Mindoro State University
Victoria, Oriental Mindoro 5205 Philippines

Email: universitypresident@minsu.edu.ph
Website: www.minsu.edu.ph
Mobile: +63 977 846 72 28

BAGONG PILIPINAS

University Bids and Awards Committee
Resolution No. 100-A, S. 2024

RESOLUTION RECOMMENDING THE PROCUREMENT OF THE PROJECT SUPPLY AND DELIVERY OF RICE HULL CARBONIZER FOR THE RESEARCH PROJECT ON AUTOMATED BANANA LEAF SINGEING TECHNOLOGY OF MinSU THROUGH NEGOTIATED PROCUREMENT UNDER SECTION 53.5 (THROUGH AGENCY-TO-AGENCY)

WHEREAS, the **Mindoro State University (MinSU), Research, Development, and Extension (RDE)** prepared a Purchase Request No. PR24-0148 dated March 19,2024 for the, **"SUPPLY AND DELIVERY OF RICE HULL CARBONIZER FOR THE RESEARCH PROJECT ON AUTOMATED BANANA LEAF SINGEING TECHNOLOGY OF MinSU",** a DOST-funded project under the Collaborative Research and Development to Leverage Philippine Economy (CRADLE) Program;

WHEREAS, as a general rule, all procurement shall be through Competitive Bidding. However, whenever justified by the conditions provided in Republic Act No. (R.A.) 9184 and its revised Implementing Rules and Regulations (IRR), the Procuring Entity may, in order to promote economy and efficiency, resort to any of the alternative methods of procurement
provided in Rule XVI of the IRR of R.A. 9184;

WHEREAS, Rule XVI, Section 48, Alternative Methods of Procurement shall be resorted to only in the highly exceptional cases provided for in this Guidelines and subject to the prior approval of the Head of the Procuring Entity (HOPE) upon recommendation of the Bids and Awards Committee (BAC). In all instances, the Procuring Entity shall ensure that the most advantageous price for the Government is obtained

WHEREAS, Section 53 of the aforementioned IRR, states, "Negotiated Procurement is a method of procurement of Goods, Infrastructure Projects and Consulting Services, whereby the Procuring Entity directly negotiates a contract with a technically, legally and financially capable supplier, contractor or consultant in any of the following cases: (1) Two Failed Biddings; (2) Emergency Cases; (3) Take-Over of Contracts; (4) Adjacent or Contiguous; (5) Agency-to-Agency; (6) scientific, Scholarly or Artistic Work, Exclusive Technology and media services; and among others;

WHEREAS, Section 53.5 of the same Revised IRR provides that Procurement from another agency of the government (i.e., Servicing Agency) that has the mandate to deliver goods or services or to undertake infrastructure projects or consultancy services as required by the Procuring Entity. Which is hereby quoted as with the following conditions:

(a)The Procuring Entity shall justify that entering into an Agency to- Agency Agreement with the Servicing Agency is more efficient and economical to the government;

(b) Servicing Agency has the mandate to deliver the goods and services required to be procured or to undertake the infrastructure project or consultancy required by the Procuring Agency;

(c)Servicing Agency has the absorptive capacity to undertake the project;

(d) Servicing Agency owns or has access to the necessary tools and equipment required for the project;

(e) Sub-contracting is not allowed. However, the servicing agency may implement the infrastructure project in-house, by job-order, or through the pakyaw contracting system; and

(f) For procurement of infrastructure projects, the Servicing Agency must have a track record of having completed, or supervised a project, by administration or by contract, similar to and with a cost of at least fifty percent (50%) of the project at hand.

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WHEREAS, Annex "H", (Agency-Agency) the procedure are enumerated as follows: c) (i) The End-User unit shall justify to the BAC that the resort to Agency- to-Agency is more efficient and economical to the government. (ii) It shall likewise secure a certificate from the relevant officer of the Servicing Agency that the latter complies with all the foregoing conditions. (iii) Based on the assessment and recommendation of the End-User unit, the BAC shall issue a Resolution recommending the use of Agency- to-Agency Agreement to the HOPE. (iv) In case of approval, the HOPE shall enter into a Memorandum of Agreement (MOA) with the Servicing Agency.

WHEREAS, as determined by the Procuring Entity based on the nature of the project that involves agency-agency, the project herein falls under the aforementioned Section (53.5);

NOW, THEREFORE, with the foregoing premises, We, the Bids and Awards Committee, hereby RESOLVE, as it is RESOLVED, to recommend to the Head of Procuring Entity (HoPE) the approval of Negotiated Procurement under section 53.5 (through Agency -to-Agency) for the project **SUPPLY AND DELIVERY OF RICE HULL CARBONIZER FOR THE RESEARCH PROJECT ON AUTOMATED BANANA LEAF SINGEING TECHNOLOGY OF MinSU;**

RESOLVED this ____ day of _____, 2024 at MinSU Main Campus, Alcate, Victoria, Oriental Mindoro.

NEMESIO H. DAVALOS, *Ph.D.*
BAC Chairperson

ANSELMO R. ULEP, JR.
BAC Vice-Chairperson

ELVI C. ESCAREZ, *Ph.D.*
BAC Member

CIEDELLE P. SALAZAR *Ph.D*
BAC Member

MELGAR G. FADRIQUELAN
BAC Member

Approved/Disapproved

CHRISTIAN ANTHONY C. AGUTAYA, *Ph.D.*
OIC- Office of the University President
Date: _____

Mindoro State University
Victoria, Oriental Mindoro 5205 Philippines
Email: universitypresident@minsu.edu.ph
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BAGONG PILIPINAS

University Bids and Awards Committee
Resolution No. 100-B, S. 2024

RESOLUTION RECOMMENDING THE AWARD OF CONTRACT THROUGH NEGOTIATED PROCUREMENT UNDER SECTION 53.5 (THROUGH AGENCY-TO-AGENCY) FOR THE SUPPLY AND DELIVERY OF RICE HULL CARBONIZER FOR THE RESEARCH PROJECT ON AUTOMATED BANANA LEAF SINGEING TECHNOLOGY OF MinSU

WHEREAS, pursuant to Bac Resolution No. 100 s. 2024, the Head of Procuring Entity (HoPE) approved the recommendation of the MinSU Bids and Awards Committee (BAC) to resort to Negotiated Procurement under Agency-to-Agency for the "**Supply and Delivery of Rice Hull Carbonizer for The Research Project On Automated Banana Leaf Singeing Technology of MinSU**";

WHEREAS, the end-user of the project submitted a request to the BAC that resorting to Agency-to-Agency is more efficient and economical to the government, then they secured a Certificate of Compliance from the Servicing Agency specifically **Philippine Rice Research Institute (PhilRICE)** that the latter complies with all the foregoing conditions to resort to Negotiated Procurement under Agency-to-Agency;

WHEREAS, upon careful evaluation of the documents received, the BAC agreed to award the Contract to **Philippine Rice Research Institute (PhilRICE)** with a contract amount of Eighty Thousand Pesos (Php80,000.00);

WHEREAS, Section 12 of RA 9184 mandates the Bids and Awards Committee to recommend the award of contract to the Head of Procuring Entity (HoPE) or his/her duly authorized representative;

NOW, THEREFORE, the Bids and Awards Committee (BAC) **HEREBY RESOLVED AS IT IS HEREBY RESOLVED** recommended to the Head of Procuring Entity the approval of this resolution for the abovementioned procurement and awarding of contract for the **"Supply and Delivery of Rice Hull Carbonizer for The Research Project On Automated Banana Leaf Singeing Technology of MinSU" Philippine Rice Research Institute (PhilRICE)** amounting to Eighty Thousand Pesos (Php80,000.00) with official address at Maligaya, Science City of Muñoz, Nueva Ecija;

RESOLVED this ____ day of _____, 2024 at MinSU Main Campus, Alcate, Victoria, Oriental Mindoro.

NEMESIO H. DAVALOS, *Ph.D.*
BAC Chairperson

ANSELMO R. ULEP, JR.
BAC Vice-Chairperson

ELVI C. ESCAREZ, *Ph.D.*
BAC Member

CIEDELLE P. SALAZAR *Ph.D*
BAC Member

MELGAR G. FADRIQUELAN
BAC Member

Approved/Disapproved

CHRISTIAN ANTHONY C. AGUTAYA, *Ph.D.*
OIC- Office of theUniversity President
Date: _____

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BAGONG PILIPINAS

REQUEST FOR NP SECTION 53.5 AGENCY-TO-AGENCY

End-User/Requesting Party: **MARK KEYLORD S. ONAL** Date: _____
Office: **Institute of Agricultural and Biosystems Engineering** Position: **Project Leader**

List of supplies/equipment/service to be acquired thru negotiated purchase under Rule XVI-Alternative Methods of Procurement, Section 53.5 and their corresponding supplier, cost and justification.

