



## (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 / Male

Project Duration (number of months): 12 months

Project Start Date: April 2023

Project End Date: March 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
<u>  X  </u>	Applied

**(5) R&D PRIORITY AREA & PROGRAM (based on HNRDA 2017-2022)**

☒ Agriculture, Aquatic and Natural Resources  
 \_\_\_\_\_ Community: 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	
1. No Poverty	2. Zero Hunger
3. Good Health and Well-being	4. Quality Education
5. Gender Equality	6. Clean Water and Sanitation
7. Affordable and Clean Energy	8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure	10. Reduced Inequalities
11. Sustainable Cities and Communities	12. Responsible Consumption and Production
13. Climate Action	14. Life Below Water
15. Life on Land	16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals	

- 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

<p>developing company, which has great potential and promising product, to foster is a worth undertaking. Its growth and success certainly contribute to the growth of local economy.</p>
<p><b>(7) INTRODUCTION</b></p>
<p><b>(7.1) RATIONALE/SIGNIFICANCE</b></p> <p>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.</p> <p>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.</p>
<p><b>(7.2) SCIENTIFIC BASIS/THEORETICAL FRAMEWORK</b></p> <p>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.</p>
<p><b>(7) REVIEW OF LITERATURE</b></p> <p><b>Existing Air Fryers</b></p> <p>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.</p> <p><i>Kyowa Convection Oven (KW-3911).</i> 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 300mm.</p> <div> </div> <p><b>Figure 1.</b> Kyowa convection oven</p> <p><i>Best Heim Air Fryer.</i> 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,</p>

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.

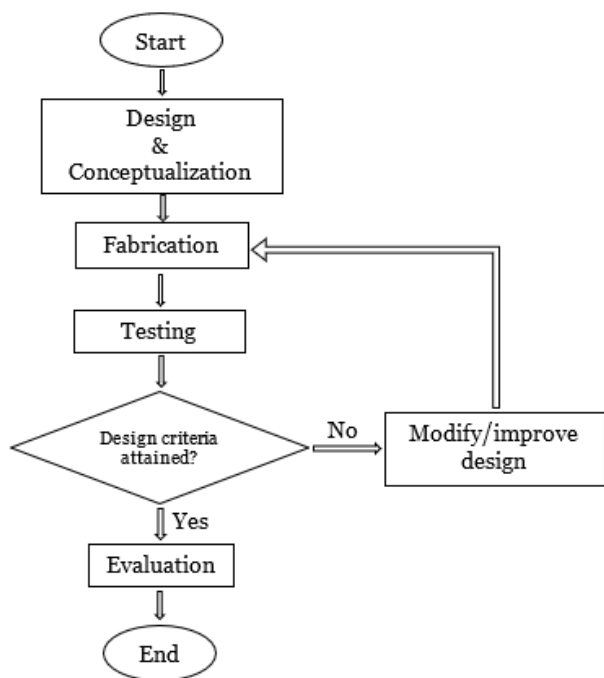


Figure 6. Paradigm of project activities

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

(11) EXPECTED OUTPUTS (6Ps)

<ol style="list-style-type: none"> <li>1. <i>Publication</i>- The research findings of this project are intended for publication in corresponding journals and presentation in any research forum.</li> <li>2. <i>Patent</i>- The machine will be subjected to intellectual property protection. It will be applied for either Patent or as Utility Model.</li> <li>3. <i>Product</i>- Commercialization of the machine will be sought to provide opportunities to others who want to venture into similar products.</li> <li>4. <i>People Services</i>- The machine can be used for training and extension activities of the University.</li> <li>5. <i>Places and Partnerships</i>- 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.</li> <li>6. <i>Policies</i>- the study may provide possible inputs to policy-making bodies to boost local utilization of coconut and patronizing locally-made products and processing machinery.</li> </ol>
<p><b>(12) POTENTIAL OUTCOMES</b></p> <ol style="list-style-type: none"> <li>1. Increased level of production of coconut chips</li> <li>2. Meet the required market demand</li> <li>3. Increase income and enhance employment</li> </ol>
<p><b>(13) POTENTIAL IMPACTS (2Is)</b></p> <ol style="list-style-type: none"> <li>1. Empower coconut farmers</li> <li>2. Boost the local economy</li> </ol>
<p><b>(14) TARGET BENEFICIARIES</b></p> <p>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.</p>
<p><b>(15) SUSTAINABILITY PLAN</b> (if applicable)</p>
<p><b>(16) GENDER AND DEVELOPMENT (GAD) SCORE</b> (refer to the attached GAD checklist)</p>
<p><b>(17) LIMITATIONS OF THE PROJECT</b></p> <p>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.</p>
<p><b>(18) LIST OF RISKS AND ASSUMPTIONS RISK MANAGEMENT PLAN</b> (List possible risks and assumptions in attaining target outputs or objectives.)</p>
<p><b>(19) LITERATURE CITED</b></p> <p><b>Internet</b></p> <p>FRED VAN DER WEIJ, (2014). Breville VDF105 Halo Plus Air Fryer (Retrieved from <a href="http://www.healthfryers.com/reviewers/breville/halo-plus-health-fryer-vdf105/">http://www.healthfryers.com/reviewers/breville/halo-plus-health-fryer-vdf105/</a>)</p> <p>Healthy but Smart (HBS)writers (2019). Philips Avance XL Digital Air fryer. (Retrieved from <a href="http://healthybutsmart.com /philips-airfryer.">http://healthybutsmart.com /philips-airfryer.</a>)</p> <p>JEP, (2020). Kyowa Convection Oven (KW-3911).( Retrieved from <a href="https://www.smappliance.com/km-3911-kyowa-convection-oven-10153811">https://www.smappliance.com/km-3911-kyowa-convection-oven-10153811</a>).</p> <p>KOCHI, (2020). Coconut Development Board. (retrieved from <a href="https://www.coconutboard.gov.in/index.aspx">https://www.coconutboard.gov.in/index.aspx</a>).</p> <p>LOLA DOMNINA B. PASTANO, (2016). Journal of Advanced Agricultural Technologies. (Retrieved from: <a href="http://www.wikipedia.com">www.wikipedia.com</a>).</p>

