Agricultural and Fisheries Mechanization Technologies for Sustainable Philippine Agriculture and Fishery Production Systems

By RMCAMONGO, MVLLARONA and ACRICO

Presentation by

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I. Introduction
   Country Background on Agriculture

II. Philippine Climate Smart Agriculture and Fisheries

III, Institutions involved in the development of climate resilient AFMTs

IV. Climate resilient AFMTs developed for sustainable agri-fisheries production systems
   - BOIMECH
   - Other Institutions

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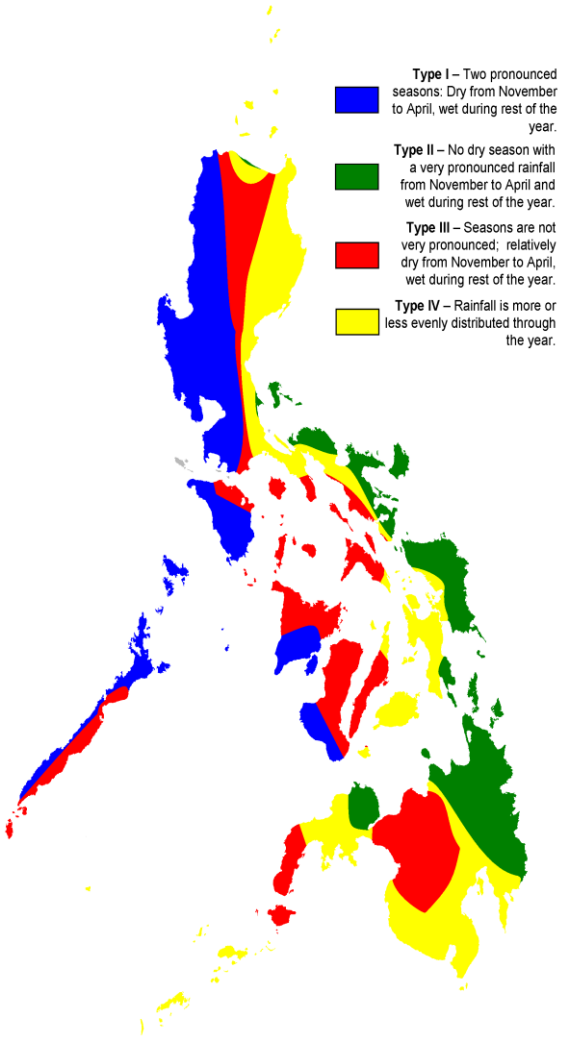
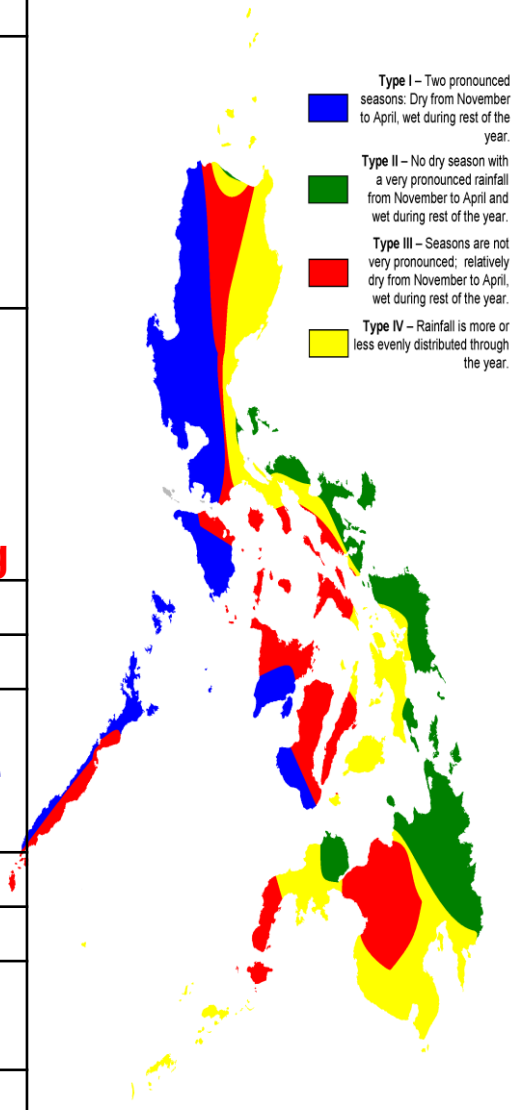
INTRODUCTION