Supplies/ Equipment/ Services	Requirement for:	Justification*	Supplier	Amount
Continuous-type Rice Hull Carbonzier	****Section 53.5 Agency-to-Agency** (Annex "H" Consolidated Guidelines for the Alternative Methods of Procurement **Conditions.** It is the general policy of government to purchase its requirements from the private sector. However, it acknowledges that, in some exceptional cases, procurement from another agency of the government is more efficient and economical for the government, subject to the following conditions: a. The Procuring Entity shall justify that entering into an Agency-to-Agency Agreement with the Servicing Agency is more efficient and economical to the government; b. Servicing Agency has the mandate to deliver the goods and services required to be procured or to undertake the infrastructure project or consultancy required by the Procuring Agency; c. Servicing Agency has the absorptive capacity to undertake the project; d. Servicing Agency owns or has access to the necessary tools and equipment required for the project; e. Sub-contracting is not allowed. However, the servicing agency may implement the infrastructure project in-house, by job-order, or through the *pakyaw* contracting system; and f. For procurement of infrastructure projects, the Servicing Agency must have a track record of having completed, or supervised a project, by administration or by contract, similar to and with a cost of at least fifty percent (50%) of the project at hand.	i. DOST Project Line-Item Budget for the above mentioned project is Two Hundred Thirty Two Thousand and Six Hundred Fifty Two Pesos(P232,652.00), MinSU and MIRDC opted to purchase the working and available patented rice hull carbonizer technology of DA-PhilRice in the amount of Eighty Thousand Pesos (P80,000) which justified it be to be more efficient and economical . Aside from lower pruchased amount, the project team has also opt to purchased the said techonology via agency-to-agency considering the following bases: a) DA-PhilRice has the capability to supply and deliver the said technology within 1 month of after the date of order. b) The said technology has been registered to the Intellectual Property of the Philippines since October 15, 2012 with a patent number of 1/2011/000077 B1). *Please see attached file.* c) Based on the project's research study, it needs a carbonizer with an input and output capacity of 20 kg/hr and 16-20 kg/hr respectively, with this, the team has determined that Continuous-type Rice Hull Carbonizer of DA-PhilRice has the following specifications. d) In order to maximize the efficiency, the CtRH carbonizer has to be new, considering this, it is advantageous that DA-	DA-PhilRice	80,000

		PhilRice has only manufactured the said technology based on order. ii. DA-PhilRice has the sole ownership of the patented Continuous-type Rice Hull Carbonizer. It has been publised on the Intellectual Property Office of the Philippines with a patent number of 1/2011/000077 B1 since October 15,2012. *Please see attached file.* iii. DA-PhilRice being the servicing agency and has the sole ownership of the patented CtRH carbonizer has all the necessary tools and equipment required. *Please see attached DA-PhilRice certification.*		

This is to certify that the request is being made in accordance with the Republic Act. No. 9184 and its implementing rules and regulations.

ENGR. MARK KEYLORD S. ONAL
Name and Signature of End-User

Recommending Approval:

MACARIO B. MASAGCA, JR.
Director for Research & Development

NEMESIO H. DAVALOS, *Ph.D.*
Chair, Bids and Awards Committee

Approved/Disapproved

CHRISTIAN ANTHONY C. AGUTAYA *Ph.D.*
OIC-Office of the University President
Date: _____

**must be accompanied by a survey/comparative survey of the industry to determine the supply source
**End-user must justify the necessity for an item that may only be procured through Direct Contracting, and must be able to prove that there is no suitable substitute in the market that can be obtained at more advantageous terms.

Documentary Requirements

Direct Contracting
- ✓ Mayor's Permit
- ✓ PhilGEPS Registration Number
- ✓ Income/Business Tax Return

Agency-to-Agency
- ✓ The Servicing Agency must issue a certificate that the latter complies with all the foregoing conditions stated above

This request should be approved prior to the actual purchase. If the expense will be charge against project ends, the project leader will be the recommending party. Otherwise, it shall be the Department Head, Director or Head of Office.

Philippine Rice Research Institute
Central Experiment Station
Maligaya, Science City of Muñoz, 3119 Nueva Ecija

CERTIFICATE OF COMPLIANCE

This is to certify that the Philippine Rice Research Institute (PhilRice) has complied with conditions specified under Section 53.5 (Agency-to-Agency) of the Republic Act (R.A.) No. 9184 Rule XVI of its Implementing Rules and Regulations, and the person whose signature appears below hereby declares and certifies the following:

That:

1. PhilRice has the mandate to deliver the goods and services required to be procured by the Procuring Agency;
2. PhilRice has the absorptive capacity to undertake the project;
3. PhilRice owns or has access to the necessary tools and equipment job order required for the project; and
4. Acknowledge that sub-contracting is not allowed. However, PhilRice may implement the project in-house, by job order, or through the "pakyaw" contracting system;

This **CERTIFICATION** is being issued to attest to the accuracy of all the foregoing based on available records and information that can be verified.

IN WITNESS WHEREOF, I have hereunto set my hand this 11th of April 2024 in Science City of Munoz, Nueva Ecija, Philippines.

PAULINO S. RAMOS
Division Head,
Rice Engineering and Mechanization Division
PhilRice

Philippine Rice Research Institute
Central Experiment Station
Maligaya, Science City of Muñoz, 3119 Nueva Ecija

CERTIFICATE OF COMPLIANCE

This is to certify that the Philippine Rice Research Institute (PhilRice) has complied with conditions specified under Section 53.5 (Agency-to-Agency) of the Republic Act (R.A.) No. 9184 Rule XVI of its Implementing Rules and Regulations, and the person whose signature appears below hereby declares and certifies the following:

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3. PhilRice owns or has access to the necessary tools and equipment job order required for the project; and
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PhilRice

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PAULINO S. RAMOS
Division Head,
Rice Engineering and Mechanization Division
PhilRice

Mindoro State University
Victoria, Oriental Mindoro 5205 Philippines
Email: universitypresident@minsu.edu.ph
Website: www.minsu.edu.ph
Mobile: +63 977 846 72 28

BAGONG PILIPINAS

April 18, 2024

MINDORO STATE UNIVERSITY
Victoria, Oriental Mindoro, 5205 Philippines
RECEIVED
RECORDS OFFICE
BY:
DATE: 5/6/24
TIME: 10:25
CONTROL #: 1327

CHRISTIAN ANTHONY C. AGUTAYA, *Ph.D.*
OIC- University President
Mindoro State University
Victoria, Oriental Mindoro

SUBJECT: MARKET RESEARCH SURVEY

Dear Sir:

In collaboration with our Research and Development Institution (RDI) partners, the Mindoro State University-Research and Development Office (MinSU-RDO) and DOST-Metals and Industry Research and Development Center (MIRDC) are conducting a research project. In order to supply and deliver one (1) continuous-type rice hull carbonizer with a loading capacity of up to 40 kg of rice hull made from black iron metal and heat-resistant stainless (for core and exhaust pipe), we are currently looking for a supplier of a mature technology, preferably a product of research and development activities. In our project, the technology will serve as a heat source. The aforementioned technology is among the essential elements that the financing agency has accepted.

Thus, in order to purchase the aforementioned equipment, we have carried out a market study.

Relative to this, we have sent invitations to three different potential fabricators of the said CtRH namely: DA-PhilRice, RMTS Co. Ltd., and JHT Micro Enterprises. Shown on the table below is the summary of the said market survey.

Name of Fabricator	Response
DA-PhilRice	The market survey was sent on March 4 thru email and they have responded on the same day with a positive remark. **please see attached*
RMTS Co. Ltd.	The market survey was sent on March 4 thru email and they have responded on March 7 with a negative remark, stating that unfortunately they do not fabricate the rice hull carbonizer as of today.
JHT Micro Enterprises	The market survey was sent on March 4 thru email and they have responded on March 7 stating that they will check with their production regarding the requirement. On April 2, they have sent an email stating that their agri-supplier does not have the requested machine as of now.

Thank you and GodSpeed!

Sincerely,

ENGR. MARK KEYLORD S. ONAL, MSc
Project Leader, DOST-MinSU CRADLE Project

Noted:

MACARIO B. MASAGCA, JR.
Director for Research & Development

Recommending Approval:

NEMESIO H. DAVALOS, *Ph.D.*
Bids and Awards Committee Chair

Approved:

CHRISTIAN ANTHONY C. AGUTAYA *Ph.D.*
OIC - Office of the University President / Head of Procuring Entity

Mindoro State University
Victoria, Oriental Mindoro 5205 Philippines

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BAGONG PILIPINAS

April 18, 2024

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OIC- University President
Mindoro State University
Victoria, Oriental Mindoro

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Thank you and GodSpeed!

Sincerely,

ENGR. MARK KEYLORD S. ONAL, MSc
Project Leader, DOST-MinSU CRADLE Project

Noted:

MACARIO B. MASAGCA, JR.
Director for Research & Development

Recommending Approval:

NEMESIO H. DAVALOS, *Ph.D.*
Bids and Awards Committee Chair

Approved:

CHRISTIAN ANTHONY C. AGUTAYA *Ph.D.*
OIC - Office of the University President / Head of Procuring Entity

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Victoria, Oriental Mindoro 5205 Philippines

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Website: www.minsu.edu.ph
Mobile: +63 977 846 72 28

BAGONG PILIPINAS

PHILRICE CENTRAL EXPERIMENT STATION
Philippine Rice Research Institute
Maligaya, Science City of Muñoz, Nueva Ecija

Sir:

Greetings!

The Mindoro State University-Research and Development Office (MinSU-RDO) is conducting a research project together with DOST-Metals and Industry Research and Development Center (MIRDC), our Research and Development Institution (RDI) partners. We are currently looking for supplier of a matured technology, preferably a product of research and development activities to supply and deliver one (1) continuous-type rice hull carbonizer with a loading capacity of up to 40kg of rice hull made from black iron metal and heat resistant stainless (for core and exhaust pipe). The technology will used as heat source in our project. The said technology is part of the critical components which are approved by the funding agency.

