BANTING

DIPLOMA in MECHANICAL ENGINEERING

DJJ50182: PROJECT 2

COCONUT DUO-TECH

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SESSION: I 2024/2025

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE: COCONUT DUO-TECH

1. We,

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are final year students of the Diploma in Mechanical Engineering at Politeknik Banting, Selangor, which is located at Persiaran Ilmu, Jalan Sultan Abdul Samad, 42700 Banting, Selangor.

2. We represent that the project and the intellectual property contained there is original work / design without taking or imitating intellectual property from other parties.

3. We hereby agree to relinquish the ownership of the intellectual property in "the project" to "Politeknik" to fulfil the requirement for the award of Diploma in Mechanical Engineering to us.

Subscribe and solemnly declare by the above named;

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(.....)

ACKNOWLEDGEMENT

Alhamdulillah, all praise to God, as it is with His grace that we were able to complete this project and report on time. Through the blessings, hard work, and cooperation of all our group members, the Coconut Duo-Tech project was successfully completed.

We express our sincere appreciation to Dr. Hartiny Binti Abd Kahar, the supervisor of the Coconut Duo-Tech project, for her invaluable guidance, suggestions, and emphasis, as well as for overseeing the project to ensure it ran smoothly.

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On this occasion, we would also like to extend our deepest gratitude to our parents and family members for their unwavering support, encouragement, and motivation throughout this project. Finally, we thank everyone who contributed to making this project a success.

Thank you.

ABSTRACT

The objective of this report is to present the design and evaluation of the Coconut Duo-Tech, which provides a creative way to process coconuts efficiently and semi-automatically in a small and medium enterprise setting. Traditional manual processing requires intensive labour and time, resulting in low productivity and higher costs. To simplify the coconut processing process and increase productivity, the Duo-Tech was created in response to these difficulties. The main goals and specifications of the Duo-Tech are discussed in the opening section of this report, along with issues such as ease of use, timesaving, and injury prevention. To meet customer demand, a strong mechanical product framework needed to be developed during the design phase. To ensure it functions well and consistently, several mechanisms, including de-husking and cutting, were developed carefully. The Coconut Duo-Tech can process coconuts in large quantities at one time compared to traditional methods, showing that it is significantly more effective than manual techniques, resulting in higher processing speeds. The Coconut Duo-Tech can increase its usefulness and potential for wider adoption, especially during festive seasons such as Ramadan, Eid al-Fitr, and Eid al-Adha. The conclusion of the report emphasizes the advantages of widespread use of the Coconut Duo-Tech. With lower labour costs, increased productivity, and minimal environmental impact, it provides a sustainable solution for the industrial and agricultural sectors. The design and analysis of the Coconut Duo-Tech can function well and contribute to advancements in automation for small and medium enterprises, paving the way for increased productivity and efficiency in coconut processing.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Coconut plants are believed to originate from the Pacific islands and are also one of the popular fruit crops grown in the Pacific islands, being widely spread in 93 countries. In Malaysia, coconut is one of the important crops for the country's economy. Most coconut plants are traditionally managed by smallholders. The coconut industry in Malaysia is an agricultural-based industry that imports and exports. Although relatively small compared to palm oil, rice, and rubber, this industry also plays an important role and is the fourth industrial crop in the country's socio-economic development. The coconut industry in Malaysia is unique because in 2017, Malaysia imported coconuts and coconut-based products worth RM1.07 billion compared to total exports of RM995.4 million. Coconut products imported and exported include mature coconuts, young coconuts, coconut oil, copra, desiccated coconut, coconut milk, and virgin coconut oil. The total land area in Malaysia under coconut in 2017 was only about 84,022 hectares.

Figure 1.1: Coconut tree

Figure 1.2: Coconut seedling

However, the coconut industry in Malaysia has a very bright future due to the increasing demand for coconut both domestically and internationally. Moreover, the use of coconut will increase significantly, especially during festive seasons such as Ramadan, Eid al-Fitr, and Eid al-Adha. So basically, the agricultural industry will face difficulties in the coconut production process. Small traders face difficulties in processing mature coconuts. Additionally, small farmers also tend to use traditional methods such as de- husking & cutting. For processing mature coconuts.

1.2 BACKGROUND

Nowadays, small farmers also tend to use traditional methods the way to de-husking & cut, coconut was done manually, using tools like a spear, coconut opener, coconut and machete. Through these processes, coconut can be used to produce coconut milk, coconut oil, grated coconut, and many more products, which affects their production output and requires more labour. However, the traditional method of processing mature coconuts is time- consuming and can be dangerous.

Figure 1.3: Coconut shear head

Figure 1.4: Coconut flank using a machete

Therefore, we have developed a product to solve these problems. Our product can help increase work efficiency, reduce the time and labour required, which is currently lacking, and reduce the cost of importing from other countries. Additionally, this study aims to design and create a machine model and finally conduct tests to determine its effectiveness.

1.3 PROBLEM STATEMENT

With the increasing demand for coconut milk in Malaysia, the supply of coconut milk in the market must meet this demand. However, the agricultural industry and small farmers face challenges in coconut milk production, as the traditional method of processing mature coconuts is time-consuming and requires a lot of labour. Manual processing of mature coconuts requires workers to bend their bodies for extended periods, maintain incorrect postures, which can lead to back pain, joint issues, and other health problems. This can result in workers falling ill and unable to process a large quantity of mature coconuts. As the labour force decreases, the industry will not be able to process more coconut milk such as the target request in one time.

Furthermore, processing a large quantity of mature coconuts using traditional methods requires high levels of concentration, leading to workers losing a lot of energy. It becomes challenging to process the quantity of mature coconuts they could produce, making coconut milk production less productive. Moreover, the existing methods also expose workers to many health and safety risks, as the tools used to peel, split, and grate coconuts are sharp and not ergonomic.

Figure 1.5: Hand injury

Figure 1.6: Back pain

1.4 OBJECTIVE OF PROJECT

The idea of this project is to design and develop a Coconut Duo -Tech mechanism with little effort compared to doing it manually. The project will include several objectives to achieve, there are:

i. To design multi-function coconut machine
ii. To de-husking & cut more coconut in one time compared to conventional method.
iii. To create a safe and healthy working environment for coconut milk workers and dealers.

1.5 SCOPE OF PROJECT

The main scope of our product production is for small and medium enterprises and small farmers. They are our main target because they are closer to the coconut industry. Therefore, they often face the problems that we mentioned before. We hope that the products we produce can provide satisfaction and solve the problems they face. Additionally, the size limit of our product is (Length:36-inch x Wide:24-inch x Height:52 inch), which is the scope of our project. So, with this size, it can facilitate them. Our product is also specifically for de-husking and cutting more coconuts at one time compared to the conventional method.

Our product is also suitable for small to medium farmers with low budgets but still want to reduce time and labour costs, as our product does not require petroleum. Additionally, it also helps reduce back pain problems for agricultural workers.