Item	Description	Data
Geographical Location	Latitude : NL	4.7 º N
	: SL	21.5 º N
	Longitude: EL	117 º E
	: WL	127 º E
Meteorological conditions	Temperature	Min. 26.1 º C Max. 28.4 º C
	Annual Precipitation	**2000 mm/year**
Agricultural Conditions	Total Area	300,000,000 km^2
	Total Land Area	**298,170,000 km^2**
	Total Water Area	**1,830,000 km^2**
	Agricultural Land	9,671,000 km^2
	Arable Lands	4,936,000 km^2
	Permanent Cropland	4,225,000 km^2
	Forest land	74,000 km^2
	Other lands	307,000 km^2
	Agricultural Farms	4,820,000 farms (2002)



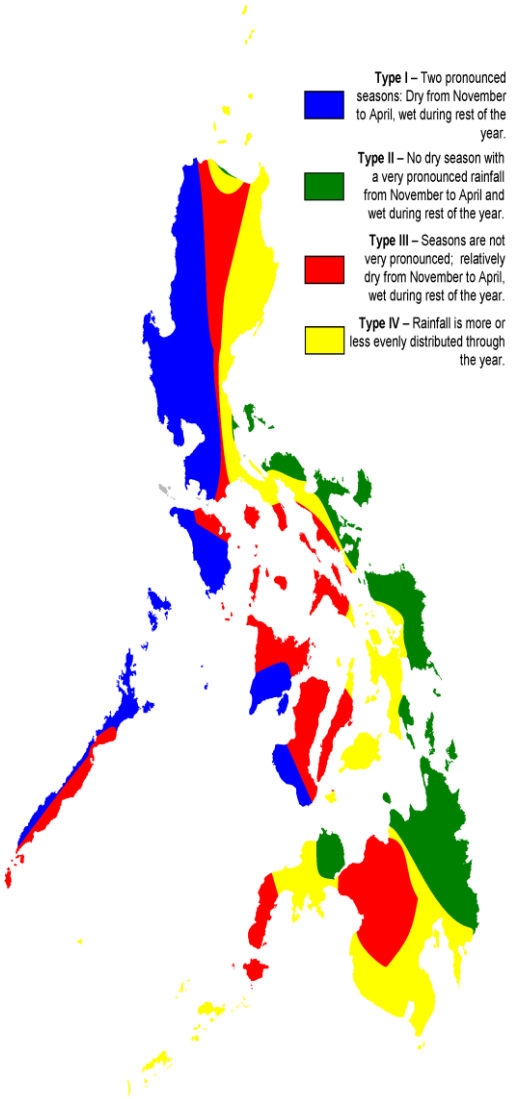
INTRODUCTION

Item	Description	Data
Agricultural Conditions	Staple foods	**RICE: (2015)** **Area Harvested::** **4.656 million ha** **Production: 18.150 MMT** **Farm gate Price: P18.04kg**
		CORN: (2015) **Area Harvested:** **2.562 million ha** **Production: 7.518 MMT** **Farm gate Price: P12.01/kg**
	Other staples	Root Crops and Plantain
	Other major crops	Sugarcane, Coconut
	Top Export crops	Coconut Oil (18%), Banana (17%), Tuna (7%) Pineapple & Products (7%)
Population and Employment	Total Population	**103.500 million**
	Total Employment	38.65 million
	Employment in Agriculture	**11.801 million (share 31%)**
	Wage Rates	P 252-454 plantation(2016)



INTRODUCTION

Item	Description	Data
Social Conditions	Official Language	English & Filipino
	National Language	Filipino
	Religion	Christians / Muslims
Economy (2015)	GNI at current prices	P 13,851 Billion
	GDP at current prices	**P 11,584 Billion (10% in agriculture with 7.18% growth)**
	GVA at current prices (agriculture and fishing	P1,293 Billion
Mechanization Level (Quick Index)	For Rice For all crops	2.32 hp/ha 1.23 hp/ha



