepts, in this case actors and goals, are described in Section 4. In order to study the process of repackaging, a model has been made that can be seen in figure 3. This Dynamic Model represents the steps that are described in Section 4.6.1.

5 CONTEXT ANALYSIS

The main purpose of the web application is to provide assistance for all stakeholders. For the Women's Institute an easy to use interface where they can forward a request from AlphaBees to the producer. Furthermore, to easily see how many working hours is needed for a product batch to be repackaged and to schedule employees. For AlphaBees the interface would help them to have an easier and more structured interaction with WI. AlphaBees can also have better insights in the repackaging process. The interface that is built now for the WI is done in Malay Bahasa, since this will be easier to read by the women who work at the WI. In this matter, language barriers will kept at a minimum. According to a hand phone users survey ¹ from 2017, the smartphone penetration was at 75.9% in 2017.

5.1 Kampung profile & interviews

5.1.1 Kampung Pinggan Jaya.

Kampung Pinggan Jaya (KPJ), located 40km from the city of Kuching is known for agriculture industry, and more specifically Gula Apong. Gula Apong is palm sugar, a sweet substance that is processed from the juice of the nipah palm. The nipah palm grows naturally and abundantly along the coastal areas throughout Sarawak [10]. KPJ is home to 467 villagers. A recent government project improved the Kampung's accessibility by building a road. This drastically improved the connectivity and visibility of the Kampung. As a result, the demand for Gula Apong increased drastically. Additionally, villagers have easier access to job opportunities outside of the Kampung.

5.1.2 Kampung Muhibbah.

Kampung Muhibbah is a neighbouring village located next to Pinggan Jaya. Muhibbah is home to nearly 750 residents of which many work in the cement factory across the river or hold a job as fishermen. The road from KPJ was only extended to Muhibbah recently.

¹<https://www.skmm.gov.my/skmmgovmy/media/General/pdf/HPUS2017.pdf>

Dynamic Model



Figure 3: Dynamic Model

Although the road improved Muhibbah's accessibility, the connectivity via land remains fairly low since the road is small and it only reaches the beginning of the Kampung. Kampung Muhibbah has a primary school that educates children from both KPJ and Kampung Muhibbah.

5.1.3 Kampung visits.

An important part of the context analysis consisted of visits to the Kampung. These visits allowed the gathering of information through the perspective of the villagers. Additionally, the direct engagement provided interesting insights in the challenges and the needs of these people. Furthermore, the visits were important to establish a form of trust. This trust is central when developing software by using a user-centered method. The importance of the users' feedback is invaluable in making an effective system. Therefore, building a relationship in which the villagers were comfortable sharing information, was a goal during these first visits.

The first visit was to Kampung Muhibbah when we were invited to celebrate Hari Raya at the chief's house. After lunch, two group interviews were conducted in which the chief explained the current challenges of Muhibbah. He indicated that lack of access to the village was the biggest problem for their community. Furthermore, he indicated that the allocation of housing was difficult due to land property issues. Moreover, most of the villagers were either employed at the cement factory across the river, or fishermen. They indicated that fishermen were connected to a governmental organization that buys their catch. However, the price was substantially lower than the normal market price. As compensation, the fishermen were provided with a monthly allowance. The chief mentioned another challenge that would help him in organizing the Kampung. The Kampung's profile only existed in hard copy and must be updated yearly. All updates are carried out manually and have to be obtained via personal contact with the villagers.

This planted the idea for developing an online profile that decentralized the registration and updating part of Kampung information. This information would be stored in a centralized database that would be easy to update.

The second visit was to Kampung Pinggan Jaya where we were also invited to celebrate Hari Raya. After lunch, three group interviews were conducted to discuss the challenges of KPJ. Their biggest challenge was proper internet connection. At most areas in KPJ, internet access is poor or non-existent. Villagers go to the dock near the river to use internet. Other discussions were regarding the Gula Apong production and education for children.

5.1.4 Follow up.

The Kampung visits provided us with interesting insights that could be transformed into use cases for this year's project. The obtained information was discussed during plenary sessions at the lab. The group was divided into smaller groups to brainstorm on possible angles for use cases. Our group was interested in taking on the profiling use case. Fortunately, a follow-up visit to Kampung Muhibbah was arranged. We were able to speak with the secretary of Muhibbah, who is living in KPJ. She provided new information on the current situation of both Kampung. A major challenge that she addressed is the visibility of the Kampung. This new information changed our view on the profiling use case. We decided to focus more on online visibility of the Kampung. Next to the visibility, We decided to focus on a marketplace that would improve the labour market of both Kampung.

Although the 'marketplace' use case was interesting, there were concerns about the sustainability of the system and that there would be a lack of users. Therefore, we decided to switch from use case. During the meetings in the Kampung, the UNIMAS project team initiated a repackaging business idea to support the women in the Kampung in getting a job. After a meeting with the project leader,

we were enthusiastic in focusing on the new use case. Most of all due to the fact that it would help the women in their development. Moreover, we understood the value of the business and were enthusiastic about its likelihood of becoming a sustainable contributor to the economic development of both Kampungs.

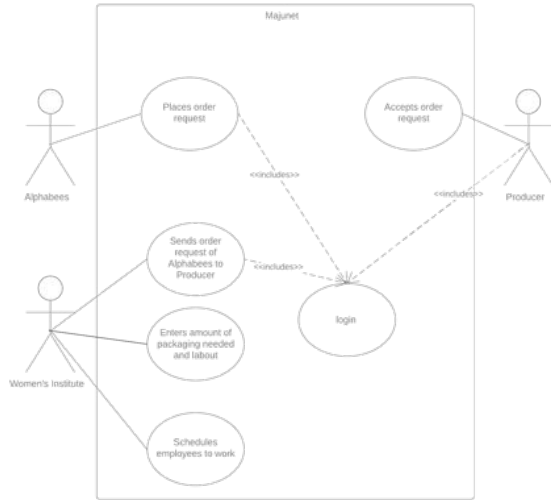


Figure 4: UML usecase diagram depicting the user interaction

6 USE CASE SCENARIO SCRIPT

AlphaBees receives a notification of 50kg leftover space in a container with destination Singapore. AlphaBees sends a request to WI to buy 50kg of repackaged Popiah simul.