1.6 CONCLUSION

Throughout this we have achieved in showcasing each topic. Also be able to identify the problem statement and we also be able to clarify the objective of this project clearly. Furthermore, we also well-constructed the scope of this project clearly above. With that said we are also going to discuss the article review of each component we have been used in our project in the following topic which is Literature Review.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is a comprehensive examination and analysis of existing scholarly research, theories, and findings relevant to a particular topic or field of study. It aims to provide a synthesis of key concepts, methodologies, and debates within the literature, identify gaps or inconsistencies in knowledge, and establish the context for the current research. Through a systematic review of past studies, the literature review informs the development of research questions, methodologies, and theoretical frameworks, ultimately contributing to the advancement of knowledge in the subject area.

The literature review is essential to commence our invention of a design to fit the objective of the project. This research is important so that there is no duplication of existing projects. In addition, it also helps students to gain access to information about the success of the project and to ensure that it can run properly, it is necessary to obtain information about the project, to meet the objectives that have been submitted. This chapter contains the different types of materials to meet the necessary features used to produce an effective design rather than the previous design. This process is important for the quality of the product to be more effective and more robust and satisfactory.

For our project, we developed a Coconut Duo-Tech that functions for de-husking & cutting the coconut shell. Firstly, the de-husking function efficiently removes the outer husk of the coconut, which is traditionally take time-consuming and physically demanding task. Lastly, the cutting function slices the coconut split into two, providing quick access to the inner flesh and liquid. By integrating these three functions into a single device, the Coconut Duo-Tech enhances efficiency, reduces manual labour, and facilitates the utilization of coconuts in various way.

2.2 EXISTING METHOD / DESIGN FOR DE-HUSKING

Table 2.1: Existing method / design for de-husking

Tools name	Diagram	Function / way to use	Disadvantages
Coconut Shear Head		Peeling a coconut by hand and then impaling it onto a spearhead.	Requires manual force to operate, which can be physically demanding.
Coconut Opener (Scissor)		Spike the coconut with both hands then apply downward pressure on the lever handle of the coconut opener while holding the coconut steady with your other hand.	Potential damage of coconut if not used with care and precision.
Manual Coconut Husk		Upgrade version of coconut shear head but have to downward lever that will give a force to open the coconut.	Risk of injury if not handled properly especially in the hands.

2.3 EXISTING METHOD / DESIGN FOR CUTTING

Table 2.2: Existing method / design for cutting

Tools name	Diagram	Function / way to use	Disadvantages
Coconut Flank using a Machete	 	Cut the coconut using machete then aiming to strike the eye firmly with the sharp edge of the blade with enough force to puncture through the hard shell of the coconut.	Flanking coconuts with a machete requires skill and practice. Inexperienced users may struggle to achieve clean and consistent strikes, leading to risk of injury.

2.4 EFFECT OF CONVENTIONAL METHOD.

The conventional method of processing coconuts typically involves manual labor-intensive tasks such as de-husking, grating, and cutting, which can be time-consuming and physically demanding. Workers often use handheld tools like machetes requiring skill and effort to achieve desired results. The conventional method of processing coconuts poses significant safety risks to workers, especially when using handheld tools like machetes. Workers are at risk of accidental slips or misjudgments, particularly during the de-husking and cutting stages, where force is applied to penetrate the tough outer husk or shell of the coconut. Another challenge of the conventional coconut processing method is the unpredictability of weather conditions. In addition, mechanized processing solutions like the Coconut Duo-Tech, which are often located in indoor also outdoor facilities with controlled environments, are less susceptible to weather-related disruptions, offering greater resilience and reliability in the face of unpredictable weather conditions.

2.5 CONCLUSION

In conclusion, while the conventional method of coconut processing has been practiced for generations, it is important to acknowledge its limitations and challenges. From safety risks and inefficiencies to vulnerability to unpredictable weather changes and supply chain disruptions, the conventional method presents numerous obstacles to productivity, profitability, and sustainability in the coconut industry. By embracing mechanization and automation, coconut producers and processors can enhance safety, increase productivity, and improve product quality, ensuring the long-term viability and success of the coconut industry in the face of evolving challenges and opportunities.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will discuss the process flow chart for the execution of the final year project, as well as the morphology chart showing the materials selected. It also covers an overview of the proposed solution/design and the function process, which indicates how each station machine operates. Additionally, the chapter discusses the material selection process, the cost analysis for the materials, and the Gantt chart outlining the planning and implementation carried out over 14 weeks.

3.2 DESIGN PROCESS FLOW CHART

Figure 3.1 shows the flow chart where this process starts with gathering information. Followed by project research, idea generation and market survey. Next is the design process of the designed idea. then choose the appropriate material next to produce the fabrication process and finally testing, if not successful, the steps above need to be repeated.

