DOST Form 2 (for Basic/Applied Research)
DETAILED RESEARCH & DEVELOPMENT PROJECT PROPOSAL

(1) PROJECT PROFILE
Program Title: Grants-in-Aid
Project Title: Development and Pilot Testing of Coconut Chips Air Fryer
Project Leader/Sex: Dr. Irven B. Cuen
Project Duration (number of months): 1 Year
Project Start Date: May 2023
Project End Date: May 2024
Implementing Agency: Western Philippines University
Address/Telephone/Fax/Email: Aborlan, Palawan, Region IVB

(2) COOPERATING AGENCY/IES

Reals Food Products Inc.

(3) SITE(S) OF IMPLEMENTATION

IMPLEMENTATION SITES NO.	COUNTRY	REGION	PROVINCE	DISTRICT	MUNICIPALITY	BARANGAY
1.	Philippines	IVB	Palawan	3rd	Aborlan	San Juan

(4) TYPE OF RESEARCH
_____ Basic
__X__ Applied

(5) R&D PRIORITY AREA & PROGRAM (based on HNRDA 2017-2022)
__X__ Agriculture, Aquatic and Natural Resources
Commodity: Coconut
_____ Health
Priority Topic: _____
_____ Industry, Energy and Emerging Technology
Sector: _____
_____ Disaster Risk Reduction and Climate Change Adaptation
_____ Basic Research
Sector: _____

Sustainable Development Goal (SDG) Addressed

- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

(6) EXECUTIVE SUMMARY

Nowadays, the price of coconut has evidently declined. Local copra prices plunged by around 45% despite government interventions. In April 6, 2019 price watch from the Philippine Coconut Authority (PCA) showed that the average farm-gate price had decreased to Php 13.71 per kilogram from Php 25.13 a kilogram in 2018. This was due to the glut in the supply of coconut oil in the world market. Thus, the Department of Agriculture (DA) and the Philippine Coconut Authority (PCA) have been looking for ways to boost domestic demand while also limiting the entry of alternative products. One possible solution to this problem is the government's approval of the increase in the coco methyl ester (CME) content in local biodiesel blend from 2 percent (B2) to 5 percent (B5) (Ocampo, 2019). Producing other products from coconut other than oil is timely to help address the problem.

Coconut chip is a unique product of the Reals Food Products Company in Puerto Princesa, Palawan. Its demand, according to the company owner, is growing that they need to increase their level of production to cope. In fact, they are on their way to expand their market internationally because this product is highly embraced by foreign people. Their major limitation is the absence of processing machineries that will suit to their product requirement. Their unique processing methods and techniques to arrive a product unique to them in terms of configuration such as, shape, size, thickness, presentation, taste and others require a specific design of machines. Currently, all their processes in coconut chips production are made manually using improvised equipment. Obviously, this method in a commercial-scale production is labor-costly, not so hygienic and may not guarantee consistency of product quality. Thus, this company really needs technology assistance in terms of appropriate

processing machineries to boost their capacity to produce and maintain product quality. Helping this developing company, which has great potential and promising product, to foster is a worth undertaking. Its growth and success certainly contribute of the growth of local economy.

(7) INTRODUCTION

(7.1) RATIONALE/SIGNIFICANCE

In coconut chip production, air frying is the method used in cooking or toasting. Generally, this method of toasting uses only hot air. Commonly it uses electrically-powered cooking equipment with heating element and fan to generate circulating hot air. This method of frying gains attention because no additional oil is needed thus getting rid of high-fat food.

There are air fryers that can be availed in the market. However, these models are designed for home use, have limited capacity, and are not suitable for commercial-scale production. In addition, these air fryers have no stirring mechanism and heat is not distributed equally inside the cooking chamber. Currently, the Reals Food Products company is using this equipment and has identified some of its limitations which include the very small capacity, tedious manual and regular stirring, and high risk of burns in stirring. Generally, this process is very laborious and energy-intensive. Thus, this study is aimed to develop an air fryer with commercial-scale capacity, a mechanized stirring mechanism, safe to use, efficient, and food grade. As Real's Food Products is one of the major food processors in Palawan, improving the production of one of their major products, the coconut chips, through the development of a machine according to the specifications they require so as to produce the quality required by their customers, will make this local industry competitive and eventually, will leverage the local economy.