MANIKANTAN, et al., (2015). Indian Coconut Journal. (Retrieved from <https://www.krishn.iicar.gov.in/jspuiPDF>).

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

WALMART, (2020). Cuisinart Air Fryer Toaster Oven. (Retrieved from <http://www.amazon.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.

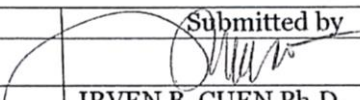
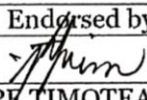
**(20) PERSONNEL REQUIREMENT**

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: - <i>Development of Coconut Chips Air Fryer</i> <i>Development of Coconut Meat Chipper</i> 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

Research Assistant	100%	<div>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</div> <div>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</div>		
Skilled Fabricator	100%	<div>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</div>		
(21) BUDGET BY IMPLEMENTING AGENCY				
IMPLEMENTING AGENCY	PS	MOOE	EO	Total

Year 1		230,000.00		230,000.00
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	Endorsed by
Signature		
Name	IRVEN B. CUEN Ph.D.	JULIE HOPE TIMOTEA P. EVINA
Designation/Title:	Chair, BSABE Dept., WPU	President, WPU
Date	July 14, 2020	July 14, 2020





**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:** April 2023

**(5) Project End Date:** March 2023

(6) OBJECTIVES	(7) TARGET ACTIVITIES	(8) TARGET ACCOMPLISHMENTS (quantify, if possible)	Y1				
			Q1	Q2	Q3	Q4	Total
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:** April 2023

**(5) Project End Date:** March 2023

[illegible]

**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:** April 2023

**(5) Project End Date:** March 2023

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	



## DOST Form 4

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

Program Title : Upscaling Production of Newly- Innovated Coconut Chips Product Through Mechanization  
 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 : PSTC-Palawan

	DOST	Counterpart Funding	
		Implementing Agency WPU	Cooperating Agency Reals Food Products Inc.
<b>I. Personal Services</b>	P	P	P
<u>Direct Cost</u>			
<i>Salaries</i>			
1 Science Research Assistant (WPU) @P21,570.00/month	258,840.00		
1 Skilled Fabricator (WPU) @18,000.00/month	180,000.00		
<i>Honoraria</i>			
1 Program/Project Leader @10,200/month	122,400.00		
<b>Sub-total for PS</b>	<b>P 561,240.00</b>	<b>P -</b>	<b>P -</b>
<b>II. Maintenance and Other Operating Expenses</b>			
<u>Direct Cost</u>			
Traveling Expenses	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		
<u>Indirect Cost</u>			
Supplies and Materials Expenses (shall be itemized based on GAM)			
Office Supplies Expenses, Gasoline, Oil and Lubricants Expenses		50,000.00	
<b>Sub-Total for MOOE</b>	<b>P 575,000.00</b>	<b>P 230,000.00</b>	<b>250,000.00</b>
<b>GRAND TOTAL</b>	<b>P 1,136,240.00</b>	<b>P 230,000.00</b>	<b>250,000.00</b>

Certified Funds Available:

Accountant, WPU

Approved by:

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

**XAVIER MAC DANIEL ORTIZ**  
 Accountant III, DOST-MIMAROPA