INTRODUCTION

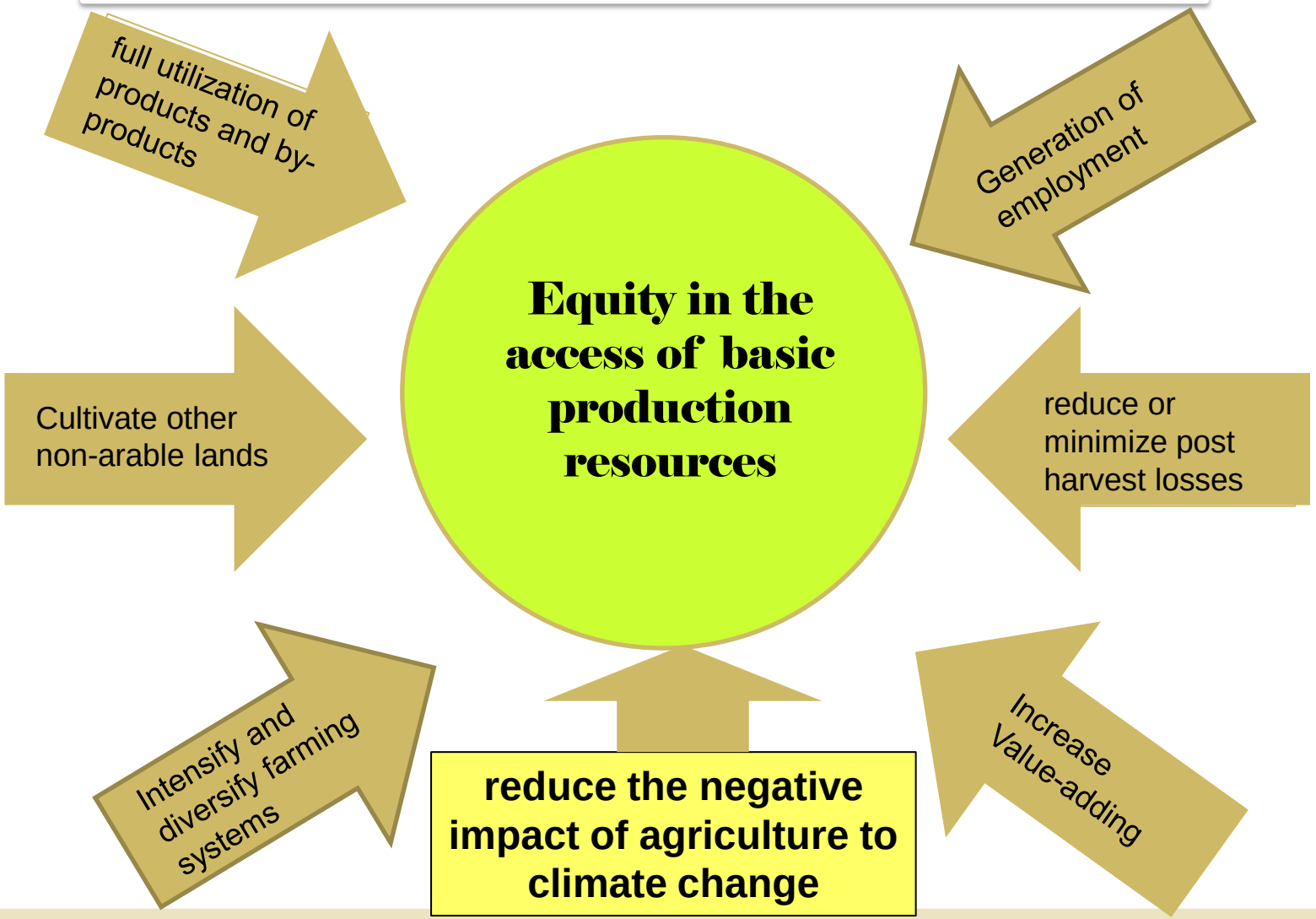
The use of climate resilient agricultural and fisheries mechanization technologies (AFMTs) is therefore necessary to sustain agricultural and fishery production systems in view with climate change, for food production and to meet the requirements of the ever-growing population.

INTRODUCTION

The introduction of suitable, innovative and climate resilient agri-fishery mechanization technologies (AFMTs) will, among others, enable the agri-fishery sector to cope up with the adverse effect of climate change, thus sustaining food productivity.

INTRODUCTION

AFMTs contribution



INTRODUCTION

This paper aims to present:

the development plan and the different institutions involved in research development and extension of innovative and climate resilient agri-fishery mechanization technologies in the Philippines;

the developed AFMTs resilient to climate change by RDIs and HEIs

current RDE efforts on precision agriculture as response in mitigating the adverse effect of climate change in the agri-fishery sector.