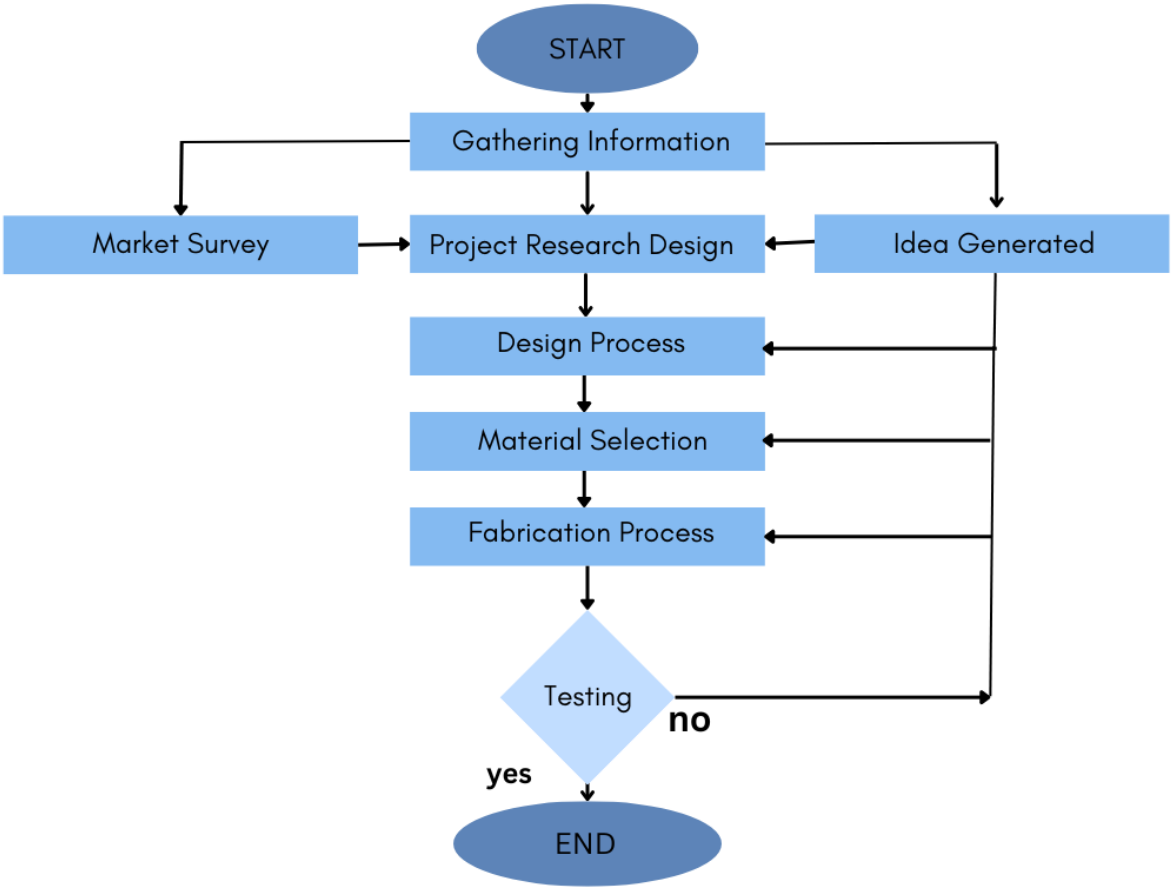


Figure 3.1: Design process flow chart

3.3 MARKET SURVEY

A market survey was conducted with a total of 8 responses from workers and sellers involved in coconut processing activities at Banting Selangor. The survey focused on understanding respondent's familiarity with coconut processing machines, specifically the concept of combining de-husking and cutting functions into a single machine.

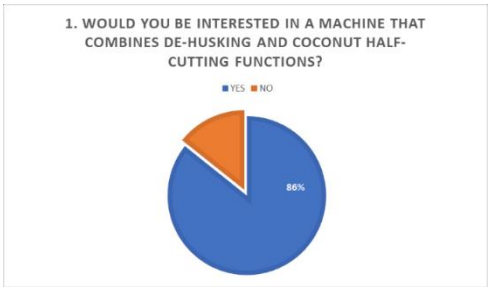


Figure 3.2: Interest in a Combined De-husking and Cutting Machine.

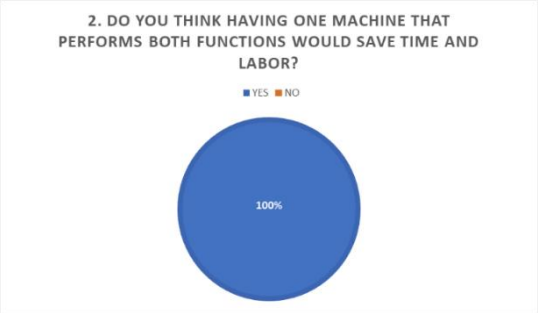


Figure 3.3: Perceived Time and Labor Savings with a Combined-Function Machine.

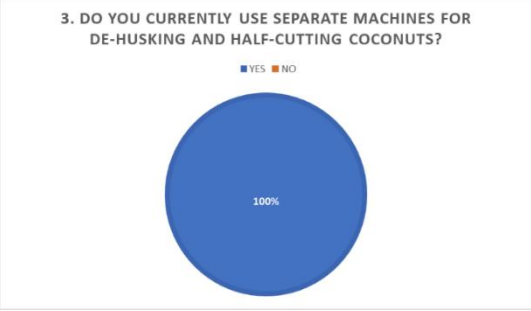
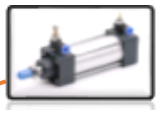
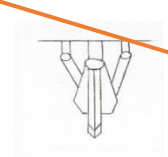
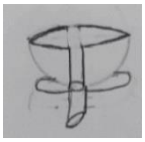
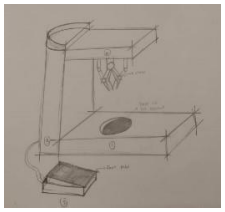
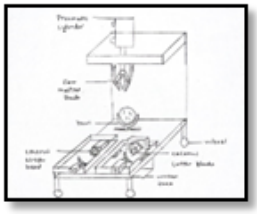


Figure 3.4: Current Use of Separate Machines for De-husking and Cutting Coconuts.

3.4 MORPHOLOGY CHART

Table 3.1 shows several options in the selection of parts / components that are compatible with the ideas produced. This process was developed using Morph. Chart method

Table 3.1: Morph. Chart of the selection of parts / components

Component	Option 1	Option 2	Option 3
Pneumatic cylinder			
Hose pipe			
Blade for de-husking coconut			
Bowl holding coconut			
Coconut cutter blade			
Assemble design			

3.5 PROPOSE SOLUTION / DESIGN

Figure 3.5 shows the proposed solution / design. In this proposal, there are 3 stations, they are coconut de-husking station, a coconut cutting station and a coconut grated station.

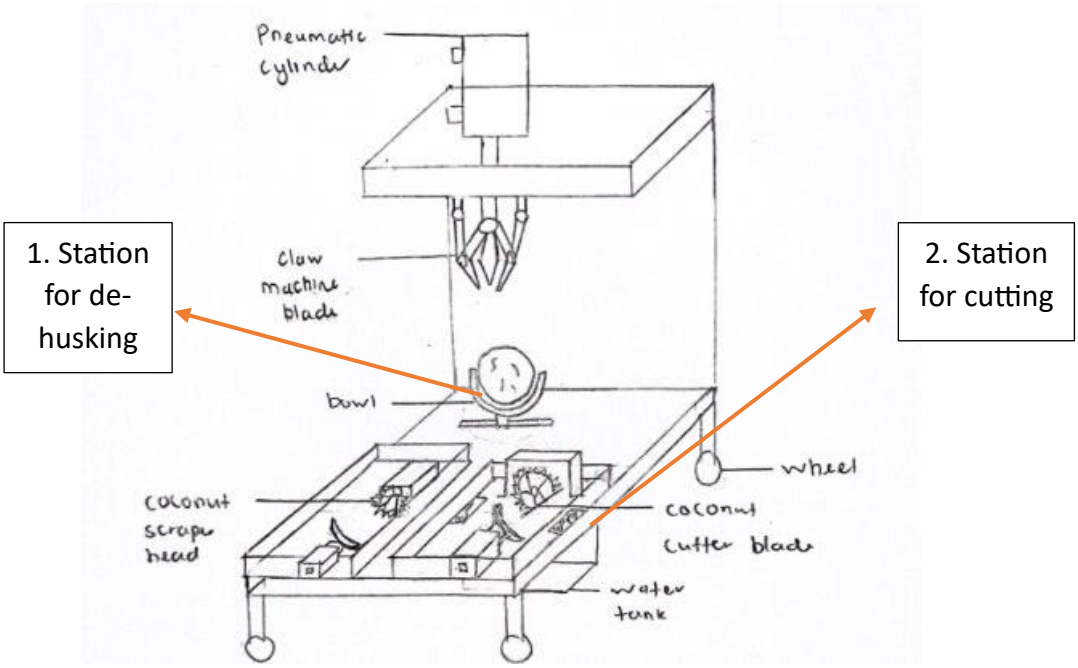


Figure 3.5: Propose solution / design

1. Station for de-husking - The de-husking process using a claw mechanism involves securely holding the coconut while the claw grips and tears away the outer husk. The coconut is placed into the machine, where the powerful, claw-like arm clasps onto the husk and pulls it off in a controlled motion. This method ensures that the coconut is de-husked efficiently without damaging the inner shell.

