## I. EXECUTIVE SUMMARY:

1. Project Title: Design and Fabrication of Cacao Tablea Kneading and Molding Machine
2. Project Proponent

Project Leader: Ferdinand Q. Masbad
Project Members: Remegio S. Tinguban
Carlos L. Elloreg Jr.
Johann Henrich P. Malongo
Hyram John R. Tinguban

3. Project Location: Bacong, Negros Oriental
4. Project Duration: February 1, 2025 - January 31, 2026 (12 Months)
5. Project Cost: Php 294,063.00

## II. RATIONALE:

The production of Tablea, a traditional Filipino cocoa tablet used for making hot chocolate drinks, requires efficient and hygienic manufacturing processes. To meet the quality standard product and ensure food safety, the design and fabrication of a Tablea Kneading and Molding Machine is all the more necessary. This proposal outlines an innovative approach to achieve compliance with FDA requirements.

The proposed design and development of a combined food-safe Tablea Kneading and Molding Machine aligns with standards for food contact equipment, ensuring the production of Tablea meets stringent hygiene and safety requirements. By integrating innovative design features and adhering to meticulous fabrication processes, we aim to set a new standard in Tablea manufacturing that possesses both quality, quantity, and compliance.

This initiative not only enhances the safety and quality of Tablea production but also contributes to the sustainability and growth of the local cocoa industry. Through gradual improvement and adherence to regulatory standards, we seek to establish ourselves as a trusted provided of food-safe equipment in the local and global markets.

### General Objective

Design and develop a tablea kneading and molding machine that meets FDA guidelines for food contact materials and processes.

### Specific Objectives

1. Ensure hygiene and cleanliness by implementing features that facilitate easy cleaning and sanitization to prevent contamination.
2. Enhance efficiency by optimizing the molding and kneading process to increase overall productivity and consistency in Tablea production.

## III. MATERIALS AND METHODS:

**Design Specifications of proposed machine highlight the following features:**

**Material Selection**

- Use food-grade stainless steel for all components that come into contact with Tablea mixture.
- Non-toxic and food-grade plastics for non-contact parts, preventing any form of contamination of the food product.

**Hygienic Design**

- Smooth surfaces to prevent accumulation of residues and facilitate thorough cleaning.
- Easy disassembly of selected components for regular cleaning and maintenance.

**Molding Process Optimization**

- Precision-engineered and identical production of molds to ensure consistent shape and size of Tablea tablets.
- Temperature-controlled molding surfaces to maintain uniform quality and texture of Tablea.
- The shape of proposed mold currently shares similar features with the manual mold used by Teldy's Tablea in their production. Other optimization processes for the duration of R&D project will be taken into account to examine the viability and efficiency of a multiple tablea-molder setup.

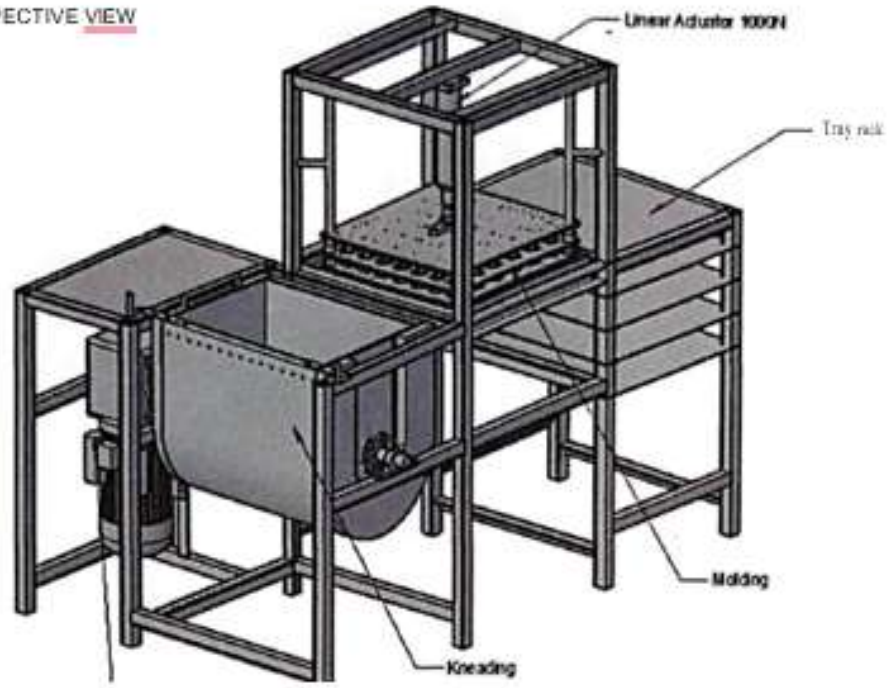
**Safety Features**

- Install safety guard especially for the prime mover; incorporate other safety features to avoid contamination during the production process.
- Proposed design taking *into* account the production area of the target beneficiary for accessibility to operators.