Philippine Climate Smart Agriculture and Fisheries

ASEAN Multi Sectoral Framework on Climate Change Agriculture and Forestry Towards Food Security (AFCC)

Sustainable Food Security Program
(DA & DAR)

- Irrigation
- RDE
- Credit & Marketing
- **Farm Mechanization**
- Land Tenure Improvement
- Other Supoort Services

Environmental Protection
(DENR/Climate Change Commission)

- Conservation(Soil, Water, Forest , ETC
- Solid Waste Management
- And Clean Air
- Climate Change Adaptation and Mitigation

Philippine Development Plan

2010-2016	2017-2022
Aquino Administration	Duterte Administration

Philippine Climate Smart Agriculture and Fisheries (Mechanization)

9.67 million ha for Intensive cultivation (rice, corn, coconut, HVCC, and livestock)

+

Agri-Fishery Mechanization Technologies

Development, Adoption, manufacture and use of appropriate and cost-effective agri-fisheries machinery

1.87 million km^2, marine and inland waters for fisheries production

Source: Country Stat, 2016;Rico 2016

Improve land and labor productivity & reduce post harvest losses

FOOD SECURITY FARM PROSPERITY

ABE Cooperation for ASEAN Food Security Climate Smart Agri-Fisheries Mechanization

Institutions involved in the development of climate resilient AFMTs

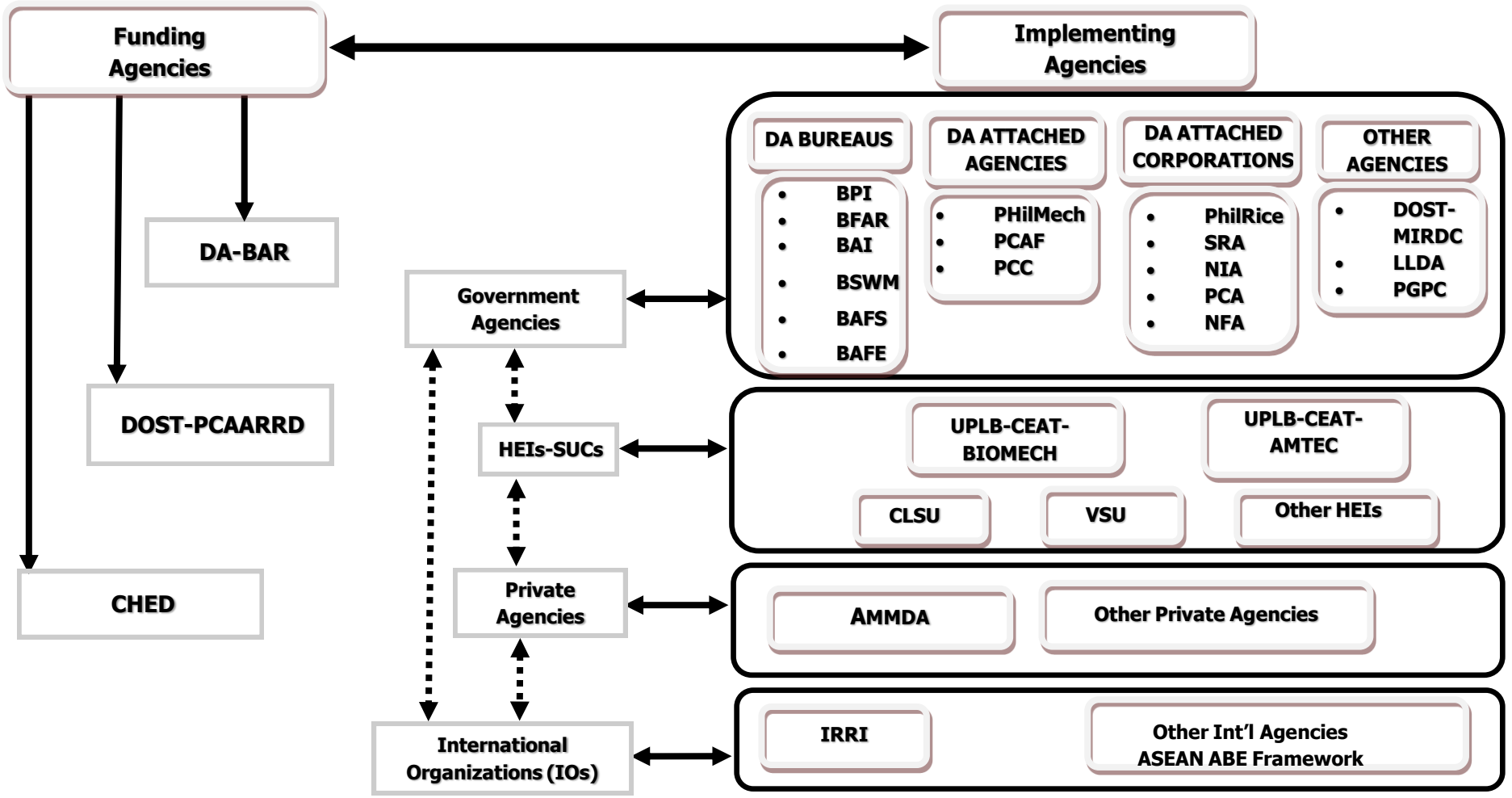


Figure 1. RDE Network for Agri-Fishery Mechanization

Institutions involved in the development of climate resilient AFMTs

Island	Region	Location of HEIs	No. of HEIs
Luzon	NCR (National Capital Region)	Caloocan	1
	Cordillera Administrative Reg	Benguet, Kalinga	2
	1 – Ilocos Region	Ilocos Norte, Ilocos Sur, La Union	3
	2 - Cagayayn Valley	Cagayan, Isabela, Nueva Vizcaya,	3
	3 - Central Luzon	Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac, Zambales	6
	4 -A- CALABARZON	Cavite, Laguna (2), Rizal	4
	4 -B- MIMAROPA	Oriental Mindoro, Palawan, Romblon	3
	5 - Bicol Region	Albay, Camarines Norte, Camarines Sur, Masbate	4
		Subtotal:	26

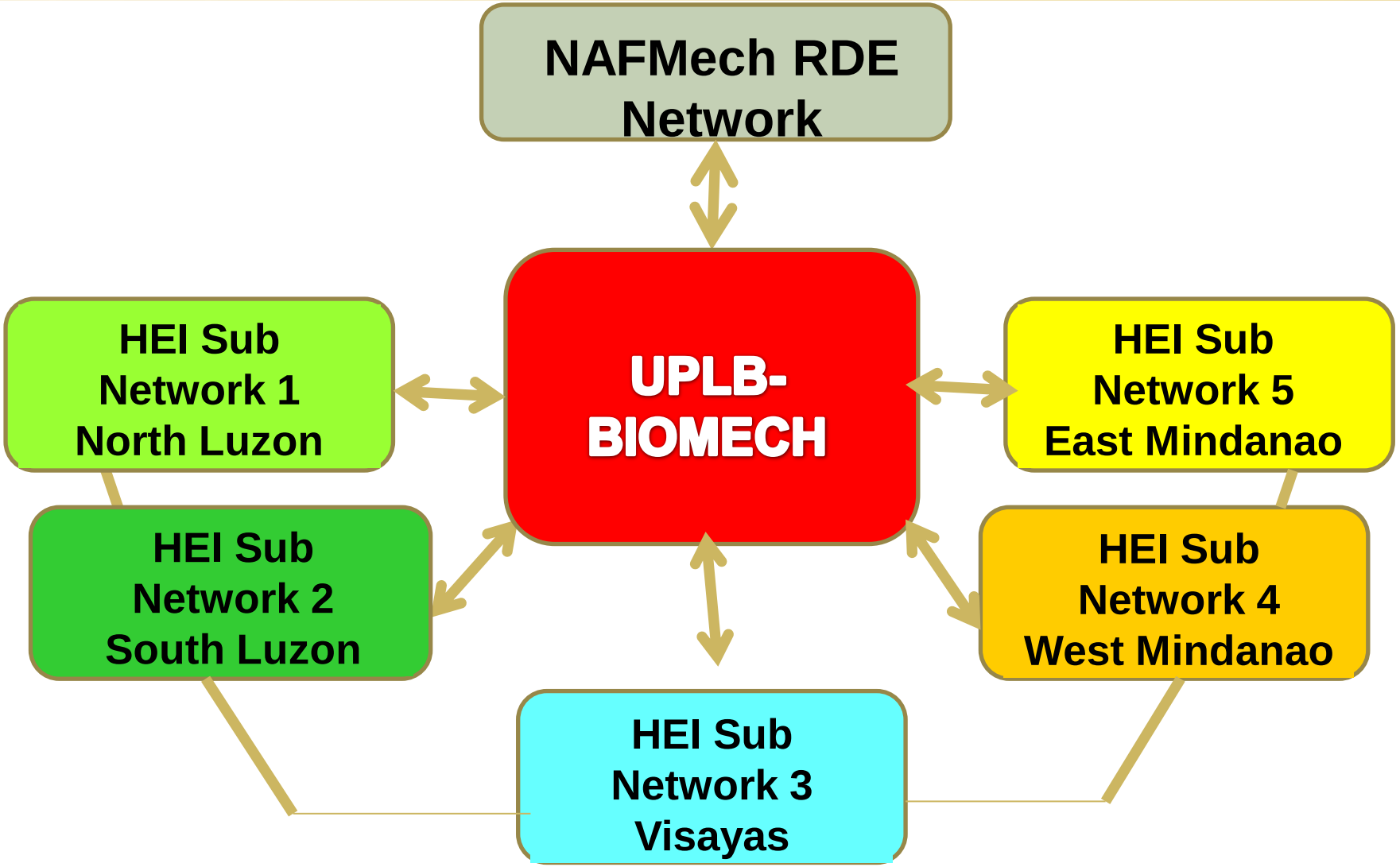
Institutions involved in the development of climate resilient AFMTs