WI Receives request from AlphaBees. She inputs the order of 50kg in the MajuNet financials calculator to check how many labour hours are needed to fulfill the request. Afterwards she checks the MajuNet schedule to verify if WI is able to deliver 50kg of product by the requested time frame. If yes, she sends a request to the popiah simul producer for 50kg.

Producer accepts the request and sends a 'go' to WI.

WI checks the financial overview again to see how many packages need to be ordered. She makes a request for the packages to the package producer. Furthermore, she updates the schedule with employees in order to fulfill the order. This gives her an estimated time on when the order will be finished. She passes this to AlphaBees so they are able to make arrangements on picking up the order. Once the product and the packages have arrived, the repackaging process starts. After finishing, the products are stored and AlphaBees is notified on the completion of the order.

AlphaBees picks up order at WI's storage unit and ships products to Singapore. A general use case diagram can be seen in Figure 4.

7 INTERACTION AND COMMUNICATION

The WI has a central role in the business as can be seen in Figure 10 in Appendix C. They are between every line of communication

with all stakeholders. Therefore, WI is able to store necessary information for a smooth running supply chain. MajuNet is supporting them in efficiently and effectively managing that information. As a large part of the process, the repackaging, is WI's responsibility, they are most likely the bottleneck in this supply chain. MajuNet decreases that likelihood by enabling the managers in making schedules easily, and by providing them with supportive information about the financials on a particular order. These functionalities increase the efficiency and effectiveness of the managers while also storing the data online in a structured manner. The system includes a basic dashboard in which the following data can be retrieved; total employee hours on a particular day, total number of employees of that day, and working hours of individual employees. This supports the WI in calculating wages easily. Furthermore, it could be used to make analysis on the production process and for making analysis on employee productivity.

7.1 Activity Diagram

In Figure 5 the Activity Diagram is shown, which shows more insight in the interactions between the actors and their tasks. In order for a product that AlphaBees wants to order and be repackaged, the WI needs to forward this request to the producer. Only if the producer fulfill the order request they can accept it and start producing the product. After this the WI starts the repackaging process, and the final product will be bought by AlphaBees.

7.2 UML Class Diagram

In Figure 9 the class diagram shows the meaning of some of the relevant concepts that are described in Table 1. Some of the concepts, such as the Green House are left out, since these are irrelevant for the MajuNet system. The Green House is only the location of where the repackaging will take place.

The timetable shows which employee is working on which day and at what time their shift starts and ends. The ISA relationship means that availability and schedule are subclasses of timetable. At availability, the employee can fill in one's availability for a certain period. This consists of the same attributes as timetable, such as employee_id, date, start_time and end_time. Schedule is a type of timetable, but it also includes the attributes of the employees' wage and whether one is paid or not (boolean attribute). Availability is managed by the employee, due to the functionality that an employee can fill in their own availability in the web application. The attributes of employee consists of the following attributes:

- ID
- first_name
- last_name
- age
- city
- address
- phone
- wage
- username
- password

The womens_institute, alphabees and the producer are subclasses of users. The reason for this is, that all of them have to go through a login screen in order to view the pages they have

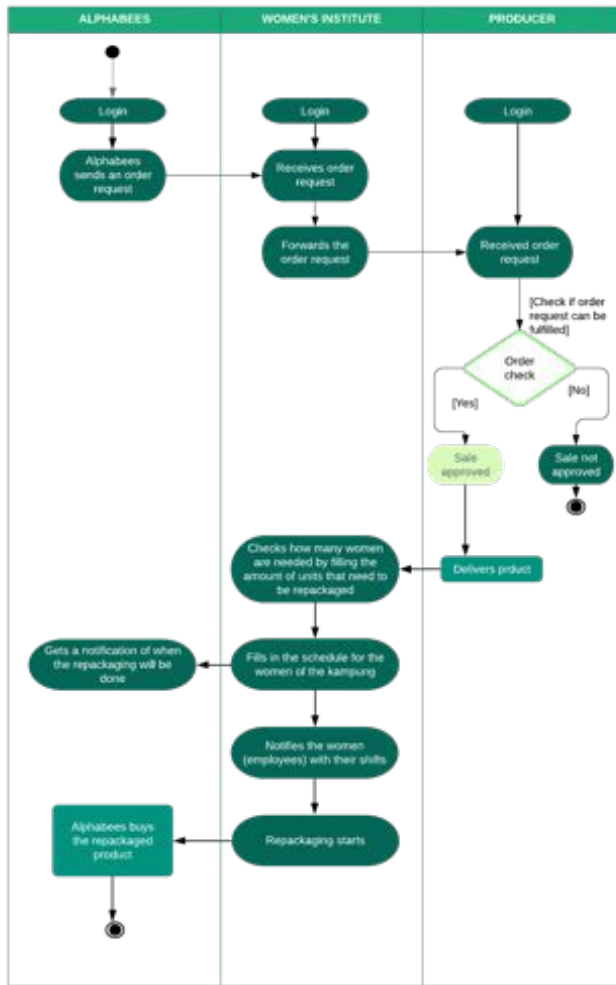


Figure 5: UML activity diagram depicting the interaction of the different users

permission to access. The womens_institute manages the schedule of the employees. Furthermore, the womens_institute creates an order that can be accepted by the producer. The important and relevant attributes can be seen in the class order. The class sale as well as the order consists of a product, since this is specific for each order.

8 TECHNOLOGY INFRASTRUCTURE

Majunet is SAAS solution to ease, improve and guide management of the repackaging process. The system was built with scalability and accessibility in mind. The result is a webapplication² which utilizes Laravel on the back-end and ReactJS on the front-end, design decisions made to minimize potential costs, maximize speed and maximize future support.

²<https://github.com/Kishanjay/MajuNet>

8.1 Front-end

The aim of the front-end: the UserInterface and UserExperience, is to create an easy to use, fast, and intuitive application. Due to the limited amount of time we opted for this CSS framework which greatly eases the process of creating a clean UserInterface. For this we used Bulma.css: a free, open source CSS framework based on Flexbox and used by more than 150,000 developers³.

ReactJS⁴ was used to structure the code and create a single page application. The idea of a single-page application is that the page gets loaded only once in the browser after which it will only refresh the parts of the page that need refreshing. This is much faster than traditional page switches as it removes the need for complete page-refreshes.