With this, we are now conducting a Market Study for the procurement of the abovementioned equipment.

Relative to this, your company is one of our potential suppliers based on your business profile and previous transactions with our University (MinSU-Biddings and Awards Committee).

Please signify your interest by checking the "Yes" or "No" box below. If yes, kindly put your estimated price of the unit including the specifications.

Thank you and God bless!

Sincerely,

ENGR. MARK KEYLORD S. ONAL
Project Leader, DOST-MinSU CRADLE Project

☑ Yes
Price: PhP Php 50,000.00 per unit (excluding delivery and VAT)
Specifications:
1. Input Capacity (rice hull): 60 kg (max.)
2. Materials: black iron metal (for body) and stainless (for chimney)
3. Dimension: L= 117.2 cm W= 89.0 cm H=135.2cm
4. Others: _____

☐ No
Reason (if any): _____

Received by:

JOEL A. RAMOS
Supervising SRS/ Shop Supervisor
Rice Engineering & Mechanization Division
Philippine Rice Research Institute

Standard Form Number: SF-GOOD-01
Revised on: May 24, 2004

APPROVED BUDGET FOR THE CONTRACT (ABC)

Supply and Delivery of Rice Hull Carbonizer for the Research Project on Automated Banana Leaf Singeing Technology of MinSU Alcate, Victoria, Oriental Mindoro

Project Name and Location

Stations: Mindoro State University

Length:

Contract Duration:

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	CURRENT MARKET PRICE	TOTAL COST	VAT, OTHER TAXES AND/OR DUTIES APPLICABLE	FREIGHT & INSURANCE	OTHER INDIRECT COSTS	OTHER COST FACTORS INFLATION, %	OTHER COST FACTORS INFLATION, VALUE	TOTAL COST	UNIT COST
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11) (5)X(9)	(12) (10%[(5)+(10)]	(13) (11) / (3)
1	Rice Hull Carboonizer	1	unt	80,000.00	80,000.00							
	Input Capacity: minimum of 40kg/hr				-							
	Output Capacity: (min 16 kg/hr)				-							
	Continuous-type				-							
	Material Used: Black Iron				-							
	xvxvxvxvxvxvxvxvxvxvxvxvxvxvxvxvxvxvxvxvxvx				-							
	GRAND TOTAL				**80,000.00**							

Prepared by

RENELITO C. RICO
Member, BAC Secretariat

Submitted by

Engr. MARK LESTER A. MASPANTAY
Head, BAC Secretariat

Recommending Approval

NEMESIO H. DAVALOS, Ph.D.
Chairperson, BAC

Approved

CHRISTIAN ANTHONY C. AGUTAYA, Ph.D.
OIC- Office of the University President

MINDORO STATE UNIVERSITY
Main Campus
Alcate, Victoria, Oriental Mindoro

BAGONG PILIPINAS

PURCHASE REQUEST

Fund Cluster:

Office/Section : Accounting		**PR No.:** PR24- 0148 **Responsibility Center Code :**		**Date:** 03/19/2024	
Stock/ Property No.	**Unit**	**Item Description**	**Qty**	**Unit Cost**	**Total Cost**
	Unit	Rice Hull Carbonizer	1	80,000.00	80,000.00
		Input Capacity: minimum of 40 kg/hr			
		Output Capacity: (min 16 kg/hr)			
		Continuous-type			
		Material Used: Black Iron			
				TF -1054 401-200 03-110	
		TOTAL			**80,000.00**

Purpose: Supply and delivery of Continuous-type Rice hull Carbonizer for the project entitled "Development of an Automated Banana Leaf Singeing Technology"

	Requested by:	Recommending Approval:	Certified: Allotment Available	Approved by:
Signature :				
Printed Name :	ENGR.MARK KEYLORD S. ONAL	MACARIO B. MASAGCA JR.	ROVELYN P. ROXAS	CHRISTIAN ANTHONY C. AGUTAYA, *Ph*.D.
Designation :	Project Leader	Director for Research and Development	Budget Officer III	OIC - University President

[19] **Intellectual Property Office of the Philippines**
Bureau of Patents

[11] Patent No.: 1/2011/000077 B1

[45] Date of Grant: 4 July 2018

[21] Application No: 1/2011/000077

[22] Filing date: 11 March 2011

[43] Publication date: 15 October 2012

[54] Title: RICE HULL CHARCOAL MAKER

[71] Applicant(s): PHILIPPINE RICE RESEARCH INSTITUTE [Science City of Muñoz, Nueva Ecija, PH]

[72] Inventor(s): ORGE, Ricardo F. [Science City of Muñoz, Nueva Ecija, PH]

[30] Foreign Application Priority Data: None

[51] Int. Class: C05F 11/00 [2006.01]; C05F 11/06 [2006.01]

[58] Field of search: C05F 11/00 [2006.01]; C05F 11/06 [2006.01]

[56] Reference(s) Considered/Cited:

Document description
JP 2007-146016 A — UNIV KOCHI TECHNOLOGY [JP] — 14 June 2007
US 5,435,983 A — ANTAL, MICHAEL, JR [US] — 25 July 1995
KR 10-1000683 B1 — HAN PAN YEAL [KR] — 10 December 2010
KR 10-2006-0110049 A — HAE PYO CO LTD [KR] — 24 October 2006

[57] **ABSTRACT**

The invention relates to a machine for making charcoal from rice hull having a hopper (1,2), a combustion chamber (3), a burner (3c), and a chimney (5). It further relates to rice hull charcoal maker that operates in a continuous mode, as differentiated from the existing one commonly used by the farmers which is of batch-type. The current practice of coverting rice hull into charcoal is accomplished by partial burning just enough to carbonize the rice hull but not to completely burn it into ash. This invention provides a design of rice hull charcoal maker that operates with a relatively clean emission. It also provides a design of rice hull charcoal maker that can operate in a continuous mode.

Industry / Technical Field	C-2011 (Manufacture of basic chemicals)				
No. of Claim(s)	3	claim/s	Drawing(s)	3	sheet/s
Multiple Dep. Claim(s)	0	claim/s	Specification and Claim(s)	12	page(s)
Special's Claim(s)	0	claim/s	Sequence Listings	0	page(s)
Total No. of Claim(s)	3	claim/s			

Examiner: Merito J. Carag

Attorney/Agent: JERRY C. SERAPION

Document No: 2019/10457

AOR

DOST Form 2 (for Basic/Applied Research)

DETAILED RESEARCH & DEVELOPMENT PROJECT PROPOSAL

(1) PROJECT PROFILE

Program Title:

Accelerated R&D Program for Capacity Building of Research and Development Institutions and Industrial Competitiveness: Collaborative Research and Development to Leverage Philippine Economy (CRADLE) Program

Project Title:

DEVELOPMENT OF AUTOMATED BANANA LEAF SINGEING TECHNOLOGY USING CONTINUOUS-TYPE RICE HULL (CtRH) CARBONIZER

Project Leader/Sex:

ENGR. MARK KEYLORD S. ONAL/MALE

Project Duration (number of months): 18 months

Project Start Date:

Project End Date:

Implementing Agency (Name of University-College-Institute, Department/Organization or Company):

MINDORO STATE UNIVERSITY – INSTITUTE OF AGRICULTURAL & BIOSYSTEMS ENGINEERING

Alcate, Victoria, Oriental Mindoro 5205

Address/Telephone/Fax/Email (Barangay, Municipality, District, Province, Region):

Co-implementing Agency

DOST – Metals Industry Research and Development Center (MIRDC)

General Santos Avenue, Bicutan, Taguig City, 4th District, NCR

DOST – MIMAROPA

General Santos Avenue, Bicutan, Taguig City, 4th District, NCR

(2) COOPERATING AGENCY/IES

Merl's Native Delicacies – Industry partner

Merlita Bolus, 09177074803

Panikian, Naujan, Oriental Mindoro

(3) SITE(S) OF IMPLEMENTATION

IMPLEMENTATION SITES NO.	COUNTRY	REGION	PROVINCE	DISTRICT	MUNICIPALITY	BARANGAY
1.	Philippines	MIMAROPA	Oriental Mindoro	1st	Naujan	Panikian
2.						
3.						
4.						
5.						

(4) TYPE OF RESEARCH

_____ Basic

__X__ Applied

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

_____ Agriculture, Aquatic and Natural Resources

	Commodity: _____ _____ Health Priority Topic: _____ __X__ Industry, Energy and Emerging Technology Sector: _____ _____ Disaster Risk Reduction and Climate Change Adaptation _____ Basic Research Sector: _____
Sustainable Development Goal (SDG) Addressed	1. Good Health and Well Being 2. Affordable and Clean Energy 3. Industry, Innovation and Infrastructure

(6) EXECUTIVE SUMMARY (not to exceed 200 words)

This project aims to develop a banana leaf singeing equipment. This technology will be used by food processor engaged in developing banana leaves as packaging material. This would be implemented by the Prototyping Division in partnership with Merl's Native Delicacies and in collaboration with Mindoro State University. The project duration will be 18 months and would cost ₱ 5.0 M.