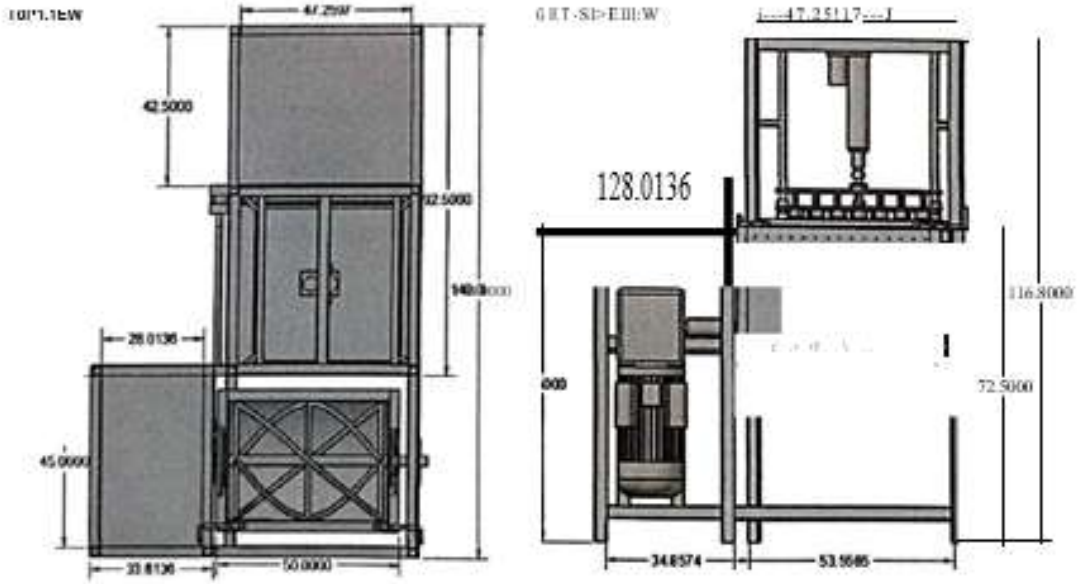
**Design Setup of Cacao Tablea Kneading and Molding Machine**

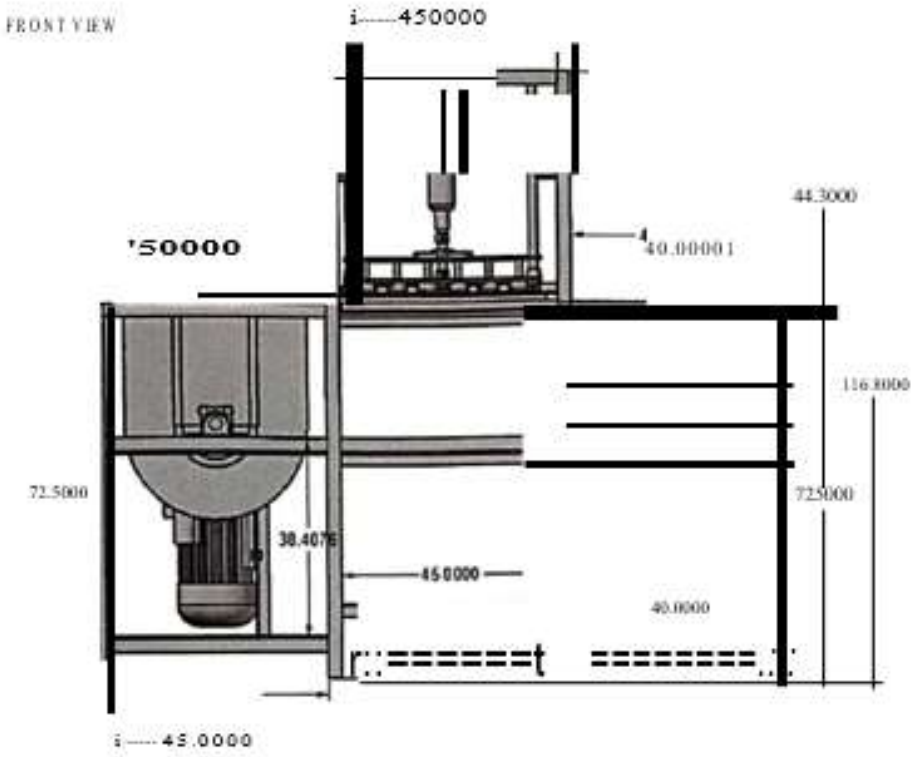
As an overview, the proposed design features the kneading process first powered by a 1.5 hp Geared Motor with the kneaded cocoa liquor then being transferred to the molding process enabled by the linear actuator of 100 kN, aiming to produce several pieces at once before being moved to the tray rack of several layers to settle for a few minutes.