8.2 Back-end

For the back-end, the part of the code that is responsible for communicating with the database, Laravel is used. Laravel is known for its speed and clear code structure and also supports lots of features (such as authentication) out of the box. The clear code structure makes it easier for future developers to contribute to this project. Another benefit is that Laravel uses an abstraction layer on top of the database interactions, making it trivial to switch databases if needed. The current version of MajuNet uses a MySQL database. The last big advantage of using Laravel as a back-end language (v.s. many scripting languages) is that PHP can run on shared hosting servers; to host a Laravel project on a server only FTP access is required.

Furthermore Laravel was used to create an API in order to Create, Read, Update, and Delete the various resources of the database. All these endpoints are available and consumed by the ReactJS front-end.

9 FEASIBILITY AND SUSTAINABILITY

To evaluate how reasonable our system including its requirements and identify the potential motifs by stakeholders to keep the system running after it is finished we assess the feasibility and sustainability.

9.1 Feasibility

9.1.1 Technical feasibility.

The timing constrains greatly affected the technical feasibility. It was known that the complete system will not be among the final deliverable. To overcome these limitation a subset of the key requirements were implemented resulting in a small and stable product.

The final product will require a internet connection to send out notifications between various parties. The data usage of the application will be negligible therefore the potential costs will be low.

9.1.2 Economic feasibility.

The economic feasibility of the system is high due to the incentives of the various stakeholders. Especially since all stakeholders have an economic incentive in the supply chain (see Figure 10 in

³<https://bulma.io/>

⁴<https://reactjs.org/>

Appendix C). When done correctly, all stakeholders benefit from their involvement in this business while creating economic welfare for many individuals. However, at first, the WI is dependent on government funding in the start-up phase. As costs have to be made regarding materials, research and development, the system, and man hours, the initial funding is an important investment to get the business running. The amount of the investment determines in what time frame the WI has to make profit. For this, we rely on the networking abilities of the UNIMAS project team and their relationship with the government.

Another advantageous aspect is the direct involvement of AlphaBees. The demonstration that was shown during the meeting, made them excited. As they are keen on filling up their containers to Singapore, they too have a big stake in making this business work. Therefore, if initial funding of the government will not be enough, there is a chance that AlphaBees would be willing to invest in the business.

Our system is directly dependent on the feasibility of the business. On the other hand, our system is an important factor in letting the business run smoothly. This interrelated dependency gives a higher feasibility to our system and provides an incentive to all stakeholders to invest in the system since it impacts their involvement as well.

9.2 Sustainability

The involvement of the different stakeholders creates a factor of sustainability in itself. Especially due to their economic incentives. We learned during the Kampung visits that economic incentives are the best motivators in this area. Given that the system enables the WI in efficiently managing the largest part of the supply chain, the different stakeholders would benefit by investing in the system. This could lower costs and increase margins for all parties.

Furthermore, the involvement of the UNIMAS project team brings sustainability. Their incentive to bring economic development to these Kampung visits over the course of several projects, creates stability. Moreover, their involvement is based on long term initiatives and by building sustainable relationships with the Kampung visits. Seeing that they were impressed by the functionalities of our system, it is likely that they safeguard its existence. Moreover, one of its team members will host monthly workshops to educate the women in these projects. This can be used to train women in using the system.

At last, we delivered the skeleton of the system in a structured manner. The coding was produced as clean as possible, allowing for easy maintenance or expansion by other developers in the future. Given that extra functionalities would increase efficiency and communication between the stakeholders, it is likely that they invest in the system to develop these functionalities.

10 KEY REQUIREMENTS

10.1 Functional requirements

- (1) The system should allow the manager(s) to manage employees
 - (a) A manager should be able to edit the schedule of an employee
 - (b) A manager should be able to add a new employee

Table 2: MoSCoW table

	Requirement
Must have	+ Timetable for employees + Order estimation calculator + Manager login + Schedule editor
Should have	+ Dashboard with basic statistics + Employee login + Self edit function for employees
Could have	+ Responsive design
Won't have	+ Interactions between various stakeholder + Advanced statistics dashboard + Advanced lay-out

- (c) A manager should be able to edit existing employees
- (2) The system should allow the manager(s) to gain insights in the production process
 - (a) A manager should be able to see the daily schedule
 - (b) A manager should be able to see the weekly schedule
 - (c) A manager should be able to see some estimations on how much labour is required for an order
 - (d) The system should keep track of the costs and incomes
- (3) The system should allow the employees to manage their data
 - (a) An employee should be able to specify its availability
 - (b) An employee should be able to gain insights of its working hours (past and future).
 - (c) An employee should
- (4) The system should allow the employees to manage their data
 - (a) An employee should be able to specify its availability
 - (b) An employee should be able to gain insights of its working hours (past and future).
 - (c) An employee should
- (5) The system should function as a marketplace
 - (a) AlphaBees should be able to place an order to WI
 - (b) WI needs to be notified for every new order
 - (c) WI should be able to accept or cancel incoming orders
 - (d) AlphaBees should be notified on the order status
 - (e) Awang should be informed by the system of orders by WI
- (6) The system should keep track of the financial status of WI
 - (a) The system should compute the expenses of the employees
 - (b) The system should compute the expenses of the products delivered by Awang
 - (c) The system should compute the expenses of the packaging products
 - (d) The system should take transport costs into account
 - (e) The system should compute the profits from the sales to AlphaBees

The requirements mentioned above can be prioritized according to Table 2.

11 COST CONSIDERATIONS

As previously mentioned the final deliverable did not meet all the requirements as specified in section 10. Since the system has yet to be

completed the cost consideration also take the future development costs into account.

The final deliverable satisfies the first two functional requirements described under section 9.1. The result is an application in which WI can manage employees, their working hours, see the schedule, and calculate an estimation of the amount of work and financial resources are needed. This system does not require internet access since it has no need to communicate with other users at different locations. Therefore a simple server with the web-application can be run on any computer (i.e. a raspberry pi).