Banana Leaf is one of the most common and effective natural Food Contact Materials (FCM) used in the Philippines due to its pliability, hydrophobic, antimicrobial, antiulcerogenic, and antioxidant properties. Banana Leaf is used by Merl's Native Delicacy as its primary materials for their "*Suman sa Lihiya*". But the process of its preparation as packaging material poses safety and health hazards among its workers as they are using traditional method of singeing using charcoal-powered burner. Singeing is the process of slightly scorching, burning or treatment of materials with flame.

This addresses the needs of MSMEs particularly food processors engaged in natural packaging operation to provide safer, reliable, and cost-efficient banana leaf singeing technology for Food Contact Materials (FCM). When adjusted/reconfigured, the technology can also be used by local weavers for singeing natural fibers for them to provide safer and better alternatives for dangerous, costly, and labor-intensive traditional methods. The project will be developed in partnership with the Mindoro State University (MinSU) and Metals Industry Research and Development Center (MIRDC) as the designer, primarily responsible for the design and automation of the technology in cooperation with Merl's Native Delicacy as the primary beneficiary.

(7) INTRODUCTION

Banana leaves are widely used as a food contact material in the Philippine food service industry. The leaf is traditionally used as a liner or wrapper for various food during cooking and packaging. Its functionality in food service and processing industries may be attributed to its availability, fast regeneration, and biodegradability. Also, its inherent chemical components and structure contribute to its suitability as a packaging material, enhancing the sensory properties and shelf life of the food it encloses [1]. The inexhaustible leaves are water and leak proof; free from detergent residues, provide specific flavor and aroma, and act as antioxidants and help in digestion of the food by emanating its ingredients such as vitamin C and potassium during hot food serving [2].

Filipino native delicacies are usually made from glutinous rice (also called sticky rice and locally called *malagkit na bigas*), coconut milk, sugar, cassava, and young coconut meat [2]. These food products are commonly packed using banana leaves and similar materials when

distributed and sold to the market. With the availability of technologies, such as vacuum packaging and water retort, to increase shelf life, the production of these delicacies has increased, the same with the demand for packaging materials like banana leaves.

Tropical countries like the Philippines have diverse vegetation in which various plants and different kinds of leaves can be easily gathered, produced and be used as natural food contact materials (FCM). Leaves commonly found and used as food wrappers in the Philippines are banana leaves, coconut leaves. Leaves packaging is unique, artistic, and add flavor to the product [4]. Banana leaves are commonly used as the packaging material for local delicacies and other food products such as *suman, tupig,* and many others. In practice, mainly in a small production volume, banana leaves are manually heated or singed in an open fire (LPG or charcoal stove) to become pliable and can be formed into the required packaging shape. Singeing is the process of lightly heating or burning the banana leaves. However, when the demand and production are high, a more efficient, faster, cheaper, and safer method of heating the banana leaves is needed.

Presently, the Merl's Native Delicacy employs *"maglalaib"* who are responsible for manual singeing of banana leaves using traditional charcoal-fueled stove. Merl's singe workers experience discomfort by being exposed to the smoke. No specific health problems have been reported but the exposure to smoke could lead to health problems. Since the polycyclic aromatic hydrocarbons are carcinogenic, lung cancer could be a potential health hazard to grill workers.

The current situation of Merl's uses manual singeing of the banana leaves using coconut charcoal. Through the utilization of the much cheaper rice hull, the monthly operating cost will be lessened and the health hazard to the manual singeing workers of the banana leaves will also be eliminated. This method not only poses great risk to workers from burning but also incurs additional cost to the company as coconut charcoal is more expensive and harder to acquire. Merl's Native Delicacies currently use 64 sacks of charcoal a month which cost around ₱37,000. The projected monthly cost of using the rice hull carbonizer is only around ₱21,000.

Rice producers could also benefit by selling their waste rice hull from milling their palay. Banana farmers could also earn by supplying banana leaves to the food processers that will use the technology. Food processors that use banana leaves as food contact materials for delicacies such as *tupig, bibingka, puto* and other food products could benefit from the technology. Restaurants which use singe banana leaf as lining to their plate or as wrapper of rice are also potential users of this technology. Metal fabricators that could fabricate the whole set of technology and integrators that could integrate automation technologies to the rice hull carbonizer and conveyor system will also benefit and will help the sustainability of the technology.

This project offers a value-addition in the production aspect where in there is an improved quality or evenly singed banana leaves, a higher margin of safety for the laborers and a more efficient singeing process resulting to lower production cost. Singeing banana leaves will enhance its natural waxy coating that provides better insulation for hot food. Another positive attribute in using singed banana leaves is the aroma produced when food is wrapped in it. Singeing banana leaves will also make it soft and pliable, making the packaging process more manageable.

(7.1) RATIONALE/SIGNIFICANCE (not to exceed 300 words)

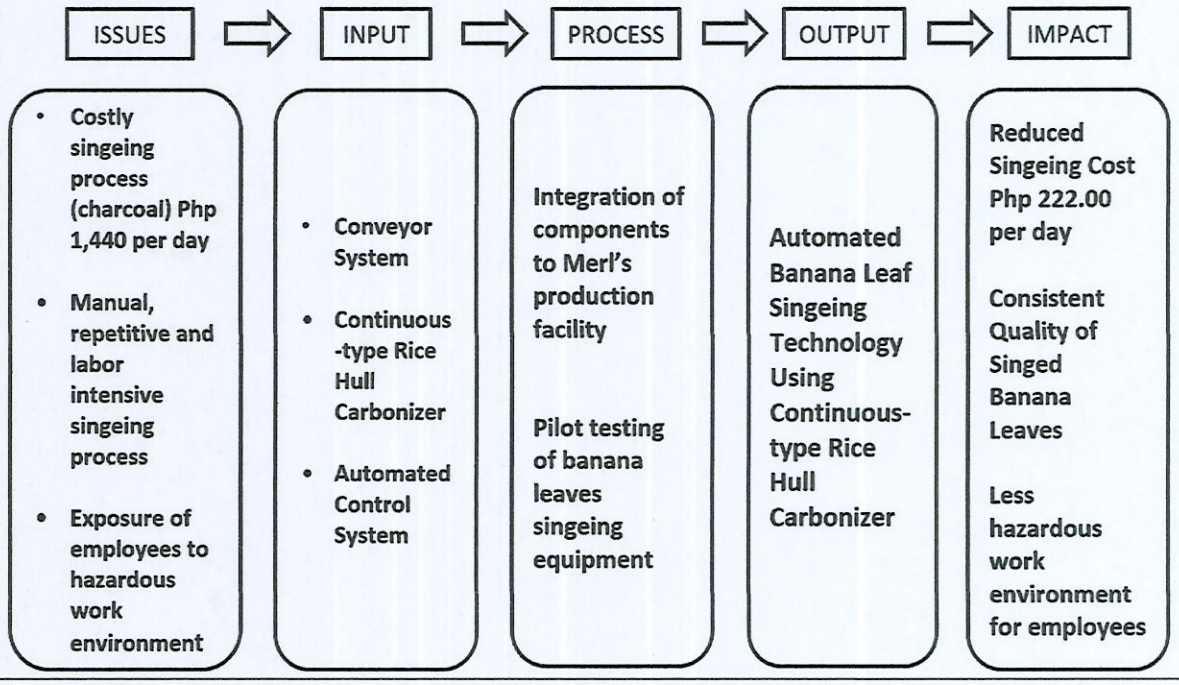
Merl's Native Delicacies is a food processing company located in Calapan, Oriental Mindoro, that ventures into the supply and distribution of pasalubong products. They are known for their best-seller *Suman sa Lihiya,* a native delicacy made of sticky rice. The company produces about 300,000 pieces of *suman* per month and is expanding their market reach abroad.

Currently, the company uses charcoal as the fuel source to singe banana leaves. The workers in charge have separate charcoal stoves that are used to singe the banana leaves by manually. This process is labor-intensive, repetitive, and hazardous to workers' health due to lengthy exposure to charcoal combustion by-products such as dust, particulates, and other harmful fumes and chemicals produced.

The company owner wants to modify their singeing process to be more efficient, faster, and safer for the health of their employees. The solution is to develop an automated banana leaf singeing technology that utilizes rice husk as fuel. A conveyor system will be used to control the contact time of banana leaves with the flame produced in the rice husk carbonizer. This proposed system will reduce the manual and repetitive process of singeing thousands of banana leaves daily and reduce workers' exposure to a hazardous work environment. Also, the cost of rice hull is cheaper, and is abundant in the province, therefore, it will be economical.

Other food processors will use the technology developed in this research, particularly those engaged in the mass production of native delicacies, pasalubong items, and other food products packed in banana leaves. The metal fabricators can acquire a license for the equipment design and manufacture for the companies in need of the equipment. Mindoro State University will also be part of the project, particularly in the testing phase, boosting its R&D capabilities. The banana leaf singeing technology aligns with sustainable development goals 3, 7 and 9, and supports the transition towards circular economy, where resources are used efficiently, and waste is minimized.

(7.2) SCIENTIFIC BASIS/THEORETICAL FRAMEWORK



(7.3) OBJECTIVES

a. General: This project aims to address the needs of MSMEs (Merl's Native Delicacy) to provide safer, reliable, and cost-efficient banana leaf singeing technology for Food Contact Materials (FCM).

b. Specific:

1. To design and install a banana leaves singeing equipment in Merl's Native Delicacies production plant;
2. To come up with an optimum singeing temperature, rice hull feed rate, and exposure time of varying banana leaf moisture content to maximize the use of rice hull as fuel source;
3. To determine the economic viability of the banana leaves singeing technology.