2. Station for cutting - The process of cutting the inner shell involves cracking the hard shell to extract the coconut meat. The coconut is placed in a machine with precise blades that cut the shell without damaging the meat. This automatic process is quick and efficient, reducing manual handling. Once the shell is removed, the coconut meat is ready for further processing.

3.6 FUNCTION PROCESS

Figure 3.6 shows the function process for each station. Coconut de-husking station & coconut cutting station.

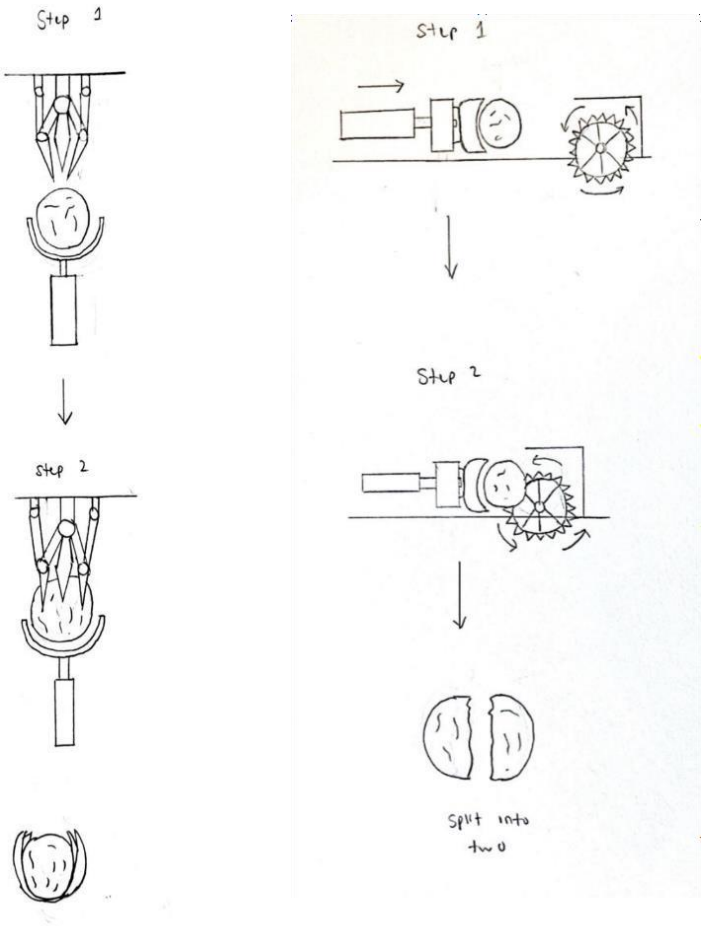


Figure 3.6: Function process for each station.

3.7 MATERIAL SELECTION

Table 3.2 shows the material that has been selected based on Table 3.1 Morphology Chart.

Table 3.2 Parts / components that has been selected

Part/component	Description	Diagram
Air compressor	Used to supply air into the air flow	
Stainless steel	For frame & stand	
Pneumatic hand level	Used to control of extend & retract pneumatic hydraulic cylinder	
Wheel	Used to move Coconut Trio-tech	
Pneumatic hydraulic cylinder	Used to converts compressed air energy into reciprocating linear motion	
Hose compressor	Channel air from air compressor	
Stainless steel bar	For clow blade	
Coconut blade cutter	Function to cut the coconut split into two	

Water tank	Portable container for transport, storage & use of water	
Ac motor	Electric motor which converts AC into mechanical power	
Battery	Providing power to the electric motor	
Pneumatic airflow regulator FCV	For adjust speed extension & retraction	

3.8 GANTT CHART

Figure 3.7 & 3.8 shows the Gantt chart that has been planned and implemented throughout the 14 weeks for final year project 1 and final year project 2.