The complete application will feature communication between the different parties including notifications whenever a order status gets updated. Therefore the application needs to be run in the air and will have the following recurring costs:

- Shared hosting server; any server that supports PHP 7.1.3 or higher will suffice. Since FTP hosting is adequate to host our application, costs can be as low as 50MYR/year.
- Domain name; to make the web-application easy accessible a domain name should be registered. Depending on the domain extension prices vary between 30 to 70 MYR/year.

A rough estimation of the number of hours it will take to wrap up all the functional requirements will take up approximately 150 hours.

12 PROTOTYPE (PROOF OF CONCEPT)

12.1 Women's Institute Interface

12.1.1 Low fidelity mockups. Figure 6 shows the interface designed for the WI. The first screen shows all the functionality that the interface of the system has. It consists tabs of interface for Schedule, Wages, and Supply Info. The Schedule interface shows the timetable of the employee's working date and time. The Wages interface shows the personal details and working hours of an employee. This page also calculates the wages for employee according to the working hours. The Supply Info tab is the interface for WI to receive request from AlphaBee for production purposes. Once WI receive request from AlphaBee, WI can either accept, reject or adjust the request according to their situation. Since these were only the very first mockups, they were not drawn in much details. The main focus on these lo-fi mockups where the employees and supply page.

12.2 Finished interfaces

In Appendix A the final interfaces of the webapplication can be seen. Note that all the screens are written in Malay Bahasa, since this would be easier for the community to read. All of these texts are translated into English and added as comments in the code. Figure 11 shows MajuNet's homepage were a short description of MajuNet can be seen. The translation of the homepage is as follows: "Explore, Expand, Experience local food of Sarawak" "The main purpose of the system is supporting the Women's Institute (WI) in repackaging local products from Sarawak. The WI is the central stakeholder that employs women from Kampung Pinggan Jaya and Muhibbah. They will repackage and rebrand the local product popiah simpul, that will be exported by a third party, AlphaBees, to Singapore. The

system supports the WI in scheduling women and keep track of the financials from requested orders."

Figure 12 shows the schedule editor of MajuNet. It provides an overview of the current schedule. Furthermore, it allows the WI to schedule, update or delete existing employees to the schedule in order for them to keep track of the process.

Figure 13 "Anggaran Pesenan Produk (nasihat)", which means estimation of order (advice), in this screen, the WI can fill in the form how much of a product is needed. After this is done, the WI can see how long it will take to do the repackaging. From top to bottom the translation is as follows:

- Package name
- Equipment name
- Material name
- Employee hours
- Employees

Figure 14 shows a basic dashboard that allows the WI in doing basic analysis on employee hours or specific orders. This supports the WI in calculating employee salaries and keep track of their weekly or monthly hours.

Figure 15 shows the overview of employees that are in the system. Moreover, it includes employee information such as telephone number, address and city. This supports the WI in managing their workforce more efficiently.

Finally, Figure 16 shows the 'Add employee' page. This allows the WI to add a new employee to the system. This employee is added to the database and is shown in the 'employee overview' page. Moreover, once the employee is added, the WI is able to schedule that employee in the schedule editor.

13 USER EVALUATION

User evaluation takes a central role in ICT4D. It allows one to validate functionalities, assumptions and requirements of the system. By testing the system in early stages of the project, makes it easier to change the system. Furthermore, user engagement to the project increases which in turn boosts the system's sustainability. During a meeting with AlphaBees and UNIMAS project team, we showed a demonstration of the prototype. Since the UNIMAS team is the initiator of this project and plays a central role in the start-up phase, it felt important to obtain their feedback. We were able to verify our assumptions and the functionalities of our system. The next paragraph is the original evaluation by the UNIMAS team on our prototype.

13.1 UNIMAS team feedback

- (1) Rural Village Transformation Programme 2019
- (2) Project Name: KPJ Women Institute Packaging Center (WIPC)
- (3) User Evaluation of the ICT system developed by VU & UNIMAS students
- (4) Proposal by Assoc Prof Dr Mohammad Ibrahim Safawi and team members
- (5) Universiti Malaysia Sarawak
- (6) 29 June 2019

13.1.1 INTRODUCTION.

This is a user evaluation of the newly developed system by the

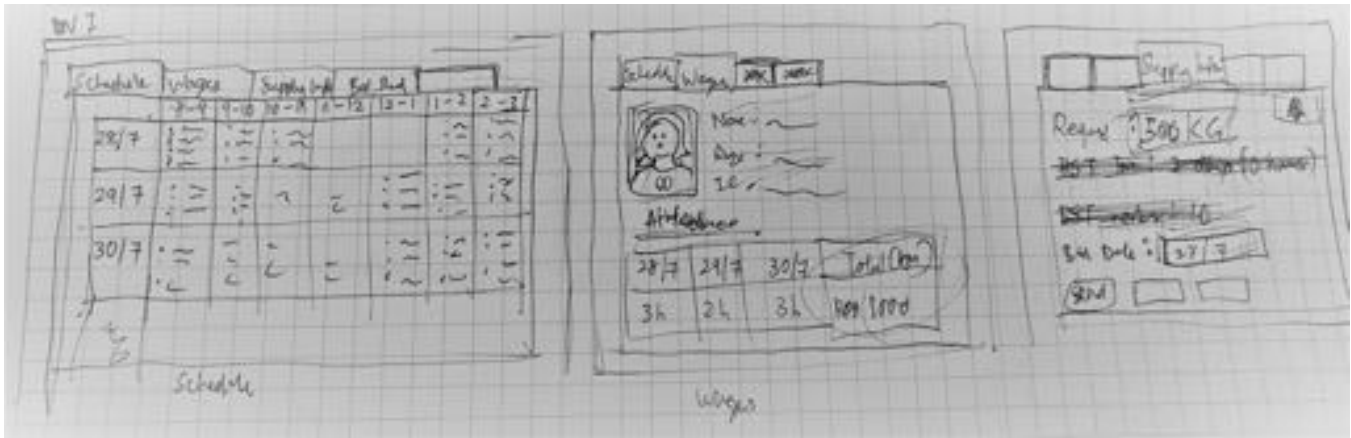


Figure 6: Lo-fi Mockup of WI interface

VU and UNIMAS students. The system was developed to support the rural transformation project in Kampung Pinggan Jaya. The proposed project is called KPJ Women Institute Packaging Center (WIPC). The main objective of WIPC is to harness the available women labour in the village and offer packaging business to them. The name of the product to re-packaged is popia. The local champion for the project is an NGO for women called Woman Institute (WI). Within the available time the students successfully produced the ICT system (termed here as Process) that will support WIPC activities.