(7.2) SCIENTIFIC BASIS/THEORETICAL FRAMEWORK

Coconut meat price, which is the primary product of coconut farmers, is essentially unstable with time. The farmer depends on the price dictated by the traders. They are not given the attention to develop and empower as entrepreneurs in the coconut industry. They remain poor among all other actors in the supply chain (Moreno et al., 2020). As such, interventions must be made for coconut farmers to receive the due benefit from their produce. Coconut meat product innovation is one of the solutions such as coconut chips, desiccated coconut, and other products.

(7) REVIEW OF LITERATURE

Existing Air Fryers

The following are the existing air fryers that can be found in the market. Generally, these air fryers are designed for household use only and not for commercial-scale production. Its design is not really suited for toasting coconut chips because it has no stirring component. Stirring is very much needed to ensure equal distribution of heat and enhance even cooking or toasting of chips.

Kyowa Convection Oven (KW-3911). This air fryer (Figure 1) is produced by Kyowa Appliance Company. It is made of tempered glass pot and has a capacity of 10 liters. Its power requirement is 1300W with a voltage requirement of 230 Volts and 60 Hertz of frequency. It has a dimension of 360mm x 360mm x 3000mm.

Figure 1. Kyowa convection oven

Best Heim Air Fryer. This air fryer (Figure 2) is produced by Ningbo Pershow Electrical Appliance Company. This company specializes in manufacturing kitchen appliances and air fryer is one of their

major products. This model of air fryer has a capacity of 2.5 liters and its power requirement is 1300 W, 220 Volts, and 60 Hertz of frequency.

Figure 2. air fryer (*Best Heim*)

Cuisinart Air Fryer Toaster Oven. It is an 1800-watts stainless steel multicooker (Figure 3). It measures 15.50 inches long, 16 inches wide, and 14 inches high. It has an interior volume of 0.6 cubic foot. It has an adjustable thermostat with a 60-minute timer/ auto shutoff.

Figure 3. Cuisinart Air Fryer Toaster Oven

Breville Halo Air Fryers. (Figure 4) It is a 1400 watts air fryer with a dimension of 32 cm in height. This air fryer has a dual heat function, non-sticky rotating bowl and tilt mechanism to enhance even cooking of food. All removable parts are dishwasher-safe, easy to clean and convenient. It offers a healthy way to cook chips and a variety of other delicious food.

Figure 4. Breville VDF105 Halo Plus air fryer

Philips Avance XL Digital Air Fryer. It uses Rapid Air Technology to fry foods with little or no added oil

(Figure 5). It has an extra-large capacity and can hold 2.65 pounds of food. It has a digital touch screen that is very user-friendly. The digital control includes a timer that accommodates cooking time up to 60 minutes, a ready indicator, and an auto-off function. The temperature control is completely adjustable to the desired temperature between 150 and 390 Degrees Fahrenheit.

Figure 5. Philips Avance XL Digital Air fryer

(9) METHODOLOGY

The paradigm (Figure 6) shows the general flow of activities in the conduct of this project. Limitations of existing machines and the desired specifications from the partner industry will become the bases of innovation to come up with an improved prototype. The identified machine specifications will be considered as the ultimate criteria to be met in the development. The conceptualized design will be drawn using Computer Aided Drafting (CAD) or SolidWorks Softwares for easy simulation. The completed machine design and specifications will serve as guide and reference in the procurement and fabrication processes. Fabrication will be made at the Technology Innovation Center of the Western Philippines University to ensure close supervision and monitoring. Evaluation of machine performance will be conducted once the criteria has been met. To ensure the functionality of the machine, pilot testing will be made at the industry partner. Through this, the machine will be subjected to actual operation and its components will be tested at a longer period to determine its strength over fatigue. Once development is completed, intellectual property protection will be sought.