Island	Region	Location of HEIs	No. of HEIs
Visayas	6 - Western Visayas	Capiz, Iloilo, Negros Occidental	3
	7- Central Visayas	Bohol	1
	8 - Eastern Visayas	Eastern Samar, Leyte, Northern Samar, Western Samar	4
		Subtotal:	8

Institutions involved in the development of climate resilient AFMTs

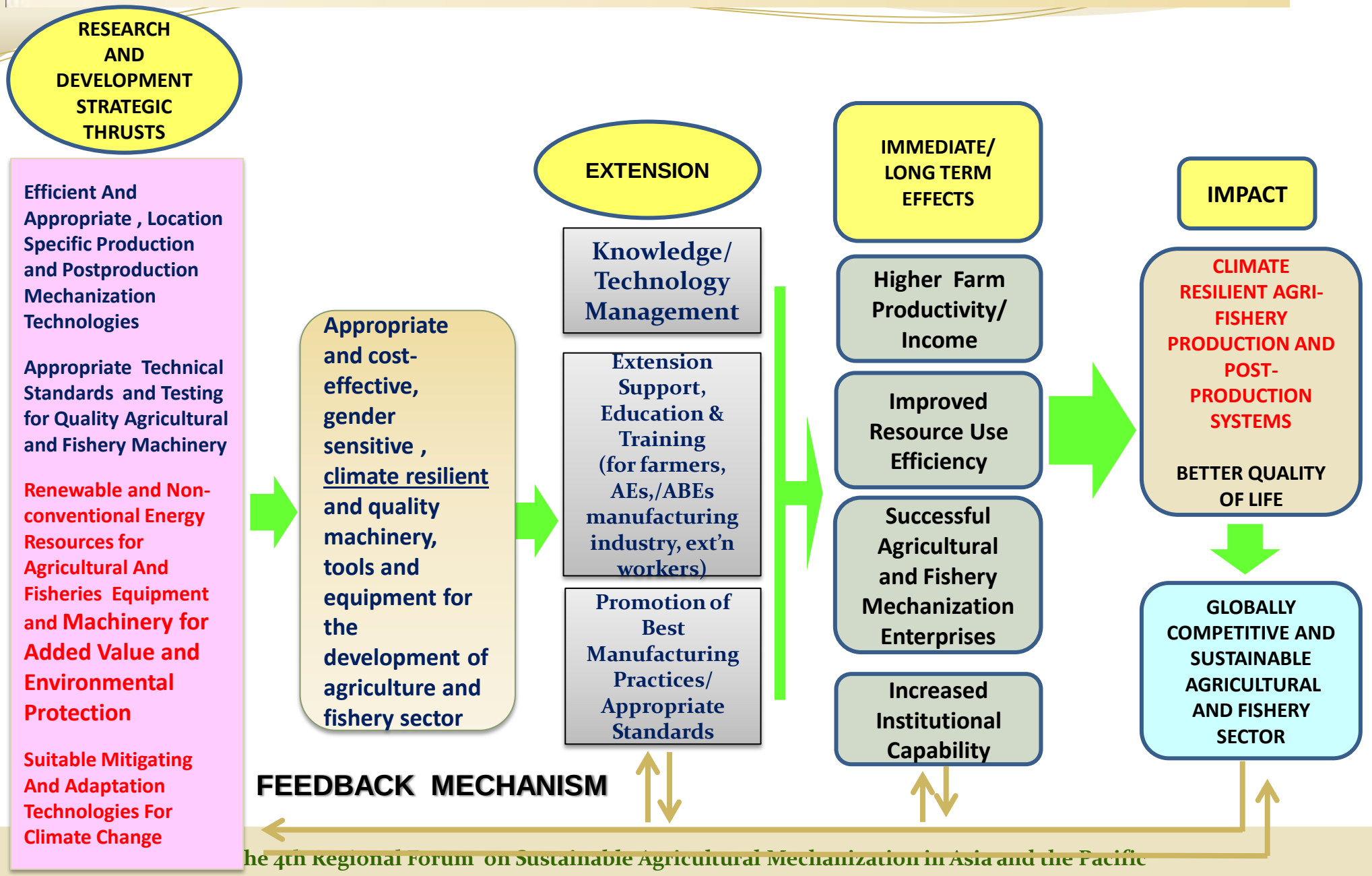
Island	Region	Location of HEIs	No. of HEIs
Mindanao	9 - Zamboanga Peninsula	Zamboanga del Norte (2), Zamboanga del Sur	3
	10 - Northern Mindanao	Bukidnon, Misamis Occidental, Misamis Oriental	3
	11 - Davao Region	Compostela Valley, Davao del Norte, Davao del Sur	3
	12 - SOCCSKSARGEN	North Cotabato, South Cotabato,	2
	13 - Caraga	Agusan del Norte, Agusan del Sur, Surigao del Sur	3
	ARMM – Autonomous region in Muslim Mindanao		0
		Subtotal:	14
		Total:	**48**