Prior to the development of the innovation, the team went through several engagement activities. These engagements were necessary to build relationship with the villagers and understand the gap between the baseline and way forward for the villagers. The focus was to identify the most impactful ICT innovation that will transform the community into a better one. These activities are given in Table 3.



Figure 7: Meeting with AlphaBees

13.1.2 EVALUATION OF PROCESS.

WIPC has three main stakeholders, viz the product producer, WI and exporter AppleBees. WIPC is for WI to purchase the product from the producer, repackaged it into a new brand and export the premier product to Singapore through collaboration with AppleBees. Based on the presentation by the VU & UNIMAS team, the below evaluate the impact of Process.

13.1.3 CONCLUSIONS.

The conclusions are summarized below:

- "Process" changed the working culture
 - The rural villagers embraced ICT in their culture
 - The profit margin from the process will increase in the future
- "Thank you very much to the VU & UNIMAS team for supporting the income generation activity of the rural community by introducing ICT in their life"

14 DISCUSSION AND FUTURE WORK

The user-centered approach played a central role in the development of the MajuNet-system. The field visits showed the importance of building relationships with the local community that enabled us in delivering effective and sustainable results. Furthermore, the various iterations gave us the chance to continually make improvements to the system. Given that end users provide the most valuable insights in their needs, we frequently asked for feedback and validation of our progress. Especially the feedback from the demonstration session provided us with a better overview on the desired functionalities. Unfortunately, due to time constraints, we were not able to deliver a complete system. However, it enabled us to structure the design with future development in mind.

Another aspect that positively contributed to the system was the multidisciplinary skills in our team. We had a good balance in useful skills that we managed effectively. Due to this we were able make large steps in a short period of time. Especially since

No	Activity	Date	Remarks
1	A stroll in Kpg Pinggan Jaya and Kpg Muhibbah	14/6	Identified the existence of WI, good number of fishermen, historical data
2	Engagement with Pungulu Abang (KPJ)	17/6	Number of existing products, status quo of YS kitchen
3	Engagement with YB Dr Hazlan Hipni	17/6	YB's emphasis on educating the villagers and enhancing local entrepreneurs
4	Discussion with WI on concept and proposal	21/6	Gaming feedback and buy-in on WIPC
5	Attended JKTLB Bil 1/2019 meeting	21/6	Understand status quo and JKTLB
6	Thanks giving ceremony at KPJ	22/6	"Winning the hearts" activity
7	Discussion with AlphaBees	26/7	Presenting draft version of "Process"

Table 3: Meeting overview

we decided to change our use case at a later stage in the project, we spent our time efficiently. Luckily, the deadline with AlphaBees motivated us to deliver a proper prototype that we used during the demonstration.

The biggest challenge of this project was the time constraints we encountered since we changed of use case. It costed us two valuable weeks, time that we could have spent on elaborating the system. Having an extra two weeks would have increased the value of our system for the WI. Furthermore, it would have increased the sustainability due to extra functionalities that we would have been able to include.

As addressed before, adding extra functionalities to the system would increase the value for WI and the other stakeholders in the supply chain. The following implementations would increase the value of the system;

An interactive functionality that allows communication between WI, AlphaBees and Awang. Request for orders can be made through the platform, which instantly calculates an estimation of delivery that is sent back to AlphaBees. Furthermore, the parties can have an option to adjust the amount of the order and confirm via the system. In this, all stakeholders have their personal interface with data that is useful for their process.

Another future implementation is an employee login functionality. This allows employees to indicate their availability in the schedule for certain days and working hours. It supports the WI in creating better schedules that are aligned based on the availability of the employees. This would likely reduce conflicts among personal schedules of employees. Furthermore, it enables the WI to make schedules with fewer lines of communication.

The last functionality that we were not able to implement was advanced analytics. Although the system allows for basic analysis, being able to do advanced analytics would increase MajuNet's value. The data can be used into valuable information to increase productivity.

15 CONCLUSION

This one month project has been a valuable learning experience for all of us. Being able to tackle a real life challenge by designing a practical solution from scratch, showed us the true meaning of ICT4D. We went through, and were responsible for all phases of the software project. Understanding the context by engaging local communities was the starting point of this use case. Their feedback was turned into requirements that became the building blocks of

Majunet's design. The system supports the WI in effectively managing women for a repackaging business. Furthermore, it would support the local women in Kampung Pinggan Jaya and Kampung Muhibbah in becoming economically active. In short, the local product 'Popiah simpul' is repackaged and rebranded. AlphaBees busy the repackaged products and exports them to the Singaporean market. In this, the system enables efficient management of the employees and supports with calculations on specific orders. The functionalities we delivered;

1. Schedule maker in which WI can create, read, update and delete employees into the schedule.
2. Order calculator, in which the costs, number of packages, number of employee hours are calculated for a specific order.
3. Basic dashboard that can be used for analysis.

These key functionalities are the basis on which the system can be expanded to deliver more value to the WI. Eventually, it can support the communication between all stakeholders, do advanced analytics and decentralize the schedule making by giving employees personal login. The system is not limited to these Kampung, but can be scaled to other areas of Sarawak as well. It is intended to stimulate economic development, and in specific support the women in using their skills in a working environment.

16 ACKNOWLEDGEMENTS

We would like to express our special thanks to Dr. Cheah Wai Shiang for arranging everything related to the ICT4D course in Malaysia. We would also like to offer our gratitude Associate Professor Dr. Mohammad Ibrahim Safawi for giving us the opportunity to help him with his proposal to help the development on the local economy of the Kampung communities. Furthermore, many thanks to both Kampung Muhibbah and Kampung Pinggan Jaya for their kind and warm hospitality and making us feel welcome in their homes and their willingness to work with our team. Finally, we also wish to thank the faculty dean of Computer Science & IT, UNIMAS, Associate Professor Dr. Johari Abdullah.

17 APPENDIX

A REPACKAGING FLOWCHART

See Figure 8 for the flowchart of the repackaging process

B UML CLASS DIAGRAM

See Figure 9 for the UML Class Diagram of MajuNet.