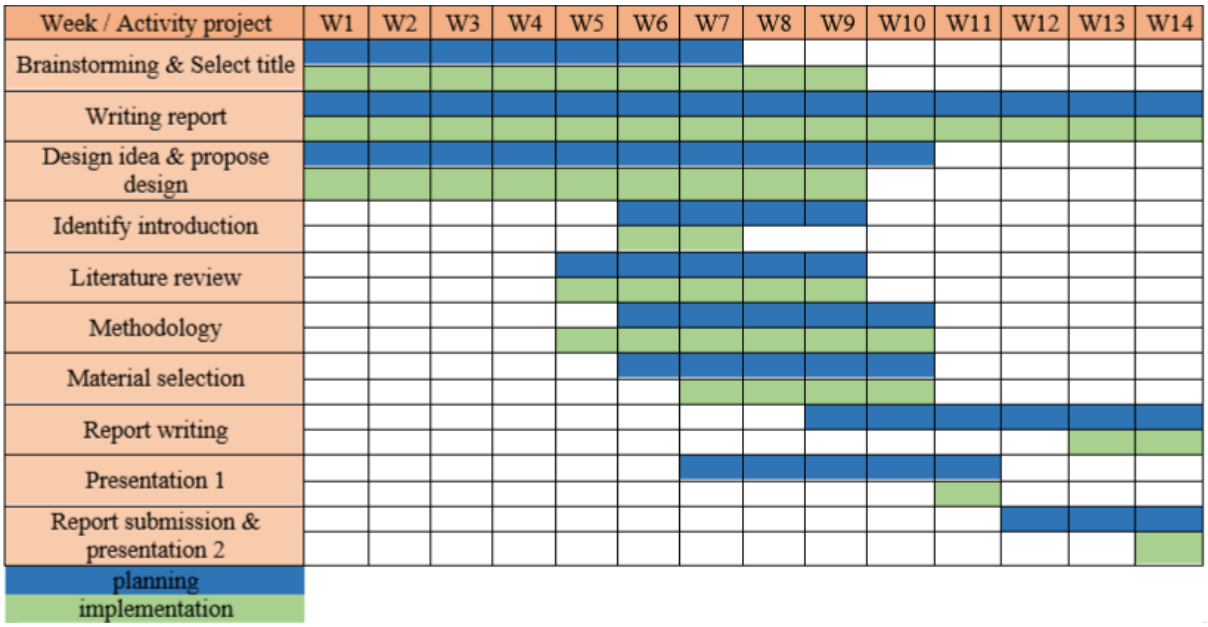


Figure 3.7: Gantt chart for final year project 1

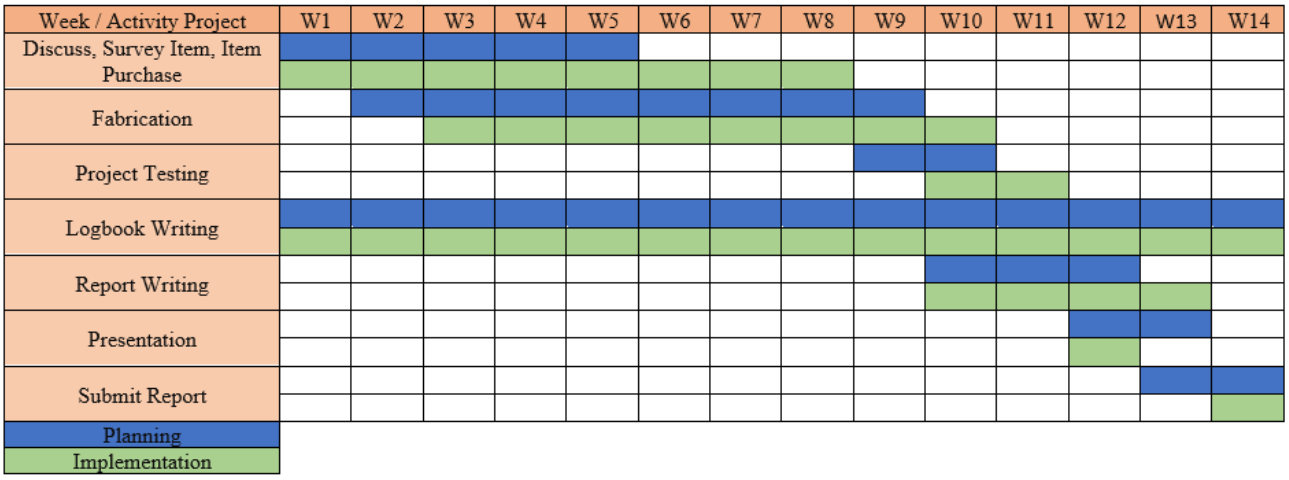
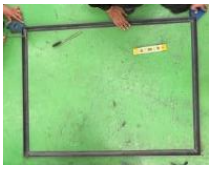


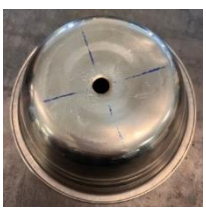
Figure 3.8: Gantt chart for final year project 2.

3.9 FABRICATION PROCESS

Table 3.3 shows the fabrication process for the Coconut Duo-Tech components, including the table base, base legs, table support, tank support, de-husking section, coconut locking bowl and wheels.

Table 3.3: Fabrication process

No.	Activities	Description
1	 	Measure and cut the angle bar steel according to the size on the drawing for the table frame.
2	 	Welding of angle bars to form the base frame.
3	 	Measure & cut plate for frame cover.
4	 	Weld plate to angle bar frame
5	 	Measure & Cut SHS [Square Hollow Section] for Base Legs.
6	 	Welding the SHS legs to the base frame.

7		Smooth welded surfaces with a grinder.
8	 	Cut the angle bars of the metal to serve as the base support. then Weld the support bar and smooth the surface.
9		Measure, cut, and weld the angle bar and plate for the water tank support, Then weld tank support under the base.
10	 	Cut the SHS for the de-husking frame, then weld and finishing the frame.
11		Cut the metal bar for the de-husking blade and then sharpen it.
12	 	Weld the blade to the de-husking frame, attach the de-husking section to the base, and grind all welds for a smooth finish.
13	 	Drill holes in two bowls for placing coconuts.

14	 	Cut the metal bar to lock the coconut, drill a hole, and then weld it to the bowl.
15		Attach the bowl to the pneumatic cylinder.
16		Cut the plate for the wheel mount and drill four holes in it for the wheels.
17	 	welding the plate with holes , then attach the wheels to the base.
18		Measure and cut the angle bar and plate. Then, weld them at table base to create a support for the cylinder. After that, take a bowl that has been securely locked and weld it on top of the support.
19		Measure the appropriate distance to place the AC motor that has the blade installed. Then, secure the motor to the table base.
20	 	Take a container to use as safety for the motor and secure it with cable ties. Then, take another container to serve as a water tank and attach a hose to this container for the flow of coconut water

3.10 CONCLUSION

At the end of this chapter on methodology, we have decided on the appropriate material for our project and have conducted a price survey for the selected material. Additionally, we have also been able to decide on a suitable design to be completed in the next semester.

CHAPTER 4

RESULT

4.1 INTRODUCTION

This chapter presents the results of the Coconut Duo-Tech project, covering various aspects of the final product and its development process. It includes detailed engineering drawings of the final design, offering visualizations of each component. The completed final product is showcased and along with an explanation of the machine's manual operation. The pneumatic circuit, essential to the machine’s functionality, is also outlined. Additionally, the chapter provides a bill of materials and project costing, including an overview of all required materials and their associated costs. A technical analysis is included to assess the performance metrics, and user feedback is presented, capturing insights and suggestions for improvement

4.2 ENGINEERING DRAWING OF THE FINAL DESIGN

Figure 4.1 shows the engineering drawing of the Coconut Duo-Tech project, providing a visual representation of the machine's frame and structural layout, including the base, support legs, and the upper section designed for the de-husking and cutting mechanisms.