(8) REVIEW OF LITERATURE

Potential Health Risks of Workers Exposed to Charcoal Grilling

The combustion of charcoal reacts with oxygen in the air to form colorless carbon monoxide (among other gases). According to the Food and Agriculture Organization (FAO), unburned carbon monoxide gas can be emitted by burning charcoal which is very poisonous [3]. In a study made by Madani et al., charcoal meat grilling workers exceeded the 5% COHb limit set by the World Health Organization and the National Institute for Occupational Safety Health [4]. COHb is the measurement of carboxyhemoglobin in the blood, which is how exposure to carbon monoxide is estimated.

Aside from carbon monoxide, grill workers are also exposed to the emissions of polycyclic aromatic hydrocarbons (PAHs), which are among the most health-relevant compounds. PAHs are known for being toxic, mutagenic, and have carcinogenic properties [5, 6]. In a study by Oliveira et al., even with a mechanical ventilation system, workers were exposed to PAHs at levels that ranged between 56.2 and 261 ng/m3, with 7.8% of PAHs being carcinogenic compounds [7]. 200 µg/m3 is the occupational threshold limit proposed by the American Conference of Governmental Industrial Hygienists for an 8-hour exposure to coal tar pitch volatiles.

In another study by Dyremark et al., charcoal grilling poses a potential health hazard to the people performing the grilling because of the PAHs emitted [8]. PAHs were also emitted during the combustion of coconut shells, as shown in the study of Gurlutyu [9].

Banana Leaves Preparation

In the study of Luna et al., the most commonly used method of preparation of banana leaves is wiping, washing, and heating or singeing. Convenience and service speed are the primary reasons cited for wiping leaves. However, *suman sa lihiya* production includes the heating process, incurring additional overhead and labor costs [1].

Singeing and oven heating are also implemented by food service establishments in Columbia and Mexico. Heating is done to soften the banana leaves, making them more pliant to facilitate handling when used as a food contact material. According to the respondents in the study of Luna et al., heating is done to kill pathogens that may harm consumers; however, there is no empirical evidence that heating ensures the safety of leaves. For heated banana leaves used as packaging material, food safety and quality

breaches are less likely to occur. Heating during cooking may potentially kill spoilage and pathogenic microorganisms. It is also crucial that the food cooked in banana leaves should be served or packed immediately after proper cooling to reduce microbial recontamination [1].

In the singeing process reported by Luna et al., the banana leaves are passed over the flame for ≤ 20 seconds allowing it to change color from light to dark green without burning. On the other hand, in oven-heating, pre-cut leaves are exposed to hot air for 20-30 seconds. Singeing can potentially generate soot that may contaminate food. Uneven heating of banana leaves occurs due to the manual singeing process. Although these are not observed in oven heating, the oven size is a limitation because it dictates the length of banana leaves to be accommodated. Both heating methods are tedious; thus, designing new mechanical heating equipment suitable for banana leaves could be explored. The prototype design may consider a thermally controlled metal plate device where the leaf can be pressed between plates [1].

Drying and Heating Methods

In the paper of Erbay Z. et al., a pilot-scale heat pump conveyor dryer was used to dry olive leaves. The drying system consisted of two main parts: a heat pump and a drying chamber. The air was heated by a heat pump system, including a scroll compressor, two condensers (internal and external), the expansion valve, an evaporator, and a heat recovery unit. R407C was used as a refrigerant in the heat pump system. The drying air was regulated by a fan and its speed control unit, and the drying air was recycled. Drying compartment dimensions were 3.0 x 1.0 x 1.0 m. Drying experiments were carried out at a drying air temperature range of 45–55 °C with a drying air velocity range of 0.5–1.5 m/s for a time range of 270–390 min. Olive leaves were moved by a conveyor band system driven by a motor. The heat pump was used in drying because of the low operating cost [10].

Akpinar developed a solar dryer with forced convection which was used to investigate the drying of parsley. The setup mainly consists of an indirect, forced convection solar dryer with a solar air collector, a circulating fan, and a drying cabinet. The solar air collector was constructed from stainless steel sheets, and the outer surface was painted black. The solar air heater was covered with a copper sheet. Fins were also installed in the flow area to increase the heat transfer coefficient and output of temperature air. Glass is used to cover the air heater to prevent top heat loss. The drying cabinet was made from wood, forming a rectangular tunnel. Dry and hot air is blown into the top side of the cabinet. A centrifugal fan is installed in the drying cabinet to provide an air velocity of 0.4 m/s. The temperature of drying air at the inlet of the drying cabinet ranged from 50.5 to 64.3 °C and the temperature of drying air at the outlet of the drying cabinet ranged from 43 to 60.4 °C [11].

In the study of Alit et al., a dryer was designed to use two rice husk-fueled furnaces in which heat exchanger pipes are added. The distribution of heat through the heat exchanger pipes and conduction from the furnace attached to the wall of the drying chamber was investigated. The test results show that the average ambient air temperature of 32.14 °C can be increased to 92.10 °C, 93.27 °C, and 94.96 °C in the drying chamber for variations in the diameter of the furnace wall holes of 8 mm, 10 mm, and 12 mm, respectively. Sequentially, the temperature in the drying chamber reaches a maximum of 119.13 °C, 127.98 °C, and 140.89 °C [12].

The dryer system includes a rice husks furnace, stainless steel pipes, iron plates, aluminum plates, solar panels, batteries, exhaust fans, type K thermocouples, and data loggers. Rice husk is the primary energy source in the drying test process. A stainless-steel pipe with a diameter of 1 inch is used as a heat exchanger. Steel plates are considered in the design of

the rice husk burning furnace with dimensions of 40 cm × 50 cm x 60 cm. The dimensions of the drying chamber are 50 cm × 50 cm x 140 cm, which is made of an aluminum sheet. A solar panel is used as an energy source to drive the exhaust fan, with batteries as energy storage.

In a separate research article of Alit et al., the heat exchanger is placed at the bottom of the furnace. The furnace and drying chamber are in separate positions. The furnace has dimensions of 800 mm × 500 mm × 500 mm, the stand is 400 mm high and it is made of steel sheet plates. The furnace wall consists of 468 holes. The diameter and the distance between the holes are 1 cm and 5 cm, respectively. Furthermore, the diameter of the furnace ash hole is 12 mm and the heat exchanger pipes are stainless steel pipe.

The drying chamber is made of aluminum with 4 shelves. The insulation is made of rubber with a thickness of 3 mm. The dimensions of the drying chamber are 600 mm × 536 mm x 536 mm, with 400 mm footrest. The hot air is circulating with a forced convection system by means of an exhaust-fan. Exhaust-fan is placed in the chimney of the drying chamber with a constant air velocity of 2 m/s. The study uses measuring devices such as data loggers, K type thermocouples, digital scales, anemometers, and moisture meters [13].

Biomass Fuel for Dryers and Heaters

Bello et al. investigated the thermal properties of three biofuels: charcoal, sawdust, and rice husk. The biomass fuels were burned in a furnace-dryer where the air was supplied through natural convection using air ducts. In order to prevent heat loss, the drying chamber was insulated by a 25.4 mm air space between the inner wall and the outer casing. It was found that charcoal exhibits the highest thermal power (4.08 kW) expressed by temperature increase. The burning of sawdust was slower, and the thermal energy was 3.56 kW. Rice husk has the least thermal power of 2.93 kW due to slight temperature increases and emitting dark exhaust gases. The observed temperature rise and characteristic temperature curves in the drying chamber indicated that charcoal attained a very high drying temperature and increased within a short period than other fuels. The sawdust and rice husk have much lower heat buildup and longer temperature rise response time. Also, charcoal's total energy/heat transfer by conduction per hour is the highest at 1.47 kW per hour, while rice husk is the least with 0.98 kW per hour, though rice husk retains its heat over a long period. It was observed that charcoal completely burns away at shorter durations than sawdust and rice hull [14].

Charcoal is suitable for short time heating processes such as baking and roasting. Rice husk could be ideal for milk and fruit juice pasteurization, which requires heat processing conditions of between 63-85° C for about 15 to 30 minutes. Sawdust can be used to sterilize meat, fish, soup, etc. Charcoal is more environmentally friendly than other products because of the smokeless burning process, thus suitable for indoor cooking [14]. However, rice hull is cheap and lowers drying cost, thus making mechanical drying competitive. As a waste of the rice milling process, the cost of acquiring rice husk is practically its transportation cost to the dryer [15].

Rice Hull Carbonizer

Philippine Rice Research Institute (PhilRice) had developed it's continuous type rice hull carbonizer. It processes rice hull into biochar. It has an input capacity of 20-60 kg/h of rice hull and has a yield of 35 – 42 % charcoal. It's operation is continuous operation, and safe to operate during windy season. Presented in Figure 1 is the PhilRice Continuous Rice hull Carbonizer that the project proposed to utilize.

Figure 1. PhilRice continuous rice hull carbonizer.

PhilRice had developed some attachments for their continuous rice hull carbonizer to utilize the heat it produce. Among the applications were cooking attachment and pasteurization chamber, oven attachment, multi-purpose attachment (roaster), and heat recovery attachment. These attachments are presented in Figure 2.

Figure 2. PhilRice developed attachment to recover heat from the carbonizer.