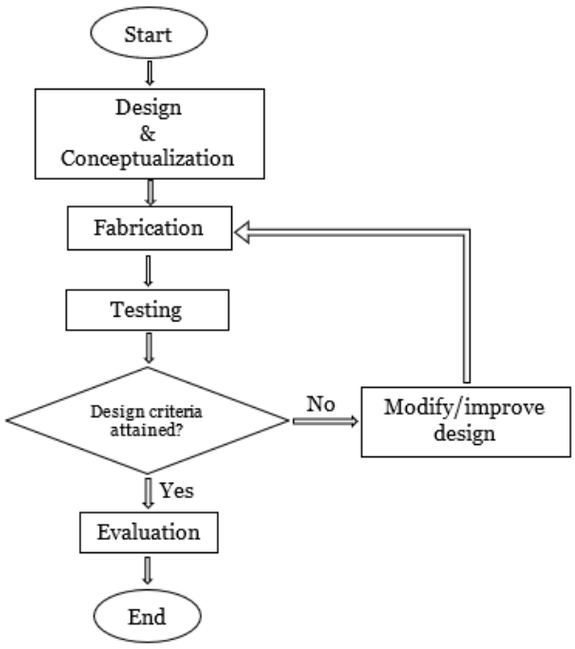

Figure 6. Paradigm of project activities

(10) TECHNOLOGY ROADMAP (if applicable) (use the attached sheet)

(11) EXPECTED OUTPUTS (6Ps)

1. *Publication*- The research findings of this project are intended for publication in corresponding journals and presentation in any research forum.
2. *Patent*- The machine will be subjected to intellectual property protection. It will be applied for either Patent or as Utility Model.
3. *Product*- Commercialization of the machine will be sought to provide opportunities to others who want to venture into similar products.
4. *People Services*- The machine can be used for training and extension activities of the University.
5. *Places and Partnerships*- Primary partner and beneficiary of the study is the Reals Food Products Company. Other possible linkages and partnerships will be established in the commercialization process and with others who wish to venture into the same business through the extension activities of the University.
6. *Policies*- the study may provide possible inputs to policy-making bodies to boost local utilization of coconut and patronizing locally-made products and processing machinery.

(12) POTENTIAL OUTCOMES

1. Increased level of production of coconut chips
2. Meet the required market demand
3. Increase income and enhance employment

(13) POTENTIAL IMPACTS (2Is)

1. Empower coconut farmers
2. Boost the local economy

(14) TARGET BENEFICIARIES

The primary beneficiary of this project is the Reals Food Products Company, which is the local industry partner of this project. Mechanization of their processes will certainly reduce drudgery and increase their production capacity.

(15) SUSTAINABILITY PLAN (if applicable)

(16) GENDER AND DEVELOPMENT (GAD) SCORE (refer to the attached GAD checklist)

(17) LIMITATIONS OF THE PROJECT

The prevailing major constraint in project implementation is the delay especially in the procurement of supplies and materials. This is the common primary cause of not achieving milestones as planned. Measures to help expedite its process must be pursued such as prompt submission of procurement documents, correct materials and equipment specifications, and updated prices.

(18) LIST OF RISKS AND ASSUMPTIONS RISK MANAGEMENT PLAN (List possible risks and assumptions in attaining target outputs or objectives.)

(19) LITERATURE CITED

Internet

FRED VAN DER WEIJ, (2014). Breville VDF105 Halo Plus Air Fryer (Retrieved from http://www.healthfryers.com/reviewers/breville/halo-plus-health-fryer-vdf105/)

Healthy but Smart (HBS)writers (2019). Philips Avance XL Digital Air fryer. (Retrieved f rom http://healthybutsmart.com /philips-airfryer.).