PERSPECTIVE VIEW




*Isometric View of Design Setup*






*Orthographic Views of Design Setup*

## IV. WORKPLAN (Gantt Chart):

| Project Flow of Activities | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| a) Design and fabrication of alpha prototype | | | | | | | | | | | | |
| b) Selection of materials, collection of data, and purchase of equipment / supplies | | | | | | | | | | | | |
| c) Fabrication of the beta prototype | | | | | | | | | | | | |
| d) Configuration of the final design of the device | | | | | | | | | | | | |
| e) Testing and Evaluation/ Performance Analysis of the Final Product | | | | | | | | | | | | |
| f) Patent application and presentations | | | | | | | | | | | | |

## V. EXPECTED OUTPUTS:

The project aims to achieve the following outputs:

1. Prototype equipment *(Include target parameters, special features, etc.)*
   *Performance Criteria*
   - Cocoa liquor to be used shall be from commonly or locally grown cacao with 99% purity
   - Continuous operation
   - Recovery Efficiency, 90.0% minimum
   - Output Capacity, 1000 pcs/hr minimum

   *Other ObseNations*
   - Ease of transporting the machine
   - Ease of cleaning the machine
   - Ease of adjusting and repairing of parts
   - Ease of loading input and collecting output
   - Safety requirements

2. Patent *(Invention, utility model and industrial design)*
   *File Intellectual Property rights under the Utility Model during the last three months of the R&D project.*

3. Publication
   *Publish the original research in a Scopus-indexed journal during the last three months of the R&D project.*

## VI. TARGET BENEFICIARIES *(Clients, size of market, expected outcome/effects of the use of the project output)*

The Teldy's Tablea is named after the founder who started the business in 1996 as cacao beans trader and eventually engaged in tablea business in 2004. The proprietor later put up her own equipment in 2014 located in Bacong, Negros Oriental and two years thereafter registered here business as Teldy's Tablea Manufacturing as a manufacturer and distributor of Philippine Tablea within the whole province of Negros Oriental and frequently to some other markets within the Philippines.

Recently, the enterprise seeks to expand their market and establish a constant process outside Negros Oriental following the rise of their new building facility, and advent of digital platforms. With Teldy's Tablea having a team of around 10-20 employees focused on manual molding of tablea, they are aiming to introduce mechanization and automation technologies in daily operations, and escalate their production capacity.
During the market validation visit by MEIC-NORSU last November 2024, the team observed the manual molding process of cocoa liquor wherein the staff are repeatedly molding and kneading the cocoa liquor after making several tablea pieces to prevent the liquor from hardening during the process. As mentioned previously, this is the main aim of the project proponent in automating such process through mechanization.

After the production period, the team continued to observe the production area of Teldy's Tablea wherein best food safety practices including food handling, good hygiene, current Good Manufacturing Practices (cGMPs) are evident in both the equipment and personnel and are observed at all times. Given the expansion of the firm, the increase area will give way to the fabricated machine, complementing the function of the current personnel, and can be reproduced in the near future.