Repackaging Flowchart

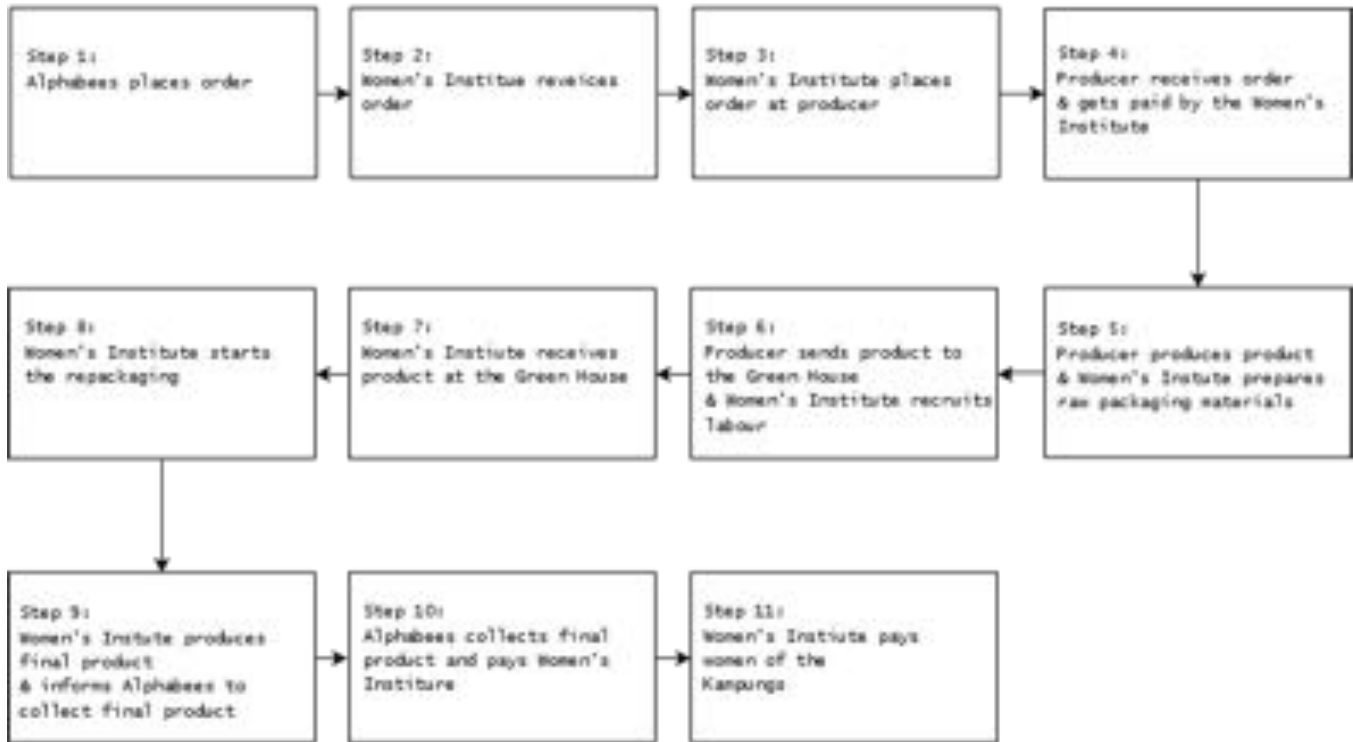


Figure 8: Repackaging flowchart

C E-VALUE MODEL OF MAJUNET

See Figure 10 for the E-Value Model of MajuNet.

D FINAL SCREENS OF THE WEB APPLICATION

See Figure, 11, 12, 13, 14, 15 and 16 for all the screens.

E INTERVIEW SUMMARIES

Since most of the first interviews that took place about the use case described in this paper were unplanned, not much has been documented in a proper way. This Section will describe the interviews as a an overview. The first interview took place in Kampung Muhibbah, as described in Section 5.1.3. The key insights this first meeting gave us was, that most of them work at the factory across the river. Furthermore, that there are many fishermen in the kampung and that they have to sell their fish for a very low price. The insights we got from our first interview with dr. Ibrahim were the importance of scalability and sustainability. Dr. Ibrahim told us that we had to consider the administrative part of the system as well. As in, we need a local champion that can maintain the system. With scalability, he meant that the developed system had to be scalable to other areas and communities. And with sustainability, that the

project is for long term development. Furthermore, he described the importance of needs versus wants, the gap between vision and status quo. The purpose of the project is important, it has to be genuine and hopefully the ability to change the lives in the Kampung. In order to discover the needs, community engagement needs to take place to gather information about the community. Moreover, dr. Ibrahim told us about his pitch he would present on the 24th of July to the Government. This pitch was about Economic Transformation, with the focus on income. According to dr. Ibrahim, transformation will take place when the income rises. The meeting with the Alphabees representative, Cedric Kon, gave us interesting insights. For example, the possibility to calculate the speed of each employee, in order to know how fast the repackaging will be done. Moreover, he told us that the products will be measured in SKU, which stands for Stock Keeping Unit. SKU is a product code that can be used to search and identify stock from order forms, invoices and lists. At last, he indicated that an interactive functionality would be interesting for them.