JEP, (2020). Kyowa Convection Oven (KW-3911).(Retrieved from https://www.smapplia ce.com/km-3911-kyowa-convection-oven-10153811).

KOCHI, (2020). Coconut Development Board. (retrieved from https: //www.coconutboar d. gov. in/index.aspx).

LOLA DOMNINA B. PASTANO, (2016). Journal of Advanced Agricultural Technologies.

(Retrieved from: www.wikipedia.com).

MANIKANTAN, et al., (2015). Indian Coconut Journal. (Retrieved from https//www.krish i.icar.gov.in>jspuiPDF.).

SHERRY HEIM, (2020). Best Heim Ningbo Pershow Electrical Appliance Company. (Ret rieved from https://m.made-in china.com/company-preshow.).

WALMART, (2020). Cuisinart Air Fryer Toaster Oven. (Retrieved from http;//www.amaz on .com/Cuisinart-TOA-60-Fryer-Toaster-silver/dp/BO1KOW8LTE.).

Journal

Marife L. Moreno,John K. M. Kuwornu &Sylvia Szabo
Overview and Constraints of the Coconut Supply Chain in the Philippines. International Journal of Fruit Science. Pages S524-S541 | Published online: 06 Apr 2020

PANAGSAGAN, J. (2010). Philippine Agricultural Engineering Standard. *Agricultural Machinery – Fruit Dryer – Specifications,* Vol 248, 1-14.

(20) PERSONNEL REQUIREMENT

Position	Percent Time Devoted to the Project	Responsibilities
Program/Project Leader	30%	a. Manage the implementation of the program b. Serve as Project Leader and manage the implementation of the two (2) incorporated projects in the program namely: -*Development of Coconut Chips Air Fryer Development of Coconut Meat Chipper* c. Facilitate/Assist in personnel hiring d. Provide technical expertise in meeting the specific technical parameters required by Real's Food Products and demonstrate creative thinking in the conceptualization and development of the design of the machines e. Provide detailed machine specifications f. Generate final list of machine parts and specifications g. Facilitate/assist in procurement process h. Assist Procurement Office in gathering market information of the materials and equipment suppliers and prices to expedite the process of procurement i. Supervise material use and custody of equipment j. Supervise and close monitoring of fabrication process k. Conduct evaluation of machine performance l. Facilitate and supervise pilot testing m. Conduct impact assessment of the machine to the partner industry n. Conduct further

		innovation/modification (if necessary) o. Prepare regular project progress reports p. Draft specifications and claims for IP application q. File IP protection at IPO Office r. Facilitate the overall IP process until awarding of Patent Certificate s. Presentation of research output to related research conferences/fora t. Publication of research output u. Facilitate technology transfer to the partner industry v. Prepare project terminal report
Research Assistant	100%	a. Assist in generating detailed drawing and specifications of the machine b. Assist in identification of materials needed for fabrication c. Assist in preparing procurement documents d. Assist the procurement office in gathering market information of the materials and equipment suppliers and prices to expedite the process of procurement e. Assist the fabricator in the construction of the machine f. Assist in the preparation of progress reports g. Assist in the performance evaluation of the machine h. Assist in the modification of the machine if necessary i. Assist and monitor pilot testing j. Assist in conducting impact assessment of the machine k. Assist in generating machine specifications for IP application
Skilled Fabricator	100%	a. Fabricate the prototype of the Coconut chips air fryer b. Assist in the machine evaluation c. Assist in Pilot Testing d. Conduct further modification if necessary
(21) BUDGET BY IMPLEMENTING AGENCY		

IMPLEMENTING AGENCY	PS	MOOE	EO	Total
Year 1	**561,240.00**	**569,000.00**		**1,130,240.00**
TOTAL				

(22) OTHER ONGOING PROJECTS BEING HANDLED BY THE PROJECT LEADER: _____ (number)

Title of the Project	Funding Agency	Involvement in the Project
None		

(23) OTHER SUPPORTING DOCUMENTS (Please refer to page 2 for the additional necessary documents.)