Carbonization process utilizes higher operating temperatures (>300^{0}C) and longer residence times (>2 hours). Carbonization aims to produce a highly carbonaceous product [16]. The product is called charcoal which refers to the highly carbonaceous product that is intended to be used as a fuel. Furthermore, charcoal can be used in the smelting and sintering processes as a reductant in the metallurgical industry [17]. Carbonization is the oldest known thermochemical process that allowed humans to convert wood into charcoal. Carbonization was performed in the early ages by gathering the wood into a cone-shaped pile, covering it with earth, slowly combusting the wood, and allowing for the water content and volatile substances to exit from a central chimney, turning the wood into coal.

There is a considerable demand for banana leaves in the cooking and packaging of food products, particularly the local delicacies. However, the manual singeing or heating of banana leaves is a tedious process and affects workers' health due to exposure to hot and dusty environments. There is also no existing equipment that can accommodate the heating of a large volume of banana leaves. This study aims to develop a banana leaves heating machine that can process faster and more efficiently but at the same time cheaper using rice hull as fuel.

(9) METHODOLOGY

Existing Practice

Currently, the company produces 14,640 pieces of banana leaves that are ready for suman packaging every day. Eighty-three (83) kilograms of coconut shell charcoal are used to singe the banana leaves to become pliable and suitable for wrapping. Three employees are involved in this process, working 4 hours a day, five days a week.

I. System Design and Development

Proposed System Design

The two main components of the banana leaf singeing technology are the conveyor system and the rice hull carbonizer. The conveyor system will be designed according to the production capacity while the rice hull carbonizer system will be adopted from existing design of PhilRice. The system's capacity will be based on the theoretical calculations of heat energy produced by the carbonizer and the conveyor speed to come up with an optimum exposure time, heating temperature, and rice hull feed rate. Dimensions of the conveyor will be sized according to the required average size of banana leaves, and the speed will be controlled using a variable frequency drive (VFD).

The heating value of the coconut charcoal is 7,200 kcal/kg, while the rice hull is 3,000 kcal/kg. Equations 1 and 2 are used to determine the required energy from the rice hull carbonizer to produce the same capacity or pieces of banana leaves heated by the coconut shell charcoal. In this study, the target production capacity of the proposed heating equipment is 14,640 pcs per day or 50% of the company's total daily capacity. Table 1 shows the summary of the calculation.

$$\dot{Q}_{COAL} = \dot{m}_{COAL} \cdot HHV_{COAL} \cdot \eta_{COAL} \qquad \text{(Eq. 1)}$$

where, $\dot{m}_{COAL}$ is the consumption of the coconut shell coal, HHV_{COAL} is the heating value of the coconut shell coal and η_{COAL} is the thermal efficiency of the system.

$$\dot{m}_{ricehull} = \frac{\dot{Q}}{HHV_{ricehull} \cdot \eta_{ricehull}} \qquad \text{(Eq. 2)}$$

Where, $HHV_{ricehull}$ is the heating value of the rice hull and $\eta_{ricehull}$ is the thermal efficiency of a rice hull carbonizer.

The thermal efficiency of burning coal in the open atmosphere is 10% [18] while typical rice hull carbonizer efficiency ranges from 20-30% [19, 20].

Table 1: Comparison of coconut charcoal and rice hull as fuel for banana leaves heating

Fuel	Heating Value (kcal/kg)	Overall Efficiency (%)	Consumption (kg/day)	Operating Cost (Pesos per month)	Production Rate (pcs/day)
Coconut Shell Charcoal (Stove)	7200	10	41.6	37,200	14,460
Rice Hull (Carbonizer)	3000	20	499.2	15,846	14,460

Assembly and Integration

The fabrication and assembly of the conveyor and the rice hull carbonizer will be done independently. These components will be integrated at the test site. Figure 3 shows the concept design of the proposed banana leaves heating equipment.

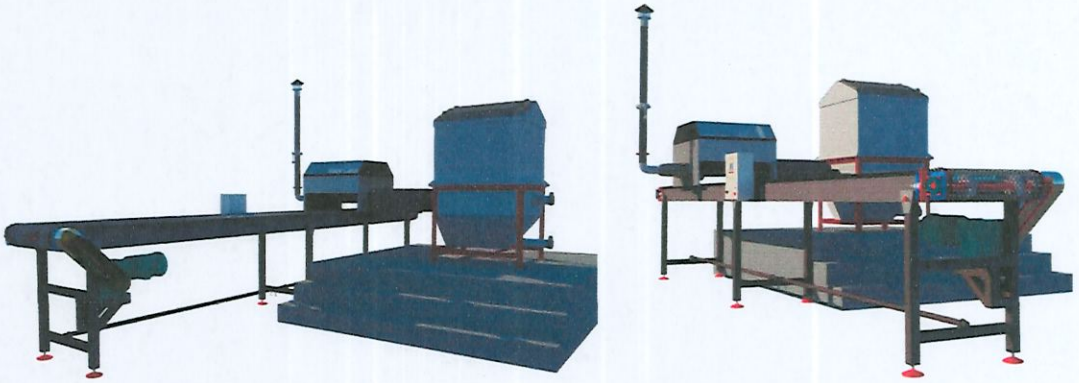


Figure 3 Concept Design Setup

Temperature sensors will be installed in the heating chamber and the carbonizer air inlet. A VFD will also be connected to the motor of the conveyor to adjust the linear speed. Another VFD will be installed in the feeder system of the carbonizer to regulate the feed rate of the rice hull. An extra pipeline will be installed to the burner. This would be used for LPG fuel once there will be a technical problem with the equipment and the operation of the company would not be hampered. These instrumentations will help the researchers determine the system's optimum heating temperature, exposure time, and feed rate to produce the required quality of heated banana leaves.

II. Testing

Functional Testing

These are the criteria that must be satisfied to consider the equipment as fully functional.

Table 2: Functional Test Checklist

Criteria	Yes	No
All motors are functional.		
All blowers are functional.		
The conveyor is functional.		
All VFDs are functional.		
All light indicators are functional.		
All temperature sensors are functional, and the readings are correct.		
Flame is produced from the rice hull carbonizer.		

Testing Protocol

The banana leaves that will be tested in the heating equipment will be prepared according to the company's existing procedure. The rice hull will be weighed before transferring into the hopper.

For a three different constant rice hull feed rate (31.2 kg/h, 23.4 kg/h, and 15.6 kg/h), the conveyor will run at different speed settings using the VFD. These feed rates correspond to 100%, 75% and 50% capacity of the rice hull carbonizer. The average length of one piece of banana leaf is 150 mm. The following linear speed will be used (see Table 3).

Table 3: Linear speed with corresponding exposure time and production rate

Conveyor Linear Speed (mm/s)	Leaf Exposure Time (seconds)	Calculated Production Rate (pieces of leaves per day)	Actual Production Rate (pieces of leaves per day)
113.1	1.3	21,714	
94.2	1.6	18,095	
75.4	1.9	14,476	
56.5	2.6	10,857	
37.7	3.9	7,238	

The quality of the singed banana leaves will be inspected, and the optimum linear speed of the conveyor will be determined. If the banana leaves are of below standard quality, the testing will proceed to the next linear speed parameter and exposure time.

For constant linear speed of conveyor, the rice hull feed rate will be varied. The optimum exposure time will be determined and will have a corresponding production rate.

Table 4: Optimum exposure time for different capacity of the rice hull carbonizer.

Carbonizer Capacity (%)	Rice Hull Feed Rate (kg/h)	Optimum Exposure Time (seconds)	Production Rate (pieces per day)
100	31.2		
75	23.4		
50	15.6		

The prototype testing will continue for two months to test the equipment for consistency and reliability. The following parameters shall be taken daily and the average value will be computed:

Table 5: Average rice hull carbonizer capacity for specific production rate

Optimum Carbonizer Capacity	Rice Hull Feed Rate (kg/h)	Optimum Exposure Time (seconds)

These are the performance parameters of the system that will be taken during the testing.

The following data will be noted during the test:

a. System downtime, errors occurred – determine the cause of errors
b. Troubleshooting and repair – determine the parts that are usually repaired
c. User experience (ergonomics, usability)

Banana Leaves Parameters

Aside from the parameters stated above (production rate, optimum carbonizer capacity, rice hull feed rate), banana leaves parameters will also be observed. Several parameters of banana leaves will be benchmarked according to the preference of the company. Color chart will be established based from their existing process. The moisture content of the banana leaves will also be monitored during performance testing. The pliability of the banana leaves will be observed.

Moisture Content

The moisture content of the raw banana leaves depend upon the season of the harvest. To analyse the effect of varying moisture content in the system, samples of raw materials will be tested for moisture content before the singeing process. The production per day of Merl's Native Delicacies is 14,470 pcs per day. A whole banana leaf could accommodate 20 pcs so approximately 732 pieces of banana leaves will be used per day. The sample size for this population is 382 pieces (95% confidence level and 5% margin of error). The correlation for the moisture content and the optimum exposure time would be established as well as the rice hull feed rated.