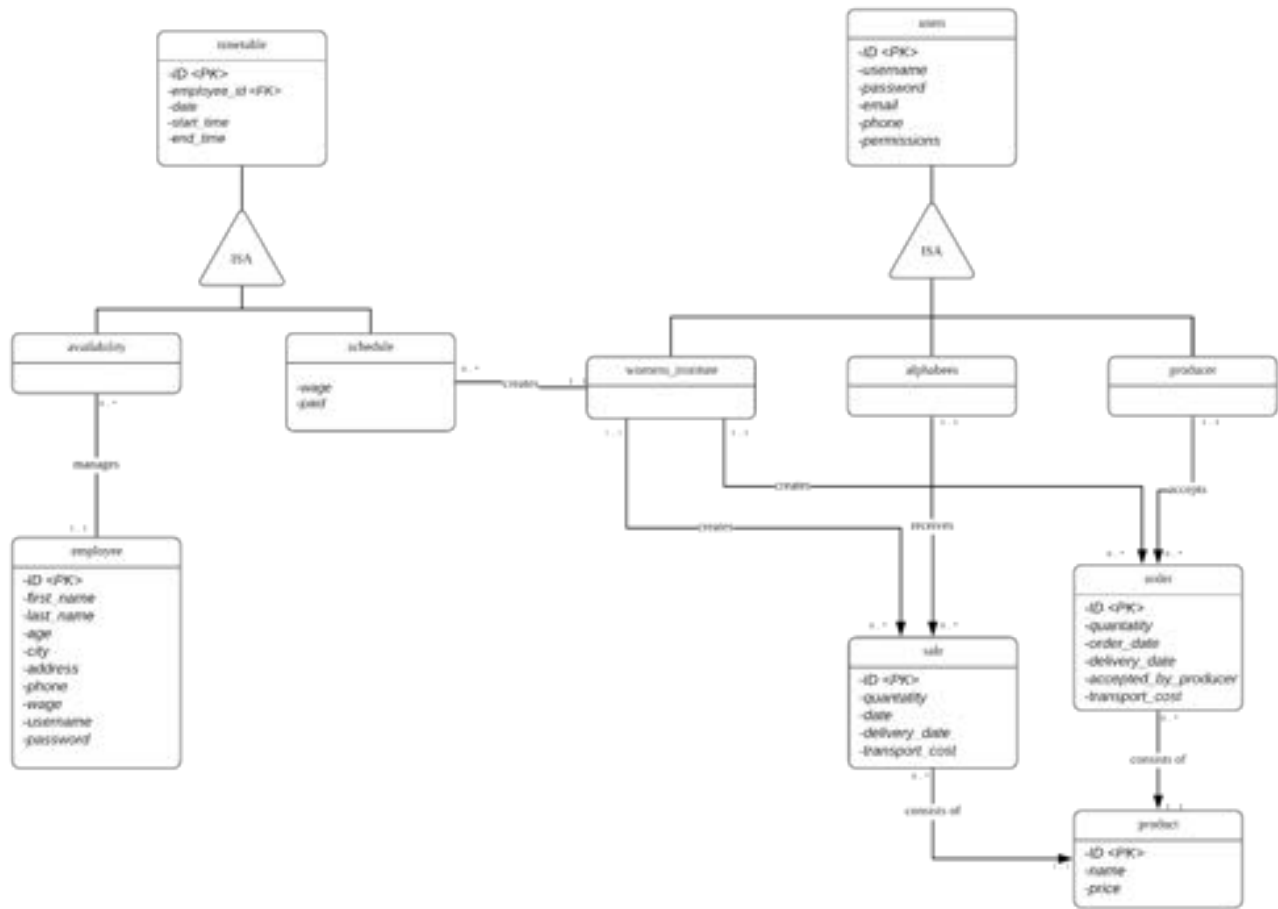


Figure 9: UML class diagram of MajunNt

F PHOTOGRAPHS & VIDEO

For an overview of the project and time spent in Kuching, Sarawak, see the following video on Youtube: <https://youtu.be/2eUgnqhKaYk>. For the photographs, see Figure 17, 18 and 19.

G CODE

The code used for this web application is open source and can be found on GitHub: <https://github.com/Kishanjay/MajuNet>