I hereby certify the truth of the foregoing and have no pending financial and/or technical obligations from the DOST and its attached Agencies. I further certify that the programs/projects being handled is within the prescribed number as stipulated in the DOST-GIA Guidelines. Any willful omission/false statement shall be a basis of disapproval and cancellation of the project.

	SUBMITTED BY (Project Leader)	ENDORSED BY (Head of the Agency)
Signature		
Printed Name	**DR. IRVEN B. CUEN**	**DR. JULIE HOPE TIMOTEA P. EVINA**
Designation/Title	**Project Leader**	**President, WPU**
Date	**March 16, 2023**	**March 16, 2023**

DOST Form 4

DEPARTMENT OF SCIENCE AND TECHNOLOGY
Project Line-Item Budget
CY 2023-2024

Program Title : Grants-in-Aid
Project Title : Development and Pilot Testing of Coconut Chips Air Fryer
Implementing Agency : Western Philippines University
Total Duration : 1 Year
Current Duration :
Cooperating Agency : Reals Food Products Inc.
Program Leader : Dr. Irven B. Cuen
Project Leader : Dr. Irven B. Cuen
Monitoring Agency : PSTO-Palawan

		DOST	Counterpart Funding	
			Implementing Agency	Cooperating Agency
I. Personal Services		P	P	P
Direct Cost				
Salaries				
	Science Research Assistant (WPU) @P21,570.00/month	258,840.00		
	Skilled Fabricator (WPU) @18,000.00/month	180,000.00		
Honoraria				
	Program/Project Leader @10,200/month	122,400.00		
	Sub-total for PS	**P 561,240.00**	**P -**	**P -**
II. Maintenance and Other Operating Expenses				
Direct Cost				
Traveling Expenses				
Local		80,000.00		
Communication Expenses				
Postage and Courier Expenses		2,000.00		
Mobile Expenses		7,000.00		
Repairs and Maintenance of Facilities				
Repairs and Maintenance of Machinery and Equipment			50,000.00	
Repairs and Maintenance of Building			100,000.00	
Supplies and Materials Expenses (Fabrication Supplies and Materials and Equipment (e.g. Machine stainless structural materials, prime mover and transmission systems, Heating systems and controllers, fabrication consumables, small fabrication equipment, performance evaluation meters, finishing materials and others)		250,000.00		
Office Supplies Expenses, Gasoline, Oil and Lubricants Expenses		50,000.00		
Agricultural Supplies Expenses, etc.				50,000.00
Semi-Expendable Furnitures and Fixtures		6,000.00		50,000.00
Utility Expenses (Please indicate)				
Water, Electricity and Cooking Fuel Expenses			30,000.00	
Representation Expenses (e.g. food for meetings, etc.)		40,000.00		
Other Maintenance and Operating Expenses (Please itemize)				
Pilot Testing Expenses				150,000.00
Labor in machining and other outside-campus metal works expenses		30,000.00		
Cost of submission of scientific paper for peer reviewed journals (Publication of the Phase 1 Project - Coconut Meat Chipper and Phase 2 Project - Coconut Chips Air Fryer)		80,000.00		
Cost of Patent Application		30,000.00		
Indirect Cost				
(Implementing Agency)				
Supplies and Materials Expenses (shall be itemized based on GAM)				
Office Supplies Expenses, Gasoline, Oil and Lubricants Expenses			50,000.00	
	Sub-Total for MOOE	**P 575,000.00**	**P 230,000.00**	**250,000.00**
III. Equipment Outlay				
_____		P	P	P
Indirect Cost				
(Monitoring Agency)				
_____		P	P	P
	Sub-Total for EO	**P -**	**P -**	**P -**
	GRAND TOTAL	**P 1,136,240.00**	**P 230,000.00**	**250,000.00**

Certified Funds Available:

AMYR LIEN V. MIRANDA
Accountant, WPU

XAVIER MAC DANIEL ORTIZ
Accountant III, DOST-MIMAROPA

Approved by:

DR. MA. JOSEFINA P. ABILAY
Regional Director, DOST-MIMAROPA

DOST Form 5

A – PROJECT WORKPLAN

(1) Program Title: Upscaling Production of Newly- Innovated Coconut Chips Product Through Mechanization

(2) Project Title: Development and Pilot Testing of Coconut Chips Air Fryer

(3) Project Duration (number of months): 12 Months **(4) Project Start Date:** May 2023 **(5) Project End Date:** May 2024

(6) OBJECTIVES	(7) TARGET ACTIVITIES	(8) TARGET ACCOMPLISHMENTS (quantify, if possible)	Y1			Y2	
			Q2	Q3	Q4	Q1	Q2
Project inception meeting	Meeting with project proponent, collaborators, and support offices	A clear understanding of project implementation guidelines and deliverables					
Hire project personnel	List of qualified project personnel	Posting of the job opening Interview and selection					
Draw conceptualized design of the machines to be developed	Drafting of machine specification using CAD or Solidworks Software	Detailed drawing of machines with complete specifications					
Procure materials and equipment needed for fabrication	Procurement of materials and equipment	Equipment, supply and materials for fabrication					
Fabrication of the air fryer	Fabrication activities	Prototype of the machine					
Evaluation of the air fryer	Testing, evaluation, and modifications if necessary	Machine performance and specifications					
Drafting of machine specifications and application for patent	Drafting of specifications and claims Filing of application	IP documents ready for filing					
Publication of research results	Drafting of research article Seeking and submission to appropriate Journal	Publication in a reputable journal					
Pilot Testing	Actual use of the machine at industry partner in quite longer period Performance validation and modifications if necessary	Final performance of the machine					
Transfer of the machine to industry partner	MOA preparation and signing Turnover activity	Signed MOA Delivery of machine to Reals Food Products Inc.					

DOST Form 5

B – EXPECTED OUTPUTS

(1) Program Title: Upscaling Production of Newly- Innovated Coconut Chips Product Through Mechanization

(2) Project Title: Development and Pilot Testing of Coconut Chips Air Fryer

(3) Project Duration (number of months): 12 Months **(4) Project Start Date:** May 2023 **(5) Project End Date:** May 2024

(9) EXPECTED OUTPUTS (6Ps)	Y1 Objectively Verifiable Indicators (OVIs)					Y2 Objectively Verifiable Indicators (OVIs)					Y3 Objectively Verifiable Indicators (OVIs)				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Publications															
Patents/IP															
Products															
People Services															
Places and Partnerships															
Policy															
(10) POTENTIAL IMPACTS (2Is)															
Social Impact															
Economic Impact															

DOST Form 5

C – RISKS AND ASSUMPTIONS

(1) Program Title: Upscaling Production of Newly- Innovated Coconut Chips Product Through Mechanization

(2) Project Title: Development and Pilot Testing of Coconut Chips Air Fryer
(3) Project Duration (number of months): 12 Months **(4) Project Start Date:** May 2023 **(5) Project End Date:** May 2024

OBJECTIVES	(11) RISKS AND ASSUMPTIONS	(12) ACTION PLAN (use a separate sheet if necessary)
Hire project personnel	Availability of qualified personnel	Increase effort in scouting qualified personnel
Draw conceptualized design of the machines to be developed	A limited number of related machines	A comprehensive study of the process and in close partnership with the end user
Procure materials and equipment needed for fabrication	Availability of equipment, supplies, and materials as specified Suppliers willing to participate in the bidding process	Assist the procurement office in the process Conduct market research
Fabrication of the air fryer	Delay in the procurement of materials and equipment Frequent power outage	Assist the procurement office in the process
Evaluation of the air fryer	No significant risk	
Drafting of machine specifications and application for patent	Limited knowledge in drafting patent specifications	Seek assistance from IPMO Office
Publication of research results	Predatory journals	Seek guidance in finding legit journals
Pilot Testing	No significant risk	