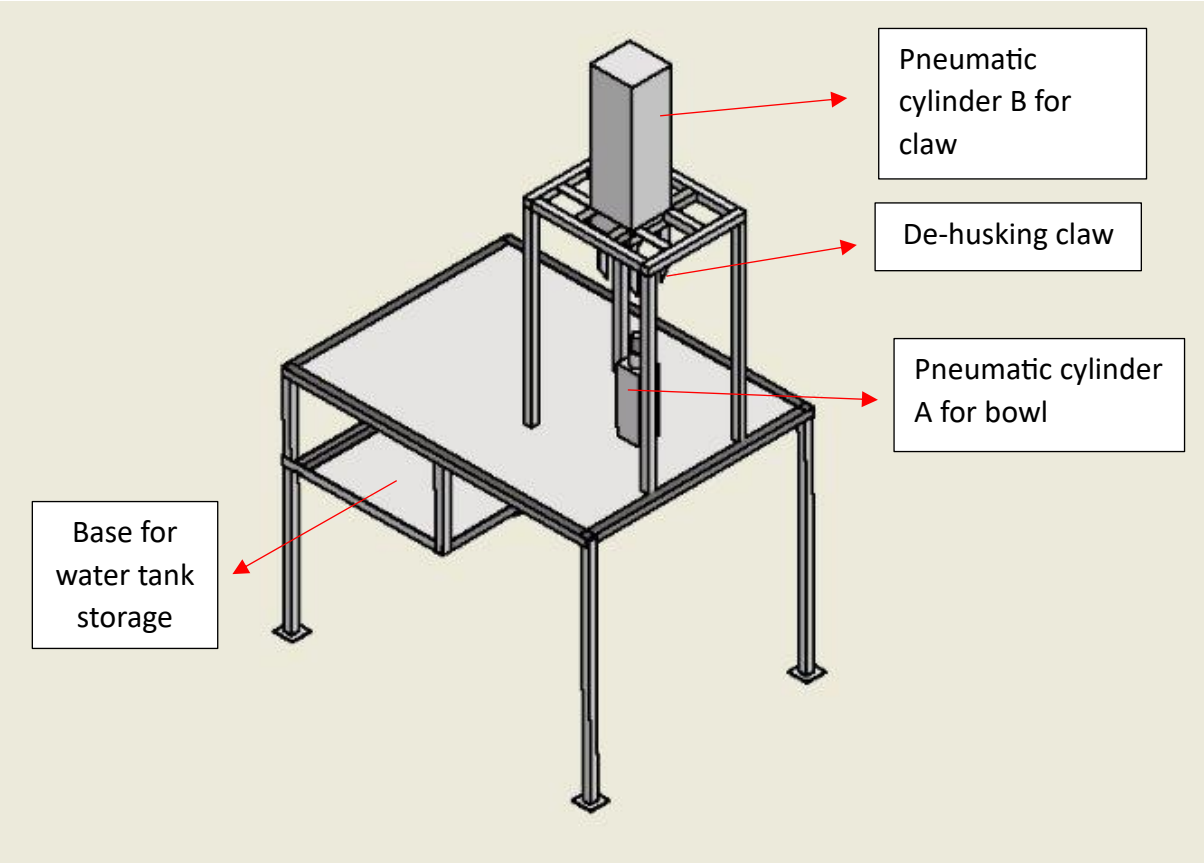


Figure 4.1: Engineering drawing for final design project

4.3 FINAL PROJECT

Figure 4.2 display images of the final Coconut Duo-Tech project, showcasing the completed machine with all components assembled and ready for operation.

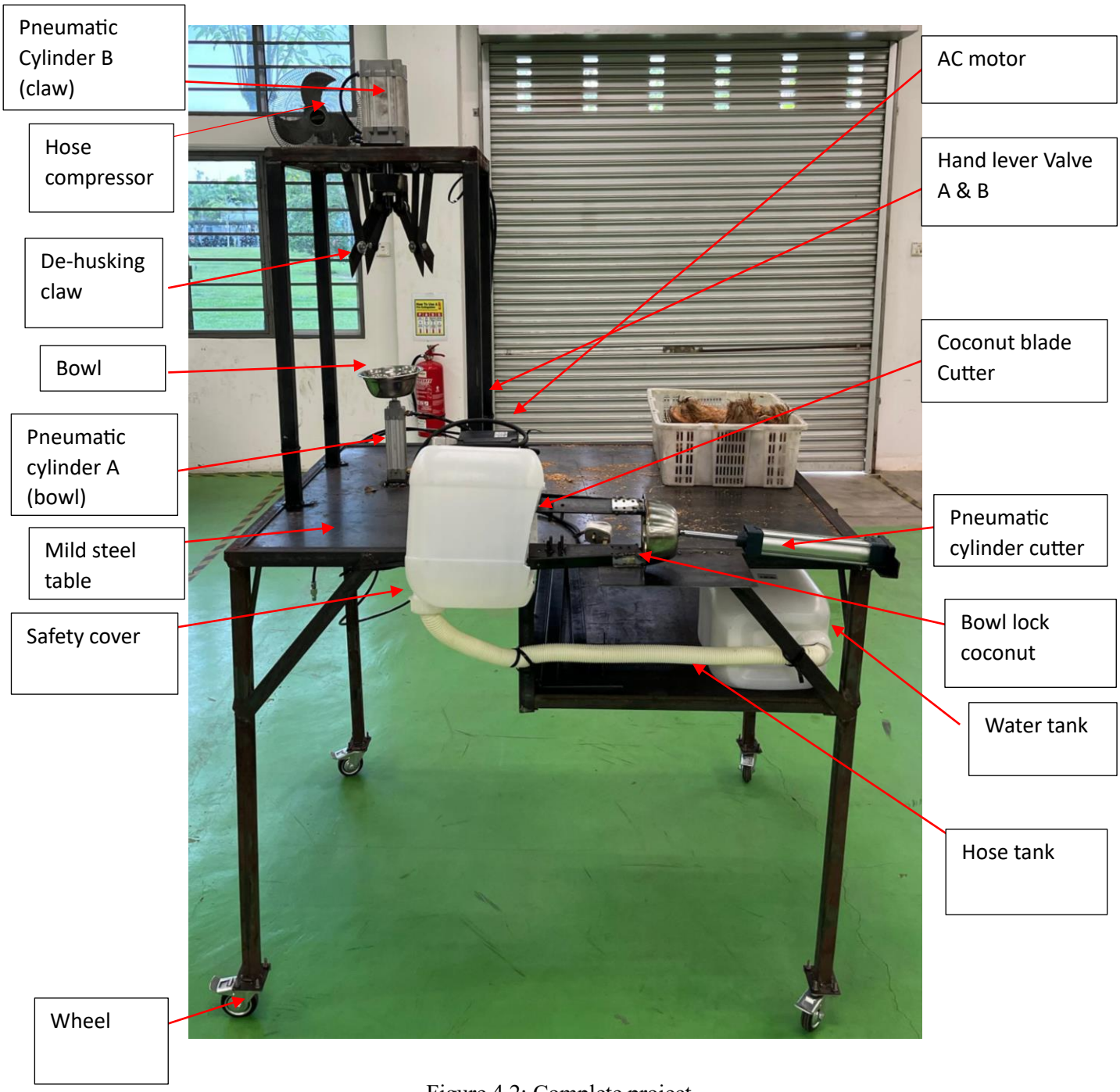


Figure 4.2: Complete project

4.4 MANUAL OPERATION

Figure 4.3 explains the manual operation process for the Coconut Trio-Tech system. The operation begins by ensuring that users have read and understood the instructions and components of the system. Before starting, operators are advised to wear safety gear, such as gloves and goggles. The compressor is then switched on, with the pressure gauge set to 6 bar. The coconut is placed securely in the de-husking bowl. Hand Lever Valve A is operated to raise Cylinder A to movement the de-husking bowl retract and extend, followed by Hand Lever Valve B to activate the de-husking claw. Once de-husking is complete, Cylinder A is retracting the movement de-husking bowl using Hand Lever A to finish the process.

Figure 4.3: Manual of operation

4.5 PNEUMATIC CIRCUIT

The pneumatic circuit for the Coconut Duo-Tech system, detailing the mechanisms involved in both de-husking and cutting operations. Figure 4.4 illustrates the pneumatic circuit setup for the de-husking process, while Figure 4.5 shows the circuit design used for the cutting process.