Institutions involved in the development of climate resilient AFMTs



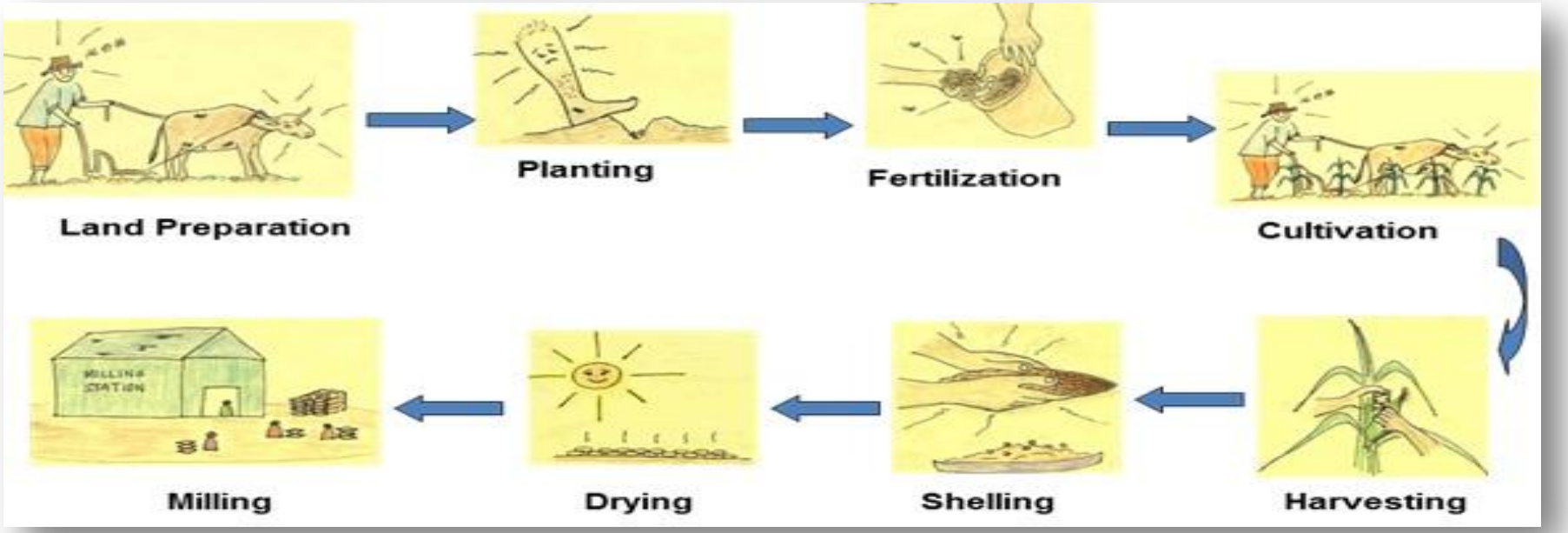
All Sub Networks will be represented in the NAFMechRDE Network