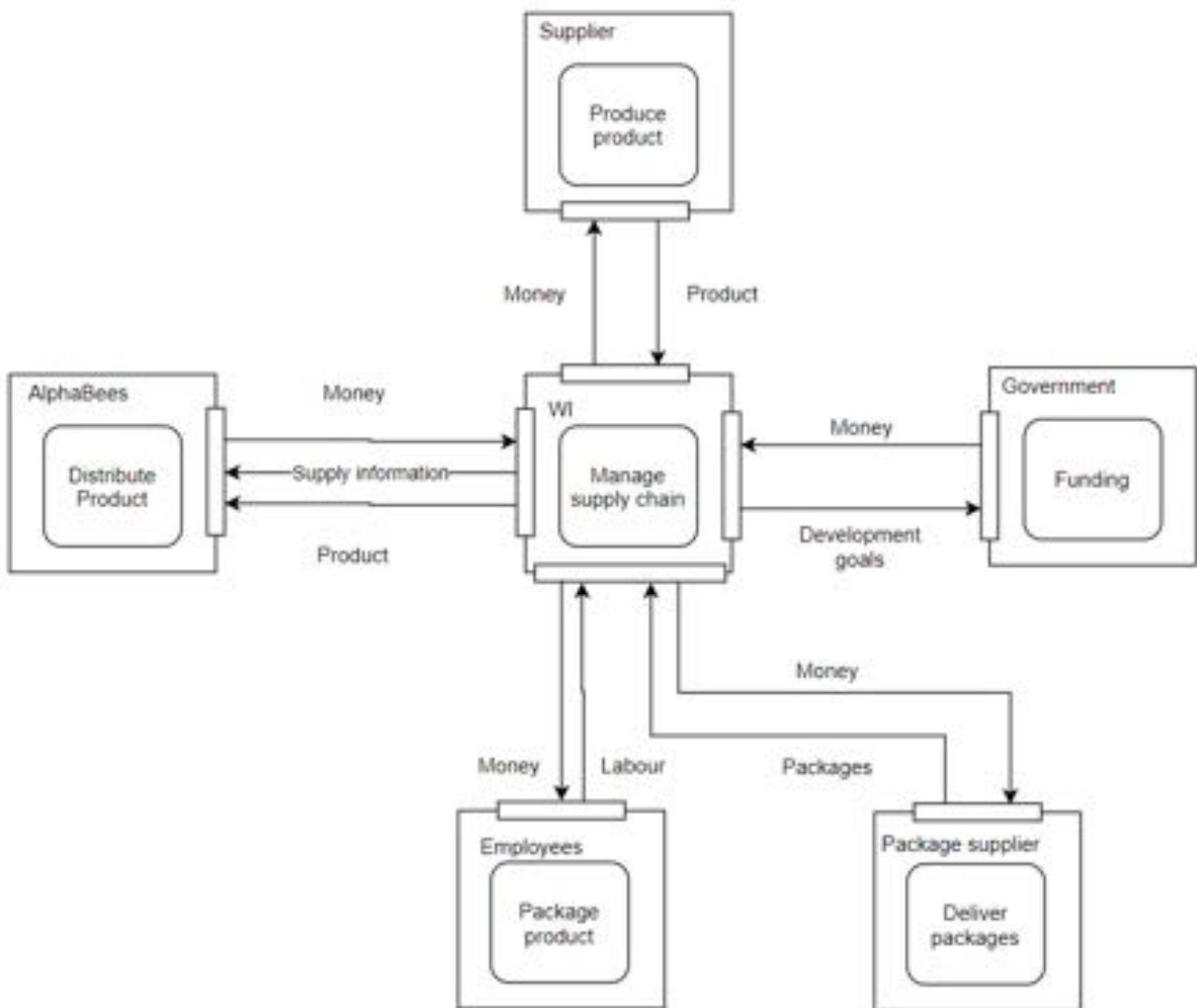


Figure 10: E-value model of the MajuNet case



Figure 11: MajuNet's homepage interface



Figure 12: MajuNet's schedule editor & overview page

Anggaran Pesanan Produk(nasihat)

Nama	Anggaran Kuantiti	Harga	Jumlah Harga	Anggaran Untuk Hari Pesanan
Nama Pelay		Rm100.00		
Nama Peralatan		Rm100.00		
Bahan		Rm100.00	Rm100.00	Tuesday, 10 June 2020
Jangka Masa Diperlukan		Rm100.00		
Jumlah Pekerja Diperlukan		Rm100.00		

MajuNet by LUMINA and VU. Please email the information for bug fixes.
MajuNet bersempena LUMINA dan VU. Sila berhubung dengan pengembangannya untuk maklumat pengubahsuaian.

Figure 13: MajuNet's order calculator page

Jumlah Pekerja
4

Jangka Masa Kerja Hari Ini
10

Jumlah Pekerja Hari Ini
4

MajuNet by LUMINA and VU. Please email the information for bug fixes.
MajuNet bersempena LUMINA dan VU. Sila berhubung dengan pengembangannya untuk maklumat pengubahsuaian.

Figure 14: MajuNet's dashboard page

Senarai Pekerja

No	Nama Pelay	No Telefon	Alamat	Gender
1	Hafizah Aini	0111140211	No 100, Kampung Ponggan Jaya	Kucing
2	Ali Bin Muhammad	0111140211	No 101, Kampung Ponggan Jaya	Kucing
3	Ali Bin Muhammad	0111140211	No 102, Kampung Ponggan Jaya	Kucing
4	Ali Bin Muhammad	0111140211	No 103, Kampung Ponggan Jaya	Kucing
5	Ali Bin Muhammad	0111140211	No 104, Kampung Ponggan Jaya	Kucing

MajuNet by LUMINA and VU. Please email the information for bug fixes.
MajuNet bersempena LUMINA dan VU. Sila berhubung dengan pengembangannya untuk maklumat pengubahsuaian.

Figure 15: MajuNet's employee overview page

Register employee

Name (given):

Name (surname):

Gender:

Birthdate:

Personal identity number:

Res. Telephone:

Figure 16: MajuNet's employee register page



Figure 17: Final Symposium - Kampung Pinggan Jaya - Meeting with dr. Haji Hipni



Figure 18: Kampung Pinggan Jaya - Hari Raya Muhibbah - Muhibbah



Figure 19: Kampung Pinggan Jaya - Coding together - Eating together

H PRESENTATION SLIDES

MajuNet

Supporting the "Women's Institute Repackaging Center" to stimulate economic development



Agenda



Context analysis

Agile method

- I. Iterative phases
- II. User-centered design → key requirements
- III. Focus on sustainability

Kampung Muhibbah

- I. 730 villagers
- II. Mainly fishermen or factory employees
- III. Primary school
- IV. Has better accessibility before the highway constructed
- V. Has good phone signal and decent internet connection



Context analysis

Kampung Pinggan Jaya

- I. 450 villagers
- II. Gula apung production
- III. Increased accessibility due to the road
- IV. Poor internet connection
- V. No primary or secondary school

Profiling -> visibility use case



Use case

Women Institute Packaging Center

Goal:

Stimulate economic development in both kampungs by empowering women in using their skills in the packaging center.

What:

Repackage & rebrand local product 'Popiah Sempul' for exporting purposes to Singapore.

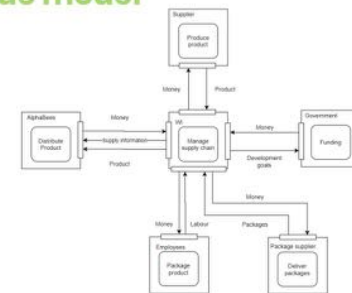
Stakeholders:

- I Women Institute
- II Awang
- III AlphaBees
- IV Government
- V UNIMAS project team

Where:



E-value model



How does it work?



Why MajuNet?



Demonstration



9

Sustainability



Assist the economic growth of the village
 → involvement of different stakeholders
 → sustain the local economy

Majunet system designed in a way that is easy to maintain and extend
 Involvement of UNIMAS project with prof. Ibrahim
 → will likely carry the system after we are done

13

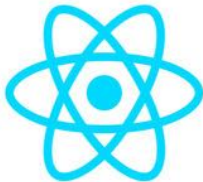
Future Work

Finalize application:

- I. Finish all interfaces
- II. e.g. login screen, interface for Alphabees, availabilities of employees
- III. Finish all formulas for the calculations with actual data
- IV. Do user testing with all stakeholders
- V. Data visualization, such as working hours

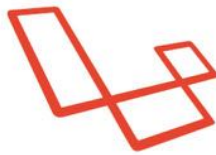
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Front-end



React.js

Back-end



Laravel

10



<https://github.com/Kishanjoy/MajuNet>



11

Thanks!

Any questions?

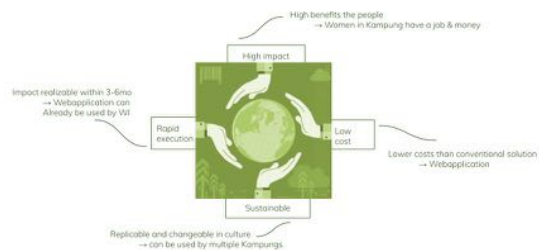


10

Video time!



Sustainability



12

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