Table 6: Comparison of Optimum Exposure Time for Different Season

Optimum Exposure (time)	**Moisture Content (Dry Season)**	**Moisture Content (Wet Season)**

Table 7: Comparison of Rice Hull Feed Rate for Different Season

Rice Hull Feed Rate (kg/hr)	**Moisture Content (Dry Season)**	**Moisture Content (Wet Season)**

Operation Manual

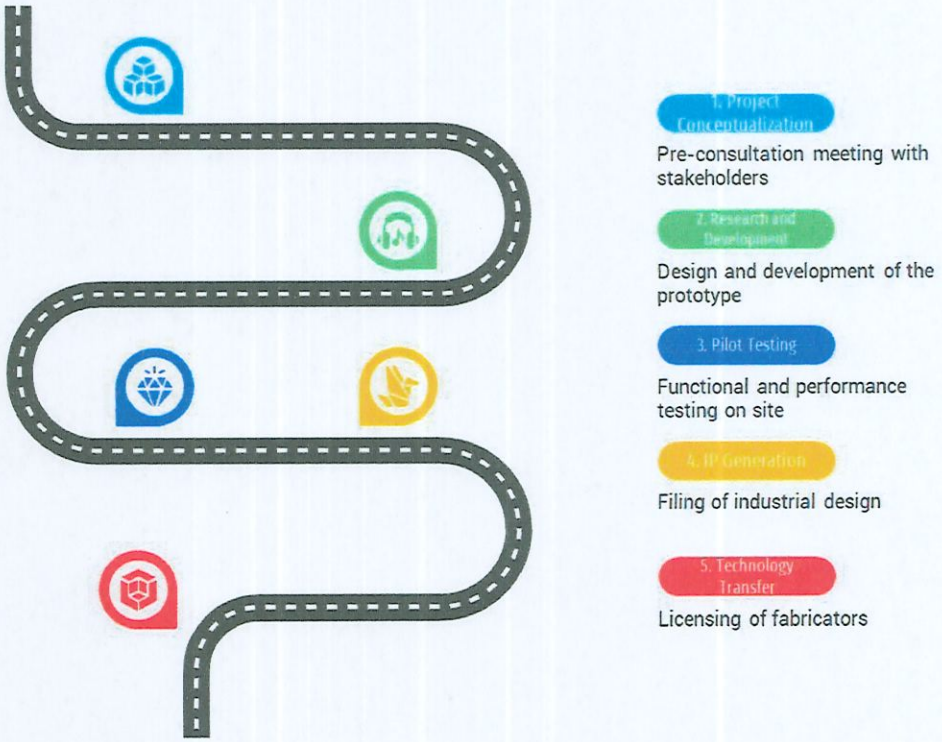
Manual of operation will be generated after the functional and performance testing of the equipment. The operation manual will be based on the final design of the equipment and will include the drawings of the major parts of the equipment. All the buttons, indicators and

controls in the panel will be included. General troubleshooting and repairs will also be included.

III. Economic Viability

The actual rice hull consumption and the number of banana leaves it can singe will be determined during the testing. The actual electric consumption will also be measured. Aside from these parameters, the cost of the rice hull and the worker's wage will dictate the operation's cost. The actual cost of the equipment will be determined. The VFDs and sensors used during the testing will not be included in the cost of the equipment. The monthly savings from using the equipment will determine the return on investment (ROI) from the commercial cost of the equipment.

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



(11) EXPECTED OUTPUTS (6Ps)

Publication – At least One (1) scientific paper for conference/publication
- One (1) operation manual
- One (1) audio visual presentation

Patent/Intellectual Property
- One (1) IP applied (rights will be shared by MinSU and DOST-MIRDC)

Product - One (1) unit of automated banana leaf singeing technology

People Services
- Three (3) persons trained for end users,
- One (1) technology training

Partnership - Two (2) partnership with a private company and a local fabricator

Policy - One (1) Draft Method of Test will be endorsed to AMTEC

(12) POTENTIAL OUTCOMES

1. Safe working environment for the workers performing the singeing of banana leaves
2. Productivity of the beneficiary will be increased

(13) POTENTIAL IMPACTS (2Is)

1. Social Impact – Reduction of health hazard for industry workers
2. Economic Impact – New product developed for metal industry; generation of income for beneficiary

(14) TARGET BENEFICIARIES

Merl's Native Delicacies, other businesses using banana leaf as packaging material, and other restaurants using banana leaf as lining in the plates and as wrapper for rice

(15) SUSTAINABILITY PLAN (if applicable)

The output of this project would enable MSME's and farmers to benefit from the developed technology and sustainable practices. The developed system minimizes health impact on the workers and support long-term production by using automation. This system could also benefit MSME's that use heated banana leaves as food contact material such as *tupig, bibingka*, and *puto* or other food products.

Farmers could benefit from the supply of banana leaves. According to the Philippine Statistics Authority, Oriental Mindoro has increased its banana production by 68% in 2021. 3,000 pieces of Pakil leaves per day are used. Pakil leaves are different from the variety of leaves used by other MSME's and is abundant in the area.

MIMAROPA is also 7th largest producer of palay in the Philippines and Oriental Mindoro supplies more than half of the palay produced in the region. Rice producers could also benefit by selling their waste rice hull from milling their palay.

Other MSME's that could benefit the technology is the metal fabricators that could fabricate the whole set of technology. Integrators that could integrate automation technologies to the system will also benefit.

A DOST-assisted local fabricators in the province will be tapped to spearhead the commercialization of the banana leaf singeing technology.

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

(17) LIMITATIONS OF THE PROJECT

The project will be limited to design, development and testing of the equipment.

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

Risks	Assumptions
Delayed acquisition of necessary equipment	Proceed with other activities such as fabrication of available parts, programming of the programmable logic controller and programming of variable frequency drive. Prioritize assembly of available off-the-shelf components, integration and programming Revisit workplan, fast track other activities
Disruption of scheduled activities due to weather disturbances	Make necessary adjustments in the work plan

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(20) PERSONNEL REQUIREMENT

Position	Percent Time Devoted to the Project	Responsibilities
Project Leader (Agricultural and Biosystems Engineer, Renewable Energy)	**20%**	Responsible to the overall technical and administrative management of the project to attain its' objectives Approves all the required documents such as Monitoring Reports, Progress Reports, Performance Evaluation Reports, etc.
Project Staff (Mechanical Engineer)	**20%**	Assist the project leader in overseeing project deliverables Responsible for the conceptualization and design of the equipment and automation system Assist in the programming of the PLC
Project Staff (Background in Economics)	**20%**	Assist the project leader in overseeing project deliverables Assist in the preparation of TORs for bidding Responsible for the implementation of the objective of attaining economic viability of the equipment
Project Staff (Agricultural and Biosystems Engineer, Crop Process Engineering)	**20%**	Assist the project leader in overseeing project deliverables Responsible for the testing and data gathering Assist in the documentation
Project Staff	**20%**	Assist the project leader in overseeing project deliverables Responsible for the preparation of TOR and bidding process Responsible for the monitoring and procurement of necessary fabrication materials
Project Technical Specialist I (CoS), (Automation)	**100%**	Responsible for the integration of the controls, sensors and plc program
Project Technical Specialist I (CoS) (Agricultural and Biosystems Engineer)	**100%**	Responsible for the system design requirements
Project Technical Assistant I (CoS)	**100%**	Liaison and clerical requirements of the project
Project Laborer II (CoS)	**100%**	Responsible for the monitoring of

		fabrication and assembly of the equipment

(21) BUDGET BY IMPLEMENTING AGENCY

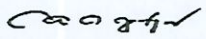
IMPLEMENTING AGENCY	PS	MOOE	EO	Total
Year 1	2,110,844.00	1,258,672.00	423,000.00	3,792,516.00
Year 2	769,786.00	437,698.00	-	1,207,484.00
Year n				
TOTAL				5,000,000.00

(22) OTHER ONGOING PROJECTS BEING HANDLED BY THE PROJECT LEADER: 1 (number)

Title of the Project	Funding Agency	Involvement in the Project
Anthropometric Survey of Farmers in Oriental Mindoro	Mindoro State University	Project Leader

(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	**ENGR. MARK KEYLORD S. ONAL**	**DR. CHRISTIAN ANTHONY C. AGUTAYA**
Designation/Title	**INSTRUCTOR/OIC-HEAD OF INSTITUTE OF AGRICULTURAL AND BIOSYSTEMS ENGINEERING**	**OIC – OFFICE OF THE UNIVERISTY PRESIDENT, MinSU**
Date	**January 18, 2024**	**January 18, 2024**

Note: See guidelines/definitions at the back.

IMPLEMENTING GUIDELINES ON AGENCY-TO-AGENCY AGREEMENTS
Negotiated Procurement under Section 53 (e) of IRR-A

1. POLICY RATIONALE

It is the general policy of government to purchase its requirements from the private sector. However, it acknowledges that, in some exceptional cases, procurement from another agency of the government is more efficient and economical for the government.

Thus, in accordance with Section 10 of Republic Act No. (R.A.) 9184 and its Implementing Rules and Regulations Part A (IRR-A), all procurement shall be done through open and competitive public bidding. Only in highly exceptional cases, and when justified by the conditions prescribed under these guidelines, can the procuring entity procure from another government agency under the 1st paragraph of Section 53(e) of the IRR-A of R.A. 9184.

2. PURPOSE

These guidelines are being issued to strictly prescribe the conditions when a government agency may procure from another government agency without need of public bidding pursuant to the 1st paragraph of Section 53 (e) of the IRR-A of R.A. 9184 (hereinafter, referred to as *Agency-to-Agency Agreements*).