## VII. BILL OF MATERIALS

| ITEMS OF EXPENDITURES | QTY | COST (Php) | TOTAL P UCE (Php) |
|---|---|---|---|
| **A.** Maintenance and Other Operating Expenses (MOOE)<br>Su lies and Materials | | | |
| 1. 1 length Pipe Stainless Steel, 1mm Thickness, 32mm Dia. | 1 | 19,878/length | 19,878 |
| 2. 2 length Round Bar SS 10mm x 6 meters | 2 | 3,500/length | 7,000 |
| 3. 1 length Round Bar SS 16mm x 6meters | 2 | 5,000/length | 5,000 |
| 4. 1 length Round Bar Stainless Steel, 5mm Dia. | 2 | 3,ODO/length | 3,000 |
| 5. 2 ft. Round Bar Stainless Steel, 50mm Dia. | 2 | 1,500/ft | 3,000 |
| 6. 4 length Angle Bar SS 3/16" x 1" x 1" SUS304 | 4 | 2,800/length | 11,200 |
| 7. 3 length Square Tube SS 1" x 1" x 2mm SUS304 | 3 | 3,400/length | 10,200 |
| 8. 2 pc Metal Sheet Stainless Steel, 1.5mm x 4'x8', SUS 304 | 2 | 15,000/pc | 30,000 |
| 9. 1 pc Metal Plate Stainless Steel, Gauge 11, 4' x 8' | 1 | 13,000/pc | 13,000 |
| 10. 1 length Shaft Stainless Steel, SUS304, 1" Dia. x 6m | 1 | 6,500/length | 6,500 |
| 11. 2 pc Shaft Couple Connector Stainless Steel, 25mm to 25mm | 2 | 3,960/pc | 7,920 |
| 12. 2-unit Heating Element Stainless steel, 300W | 2 | 2,400/unit | 4,800 |
| 13. 1 unit AC Geared Motor 220V, 1.5HP, Single Phase | 1 | 10,500/unit | 10,500 |
| 14. 25 pcs Bolt & Nut with Washer Stainless Steel, **3/8" x 1 1/2"** | 25 | 300/pc | 4,500 |
| 15. 2 pcs Pillow Block Stainless Steel, UCP205 | 2 | 1,500/pc | 3,000 |
| 16. 1-unit Variable Frequency Drive 220v, 1 phase to 1 phase, 1.SHP | 1 | 9,400/unit | 9,400 |
| 17. 1 set Controller Temperature Controller with Thermostat | 1 | 900/set | 900 |
| 18. 1 pc Solid State Relay SSR-40DA | 1 | 600/pc | 600 |
| 19. 1 unit Thermocouple K-type 1.5M | 1 | 450/unit | 450 |

| | ITEMS OF EXPENDITURES | QTY | COST (Php) | TOTAL PRICE (Php) |
|---|---|---|---|---|
| 20. | 2-meter Guitar String Extra Light: .008" Dia | 2 | 750/meter | 1,500 |
| 21. | 15 pc Spring Plunger Thread Size: MB Ball Size: 5mm Height: 16mm Height: 16mm Spring Force Final Pressure: 73N | 15 | 350/pc | 5,250 |
| 22. | 6 set Linear Rail Guide 10mm shaft Dia. 900 mm length with SK Support and SCS Bearing | 6 | 3,000/set | 18,000 |
| 23. | 1 set Stepper Motor Nema17 Stepper Motor with Linear Rail guide and Driver | 1 | 10,000/set | 10,000 |
| 24. | 1-unit Linear Actuator 12V Supply, 1000N, 150mm Stroke | 1 | 4,500/unit | 4,500 |
| 25. | 3 pcs Solenoid Linear Magnetic Solenoid, 12VDC Supply, 35mm Stroke | 6 | 920/pc | 5,520 |
| 26. | 2 pcs Microcontroller Arduino Uno R3 | 2 | 1,400/pc | 2,800 |
| 27. | 1 pc Relay Module Arduino Type, SV, 8-Channel | 1 | 600/pc | 600 |
| 28. | 1 unit Display 12C OLed Display, SSD1309, 3.3VDC-SVDC | 1 | 1,250/unit | 1,250 |
| 29. | 5 pcs Sensor Inductive Proximity Sensor, 12V | 5 | 700/pc | 3,500 |
| 30. | 1 pc Power Socket 250VAC 10A C14 Inlet Socket Connection Plug | 1 | 300/pc | 300 |
| 31. | 2 pcs Power Supply Converter 12VDC to SVDC SA Step Down Power Supply Converter | 2 | 500/pc | 1,000 |
| 32. | 1 unit Power Supply 220VAC to 12VDC, Switching Power Supply | 1 | 1,000/unit | 1,000 |
| 33. | 1 pc Power Cable Female to Male, 3 Pin, 1.5 meters | 1 | 300/pc | 300 |
| 34. | 30 meters Wire Cable, MTW/AWM Single Conductor #16 | 30 | 120/meter | 3,600 |
| 35. | 1 pc Emergency Stop Push Button Twist Release, Mushroom Head, Panel Mount, 22mm Cut-out, Normally Close Contact | 1 | 600/pc | 600 |
| 36. | 1 pc Push Button Switch Normally Open Contact, 22mm Cut-out with 12VDC Led Indicator Light, Green | 1 | 1,200/pc | 1,200 |