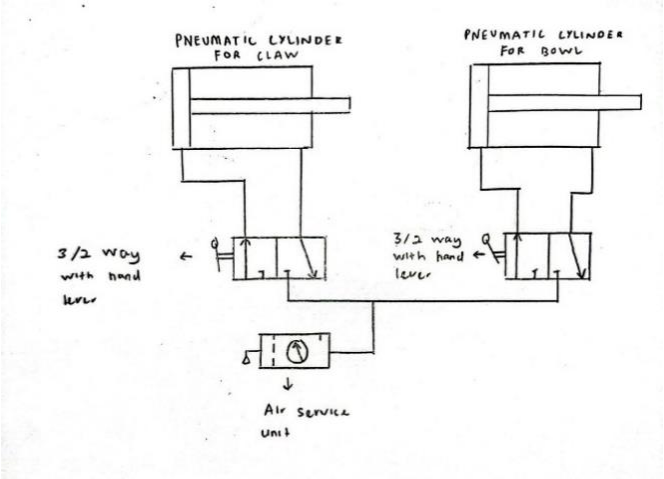


Figure 4.4: Pneumatic circuit for de-husking part.

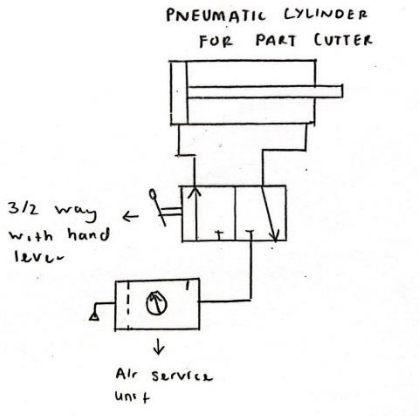


Figure 4.5: Pneumatic circuit for cutting part.

4.6 ANALYSIS

4.6.1 Cost Analysis

Table 4.1 provides the Bill of Materials (BOM) and project costing for the Coconut Duo-Tech system, detailing all necessary components along with their quantities and costs. This table offers a comprehensive breakdown of the expenses involved in the project, ensuring transparency and cost management throughout the fabrication process.

Table 4.1: Bill of Material & project costing

N0	Component	Price / unit [RM]	Unit	Total price [RM]
1	Plate [3mm x 4' x 8']	230.00	1	230.00
2	Angle bar [3mm x 30mm x 30mm x 6m]	22.00	2	44.00
3	Square hollow section [1 ¼ 'x 1 ¼ 'x 3.0mm x 6m]	51.00	1	51.00
4	Square hollow section [1 ¼' x 1 ¼' x 1.6 mm x 6m]	29.00	1	29.00
5	Flat bar [4.5 x 32 x 6m]	25.00	1	25.00
6	Pneumatic cylinder [32 mm, 150mm]	69.21	1	69.21
7	Pneumatic cylinder [80mm, 50mm]	274.16	1	274.16
8	Pneumatic cylinder [32mm, 80mm]	142.15	1	142.15
9	Pneumatic pivot rod	14.00	2	28.00
10	Flow speed control valve [8mm]	5.12	1	5.12
11	Shape air pneumatic fittings	1.19	2	2.38
12	Pneumatic mechanical hand valve	30.91	3	92.73
13	Air compressor water filter regulator	43.27	1	43.27
14	Cylinder flange bracket	39.60	1	39.60
15	Hose pipe tube [8 x 5mm x 100m]	109.00	1	109.00
16	Saw blade / polishing wheel	15.00	1	15.00
17	Motor mount bracket	10.50	2	21.00
18	Pneumatic fitting push fit hose [8mm x 3/8]	1.19	2	2.38
19	Pneumatic fitting push fit hose [8mm x 1/8]	0.79	4	3.16
20	Wheel [3" x 75mm]	7.52	4	30.08
Total cost				1256.25

4.6.2 Technical Analysis

This section will show calculation of horsepower requirement and compressor capacity for cylinder.

D: Diameter of the cylinder

A: Cross- sectional area of the cylinder

L: Length of height of the cylinder

V: Volume of the cylinder

Cylinder A [at de-husking bowl] [bore: 32mm, stroke: 80mm]

D = 32 mm, 0.032 m

A = π x [D / 2] ^2

= π x [0.032 / 2] ^2

= 0.000804 m2

V= A x L

= 0.000804 x 0.08

= 0.06432 l

Cylinder B [de-husking claw] [bore: 80mm, Stroke: 50mm]

D = 80 mm, 0.08 m

A = π x [D / 2] ^2

= π x [0.08 / 2] ^2

= 0.005024 m2

V= A x L

= 0.005024 x 0.05

= 0.2512 l

Cylinder C [at cutting] [bore: 32mm, stroke: 150mm]

D = 32 mm, 0.032 m

A = π x [D / 2] ^2

= π x [0.032 / 2] ^2

= 0.000804 m2

V= A x L

= 0.000804 x 0.15

= 0.1206 l

Compressor air flow rate [V x 10 = CFM]

A. 0.2512 X 10 = 2.512 l/min ~ 0.089 CFM
B. 0.06432 x 10 = 0.6432 l/min ~ 0.023 CFM
C. 0.1206 x 10 = 1.206 l/min ~ 0.042 CFM

Compressor recommendation: +2 HP Compressor with the estimated air flow requirement under 0.1 CFM for each cylinder, a +2 HP compressor, which typically provides around 5-8 CFM, is sufficient. This will also offer extra capacity if you want to increase the cycle rate or use additional cylinders. [1 HP = 0.746kw]

4.7 USERS FEEDBACK

A feedback survey was conducted with 7 respondents, consisting of workers and sellers involved in coconut processing. The purpose of the survey was to gather insights on the potential impact of the Coconut Duo-Tech machine, which combines both de-husking and cutting functions into a single unit.

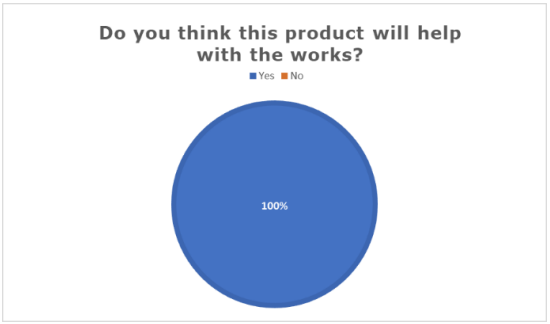


Figure 4.6: Perceived Helpfulness of the Coconut Duo-Tech Machine for Work.

Figure 4.7: Perceived Time-Saving Benefits of the Coconut Duo-Tech Machine in Production.

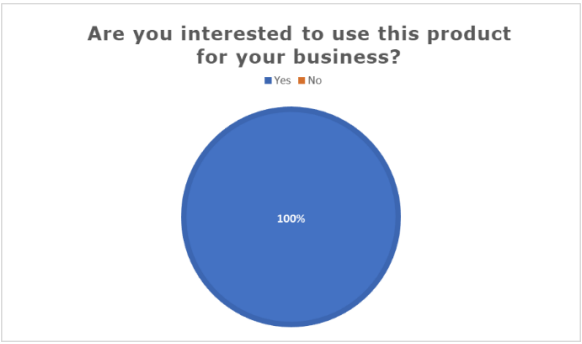


Figure 4.8: Interest in Using the Coconut Duo-Tech Machine for Business.