3. SCOPE AND APPLICATION

The following are excluded from the application of these guidelines:

a. Infrastructure projects undertaken through the Armed Forces of the Philippines Corps of Engineers (AFPCOE) which shall continue to be governed by the Guidelines on Implementation of Infrastructure Projects Undertaken by the AFP Corps of Engineers under Government Procurement Policy Board (GPPB) Resolution No. 09-2005; and

b. Procurement of goods from the Procurement Service, which is tasked with a centralized procurement of commonly used goods for the government in accordance with Letters of Instruction No. 755 and Executive Order No. 359, s. 1989.

4. DEFINITION OF TERMS

For the purpose of these guidelines, the following terms shall have the corresponding meanings:

a. **Cost-benefit Analysis.** Refers to a tool used to aid decision-making by evaluating the benefits to be attained from an action against the costs for its implementation.

b. **Procuring Agency** shall refer to any of the various units of the Government, including a department, bureau, office, instrumentality, government-owned or controlled corporation (GOCC), or a local government, or a distinct unit therein, which purchases goods, or engages the services of another agency to undertake an infrastructure project or render consultancy services.

c. **Servicing Agency** shall refer to the agency which delivers the goods, undertakes the infrastructure project, or provide consulting services.

However, in accordance with Section 53(e) of the IRR-A of R.A. 9184, as amended, GOCCs incorporated under Batas Pambansa Blg. 168 or the Corporation Code of the Philippines, which are vested with proprietary functions to enable them to compete with the private sector, are excluded from the definition of Servicing Agency, and thus, not qualified to act as Servicing Agency under the 1st paragraph of Section 53(2) of the IRR-A of R.A. 9184.

5. GENERAL CONDITIONS

a. Agency-to-Agency Agreements may only be resorted to if the following conditions are complied with:

i. Conduct of a Cost-benefit Analysis by the Procuring Agency indicating that entering into an Agency-to-Agency Agreement with the Servicing Agency is more efficient and economical for the government;

ii. Total amount of all goods, consulting, and infrastructure projects undertaken or to be undertaken through Agency-to-Agency Agreements shall not exceed twenty-five percent (25%) of the Procuring Entity's total procurement budget for each category (*i.e.*, goods, infrastructure, or consulting) as reflected in its approved APP;

iii. Servicing Agency has the mandate to deliver the goods and services required to be procured or to undertake the infrastructure project or consultancy required by the Procuring Agency; and

iv. Servicing Agency owns or has access to the necessary tools and equipment required for the project.

b. In addition, for procurement of infrastructure projects under Agency-to-Agency agreements, the Servicing Agency must comply with the following conditions:

i. It must have a track record of having completed, or supervised a project, by administration or by contract, similar to and with a cost of at least fifty percent (50%) of the project at hand; and

ii. It shall not directly or indirectly engage private contractors to undertake the project and may only implement the infrastructure project in-house, by job-order, or through the *pakyaw* contracting system.

In-house labor is undertaken if the workers are employees or personnel occupying regular *plantilla* positions in the Servicing Agency. Job-order contracts shall be governed by the applicable rules of the Commission on Audit and/or Civil Service Commission. *Pakyaw* Contracting System shall be governed by Section 4 of the GPPB Revised Guidelines for the Implementation of Infrastructure Projects by Administration.

c. Subject to appropriate guidelines, the Procuring Agency may require the Servicing Agency to post a performance security under Section 39 of R.A. 9184 and/or post a warranty security under Section 62 of R.A. 9184.

d. All procurement to be undertaken by the Servicing Agency, including those required for the project, shall continue to be governed by the provisions of R.A. 9184.

e. All projects undertaken through Agency-to-Agency Agreements shall be subject to pertinent budgeting, accounting, and auditing rules.

6. PROCEDURAL REQUIREMENTS

a. The end-user unit shall undertake a Cost–benefit analysis, taking into consideration the following factors: prevailing standard cost for the project in the market, absorptive capacity of the Servicing Agency, and such other factors.

b. It shall likewise secure a certificate from the relevant officer of the Servicing Agency that the latter complies with all the conditions prescribed under Section 5 (a) and (b).

c. Based on the assessment and recommendation of the end-user unit, the BAC shall issue a resolution recommending the use of Agency-to-Agency Agreement to the head of the Procuring Agency.

d. Upon approval of the BAC resolution,, the Procuring Agency shall enter into a Memorandum of Agreement (MOA) with the Servicing Agency.

e. Pursuant to Section 3 (c), the MOA shall reflect the agreement of the parties with regard to the posting of a performance bond and/or a warranty security.

f. For purposes of transparency, the Procuring Agency shall post for a period of seven (7) calendar days, general information pertaining to the procurement activity conducted, in the following areas:

i. Philippine Government Electronic Procurement System or (PhilG-EPS);
ii. Website of the Procuring Agency and its electronic service provider, if any; and
iii. Any conspicuous place in the premises of the Procuring Agency.

7. EFFECTIVITY

These guidelines shall take effect fifteen (15) days after its publication in the Official Gazette or in a newspaper of general circulation.

- **NEGOTIATED PROCUREMENT FOR GOODS: Agency-To-Agency**

Negotiated Procurement may be resorted to in **an agency-to-agency procurement** or in any of the following cases:

1. After 2 failed biddings,
2. Emergency,
3. Procurement Agent,
4. Defense Cooperation Agreement,
5. Small-Value Procurement,
6. NGO Participation
7. United Nations Agencies.

Agency-to-Agency Procurement is defined as the procurement of infrastructure projects, consulting services and goods from another agency of the Government of the Philippines (GOP), such as the Procurement Service, Department of Budget and Management (PS-DBM), which is tasked with a centralized procurement of Common-Use Supplies for the GOP in accordance with Letters of Instruction No. 755 and Executive Order No. 359, series of 1989.

For purposes of Section 53.5 of the Revised IRR of RA 9184, the term agency excludes GOCCs incorporated under *Batas Pambansa Blg.* 68, otherwise known as the ï¿½Corporation Code of the Philippinesï¿½.

GPPB Resolution No. 03-2011 dated January 28, 2011 incorporated into the Revised IRR of RA 9184 (6th Edition, 2012) the Implementing Guidelines on Agency-to-Agency Agreements which was the subject of an earlier GPPB Resolution No. 18-2007, dated May 31, 2007. These guidelines set forth the general conditions when procurement of goods, infrastructure and consultancy services from other government agencies may be resorted to. It also set forth the procedural requirements that agency-to-agency have to comply with.

a. *Audit Objective:*

To verify if the adoption of the alternative method in the procurement of goods was in accordance with the conditions and procedural requirements provided under existing rules and regulations.

b. *Sub-Objectives, Criteria, Validation Procedures & Suggested Working Paper*

Documents needed for evaluation:

1. Approved Annual Procurement Plan (APP);
2. Cost-benefit Analysis by the Procuring Agency indicating that entering into an Agency-to-Agency Agreement with the Servicing Agency is more

efficient and economical for the government;

3. Certificate from the relevant officer of the Servicing Agency that the latter complies with all the conditions prescribed under Section 5 (a) and (b) of the Guidelines;
4. BAC Resolution recommending the use of Agency-to-Agency Agreement to the head of the Procuring Agency;
5. The approved BAC resolution and the Memorandum of Agreement (MOA) with the Servicing Agency;
6. Performance bond and/or a warranty security; and
7. Notice of Award and evidence of its posting.

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Audit Sub-objective • *Audit Criteria*	Audit Activities	Suggested Audit Working Paper			
		Audit Question	Yes	No	Particulars of the Answer
1. To verify if the Procuring Entity (PE) has complied with the following conditions and procedural requirements for resorting to an Agency-to-Agency Agreement: **a. Conducted a Cost-benefit Analysis by the Procuring Agency indicating that entering into an Agency-to-Agency Agreement with the Servicing Agency is more efficient and economical for the government;** **b. The total amount of all goods undertaken or to be undertaken through Agency-to-Agency Agreements shall not exceed 25% of the PE's total procurement budget for each category;** **c. The HOPE/BAC has ascertained that the Servicing Agency has the mandate to deliver the goods and services required to be procured by the PE; and** **d. The HOPE/BAC has ascertained that the Servicing Agency owns or has access to the necessary tools and equipment required for the project.** **e. The HOPE/BAC has ascertained that the Servicing Agency has a track record of having completed or supervised a project, by administration or by**	1. Review and examine all the documents needed for evaluation and verify if the PE and the BAC has complied with all the conditions required for resorting to an Agency-toAgency Agreement	1. Are the conditions for resorting to an Agency-to-Agency Agreement complied with? - Is it more efficient and economical for the government? - Is the total amount of all goods to be procured through Agency-to-Agency Agreements within 25% of the total procurement budget for goods? - Is the Servicing Agency mandated to deliver the goods and services? - Does the Servicing			

contract, similar to and with a cost of at least fifty percent (50%) of the project at hand; **f. The MOA stipulates that the Servicing Agency shall not directly or indirectly engage private suppliers to undertake the project; and** g. **posted the Notice of Award for a period of 7 calendar days, in the required areas.** *Appendix 6 of the IRR of RA 9184 6th Edition 2012, IMPLEMENTING GUIDELINES ON AGENCY-TO-AGENCY AGREEMENTS, as approved by GPPB Resolutions No. 18-2007 dated May 31, 2007 and No. 03-2011 dated January 28, 2011*		Agency own or have access to the necessary tools and equipment required for the job? - Does the Servicing Agency have a track record of having completed or supervised a project, by administration or by contract, similar to and with a cost of at least 50% of the project at hand?			

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