| | ITEMS OF EXPENDITURES | QTY | COST (Php) | TOTAL PRICE (Php) |
|---|---|---|---|---|
| 37. | 1 pc Push Button Switch Normally Open Contact, 22mm Cut-out with 12VDC Led Indicator Light, Red | 1 | 1,200/pc | 1,200 |
| 38. | 5-meter Shrinkable Tube 5mm Dia. | 5 | 200/meter | 1,000 |
| 39. | 30 meters Metal Conduit Flexible Hose 1" dia. | 30 | 780/meter | 23,400 |
| 40. | 2 pcs Rubber Gasket Silicon U-Shaped Strip, 1-1.5mm Suit, 300cm length | 1 | 1200/pc | 2,400 |
| 41. | 1 set Drill Bit Stainless Steel, 2.5mm-13mm Dia. | 1 | 8,000/set | 8,000 |
| 42. | 7 kilo Welding Rod Stainless Steel, 308, 2.5mm Dia. | 7 | 900/kilo | 6,300 |
| 43. | 7 kilo TIG Filler Rod ER308L, 2mm Dia. | 7 | 1,500/kilo | 10,500 |
| 44. | 1 spool MIG Wire Stainless Steel, .8mm Dia. | 1 | 3,300/spool | 3,300 |
| 45. | 1 pc Welding Flux Paste 200g | 1 | 700/pc | 700 |
| 46. | 5 pcs Cup Brush Stainless Steel | 5 | 300/pc | 1,500 |
| 47. | 5 pcs Steel Brush Stainless Steel | 5 | 150/pc | 750 |
| 48. | 10 pcs Flap Discs Stainless Steel, 4" Dia. | 10 | 200/pc | 2,000 |
| 49. | 10 pcs Buffing Polishing Wheel 4" Dia | 10 | 250/pc | 2,500 |
| 50. | 3 bar Buff Soap/Gel 65mm x 170mm x 40mm | 3 | 750/pc | 2,250 |
| 51. | 10 sheet Sand Paper Grit 100 | 10 | 75/pc | 750 |
| 52. | 5 sheet Sand Paper Grit 500 | 5 | 75/pc | 375 |
| 53. | 5 sheet Sand Paper Grit 1000 | 5 | 75/pc | 375 |
| 54. | 10 pcs Carbide Tip {sandtip brand) 3/8" Size, Straight, Color Blue | 10 | 300/pc | 3,000 |
| 55. | 5 pcs Carbide Tip {sandtip brand) 3/8" Size, Left, Color Blue | 5 | 300/pc | 1,500 |
| 56. | 5 pcs Carbide Tip {sandtip brand) 3/8" Size, Right, Color Blue | 5 | 300/pc | 1,500 |
| 57. | 1 set Handtap M8x1.25 | 1 | 1000/set | 1,000 |
| | **Sub-total** | | | **286,068** |
| | | | | |

| ITEMS OF EXPENDITURES | QTY | COST (Php) | TOTAL PRICE (Php) |
|---|---|---|---|
| B. **Semi-expendable Item** *(e.g., pH meter, torque meter, other testing and debugging equipment should not exceed Php 50,000.00)* | | | |
| 1. 1-unit Digital Multimeter Hand-held, True RMS Reading, 10Ampere AC Max, 10Ampere DC Max, 600VAC Max | 1 | 1,599/unit | 1,599 |
| 2. 1-unit Digital Temperature Meter Handheld, Infrared Thermometer, -30°C Min, ±1.5 % Accuracy, °C and °F Measurements | 1 | 1,599/unit | 1,599 |
| 3. 1 unit Tachometer Hand-held | 1 | 1,599/unit | 1,599 |
| 4. 1 unit Noise Level Meter Range: 30-130 dB(A) | 1 | 1,599/unit | 1,599 |
| 5. 1 unit Weighing Scale Capacity: 50 kg Resolution: 0.1 kg | 1 | 1,599/unit | 1,599 |
| **Sub-total** | | | **7,995** |
| **Total Cost of BOM** | | | **294,063** |

| | SUBMITTED BY<br>Focal erson/Researcher | ENDORSED BY<br>Universi President |
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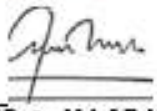
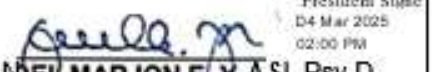
| Signature |  |  President Signe D4 Mar 2025 02:00 PM |
| Printed Name | FERDINAND Q. MASBAD, Ph.D.<br>CIT Facul | NOEL MARJON E. Y. ASI, Psy.D.<br>Universit sident |
| Date | March 3, 2025 | March 3, 2025 |