CHAPTER 5

DISCUSSION AND SUGGESTION

5.1 INTRODUCTION

This chapter presents a discussion on the results of the Coconut Duo-Tech project, focusing on the integration of the de-husking and half-cutting machines for small and medium enterprises. The discussion will analyze the performance, efficiency, and limitations of the machine, highlighting how it meets the needs of its intended users. Furthermore, the chapter will provide suggestions for potential improvements in both the design and functionality of the Coconut Duo-Tech system. Lastly, the chapter will conclude with a summary of the key findings and propose recommendations for future development and research in this area.

5.2 DISCUSSION

In this section, we will discuss the causes of the issues faced in the Coconut Duo-Tech project, particularly related to the de-husking and cutting processes, as well as the safety aspects of the machine. Additionally, suggestions for improving the involved parts will be presented to enhance the machine's performance and safety.

1. **De-Husking Issue**: One of the identified issues is the insufficient power of the compressor, which affects the de-husking process. The compressor may not provide enough air pressure to fully de-husk the coconut, resulting in an inefficient process. It is suggested to use a compressor with higher pressure such as compressor 5 Hp or to add an additional air tank system to ensure consistent and adequate pressure throughout the process.

2. **Dull Blades**: The blades used in the machine may become dull over time, causing the de-husking process to take longer or be less effective. As a solution, the blades should be replaced or sharpened regularly. Additionally, using more durable blade materials, such as high-quality stainless steel, could improve the lifespan and efficiency of the blades.

3. **Safety Issues in the Cutter Section**: The prototype design may not fully consider user safety, particularly in the cutter section. Without proper shields or guards, there is a risk of injury during operation. It is recommended to add protective covers to the cutting area and install safety switches that will automatically turn off the machine if any component is not correctly positioned.

4. **Lack of One-Way Flow Control Valve**: The absence of a one-way flow control valve in the pneumatic system makes it difficult to control the airflow, causing the cylinder movement to be too fast and unstable, which increases safety risks. Installing a one-way flow control valve is crucial to better control the airflow and ensure more stable and consistent movement of the cylinder.

5. **Smaller Coupling Shaft Diameter:** The smaller diameter of the coupling shaft compared to the motor shaft can cause an unstable connection, potentially leading to mechanical damage or failure. The suggested solution is to replace the coupling with one that matches the motor shaft diameter to ensure a more stable connection and prevent slippage or mechanical damage.

5.3 SUGGESTION

In this section, we will discuss several suggestions for further development of Coconut Duo-Tech project. These improvements aim to enhance the machine's performance, improve safety aspects, and introduce new features that can increase the machine's efficiency to better meet the needs of users and the industry.

1. **Add Safety Cover for Specific Parts (Cutting Section):** At the current prototype stage, safety features are minimal. Adding a protective cover to the cutting section can help prevent accidental contact with moving parts, which is essential for user safety. This cover would serve as a physical barrier, reducing the risk of injuries during operation and ensuring a safer experience for any users who interact with the machine. Implementing this cover now, even at the prototype stage, demonstrates a commitment to safety and can guide future refinements.

2. **Incorporate an Additional Section for Coconut Grating**: Expanding the machine to include a grating section would increase its versatility, making it a more comprehensive solution for coconut processing. By integrating a coconut grater, users can process coconuts beyond the initial de-husking and cutting stages, allowing them to produce grated coconut directly. This additional function would add value for small- and medium-sized businesses that rely on grated coconut for their products, enhancing the machine's appeal in the market.

3. **Add a Coconut Container**: Including a dedicated container for the coconut pieces after cutting or grating would help keep the processing area organized and make it easier to collect the output. This container could be designed to align perfectly with the cutting and grating sections, allowing the machine to be used efficiently without spillage or unnecessary handling. Additionally, a container would make the entire system more user-friendly by simplifying the process of transferring coconut products for further processing or packaging.

4. **Reuse the Collected Coconut Water as Fertilizer**: Coconut water is rich in nutrients that can be beneficial for plants. By collecting and repurposing this byproduct as a natural fertilizer, the machine can contribute to sustainable agricultural practices. Setting up a system to capture and store coconut water would enable users to turn waste into a valuable resource, aligning the project with eco-friendly goals. This sustainable approach not only adds environmental value but also provides users with an additional byproduct that can be utilized in farming, further enhancing the machine's appeal to businesses seeking sustainable practices.

5.4 CONCLUSION

The Coconut Duo-Tech machine successfully integrates two vital processes de-husking and cutting into one compact and efficient unit. This innovation not only saves space but also enhances productivity by streamlining the coconut processing workflow, allowing users to process coconuts more quickly and effectively. By addressing the key outcomes such as increased productivity, space-saving, and worker safety, the project delivers a comprehensive solution for small- and medium-sized enterprises.

The machine's design prioritizes safety with potential improvements such as adding safety covers for critical parts, integrating a coconut grater, and developing systems to collect coconut water for use as fertilizer. These additional features would further enhance the machine's versatility, ensuring it meets the needs of users while promoting sustainability.

Although some technical challenges remain, such as improving the air control system to regulate the movement of the pneumatic cylinder and optimizing the cutting section, the Coconut Duo-Tech stands as an innovative step forward in coconut processing. With continued refinement and adaptation based on feedback, this machine could play a significant role in improving productivity, efficiency, and worker safety in coconut processing industries.

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DECLARATION OF REPORT WRITING SEGREGATION

SUB-CHAPTER	DESCRIPTION OF SUB-CHAPTER
MUHAMMAD LUTFI SOLIHIN BIN SAPAR (24DKM22F1010)	
1.1	**Introduction**
1.2	**Background**
1.3	**Problem statement**
1.4	**Objective**
1.5	**Scope of project**
3.4	**Morphology process**
4.4	**Manual of operation**
4.5	**Pneumatic circuit**
MUHAMMAD IFHAM BIN TERMIZI (24DKM22F1025)	
2.1	**Introduction**
2.2	**Existing method / design for de-husking**
2.3	**Existing method / design for cutting**
2.4	**Effect of conventional method**
3.5	**Proposed solution / design**
3.6	**Function process**
4.1	**Introduction**
4.2	**Engineering drawing of the final design**
4.3	**Final product**
5.2	**Discussion**
IR KARTIKA NATALIE BINTI ROSELY (24DKM22F1082)	
3.1	**Introduction**
3.2	**Flow chart**
3.3	**Market survey**
3.7	**Material selection**
3.8	**Gantt chart**
3.9	**Fabrication process**
4.6	**Analysis**
4.7	**Respondent feedback**
5.1	**Introduction**
5.3	**Suggestion**
5.4	**Conclusion**
ENDORSEMENT SECTION	
ENDORSED BY:	……Hartiny…… **(Project supervisor)** **Date:** 21/22/2024
Official stamp:	