NAFMP RDE AGENDA (2017-2020) RA 10601



Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Traditional Farming



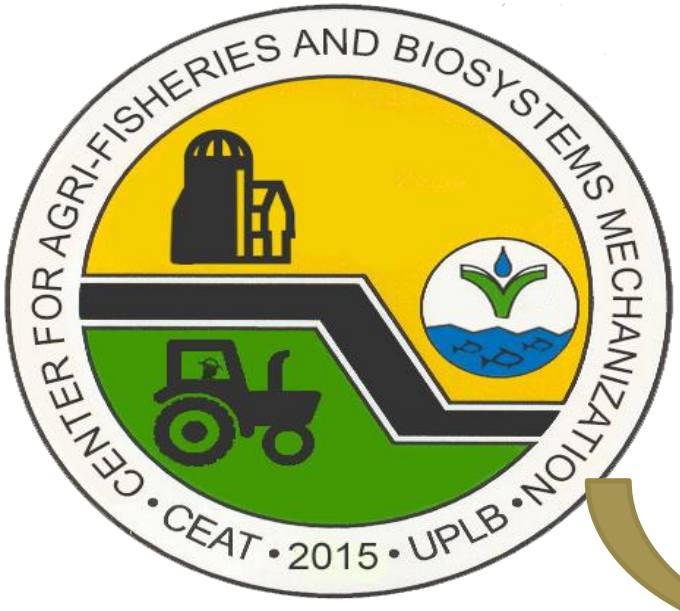
Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Farm Machinery Population, 2012 (Estimate)

Agricultural Machines	Number 2012
Agricultural Tractors	
1) 4-Wheel Tractor	9,306
2) Power Tiller	1,000,000
Paddy Threshers	
1) Rice Thresher	74,551
2) Pedal Thresher	20,149
3) Multipurpose Thresher/sheller	6,259
Mechanical Harvester	
1) Combine Harvester	50
2) Reaper	100
Post Harvest Machinery	
1) Corn Sheller	5,340
2) Flat Bed Dryers	2,620
3) Recirculating/Columnar Mech. Dryer	1,330
4) Corn Mill	2,340
5) Rice Mill (Single Pass)	24,420
6) Rice Mill (Multi-Pass)	904

Source: AMTEC; www.unapcaem.org as cited by Rico, 2016

Climate resilient AFMTs developed for sustainable agri-fisheries production systems



Excellence in RDE committed to agri-fisheries and biosystems mechanization in the Philippines **responsive to** the challenges of food security, energy sustainability, environmental protection, **climate change** and globalization.

Center for Agri-fisheries and Biosystems Mechanization (BIOMECH)

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Center for Agri-fisheries and Biosystems Mechanization (BIOMECH)

RDE THRUSTS

Areas	SPECIFIC RDE AREAS
Food Security	Crop, livestock and fisheries production mechanization technologies Aquaculture engineering Alternative food sources mechanization Postharvest mechanization Food and feed processing technology Precision agriculture and smart farming Contiguous farming system
Energy Sustainability	Energy-efficient technologies Renewable energy technology
Environmental Protection	Agro-waste management and utilization GIS for Mechanization (Agricultural Mechanization Planning and Monitoring) Soil and water conservation technologies
Climate Change	Land and water resources engineering Climate change mitigation and adaptation

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Land Preparation

UPLB Hand Tractor using surplus automotive differential

Mini hand tractor

UPLB Hand Tractor (with steering clutch)

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Crop Establishment

BIOMECH/AMDP Plow mounted corn seeder

AMDP 2W-Tractor driven seed planter cum automatic fertilizer applicator

AMDP Pneumatic Corn Planter

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Crop Care

UPLB Manure Spreader

UPLB Single-Row Organic Fertilizer Applicator

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Crop Care

Forage Chopper

Shredder

Mixer

Organic Fertilizer Production Machinery

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Primary Crop Processing

AMDP Two-drum Corn Sheller

Corn Sheller for high moisture content grains

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Primary Crop Processing

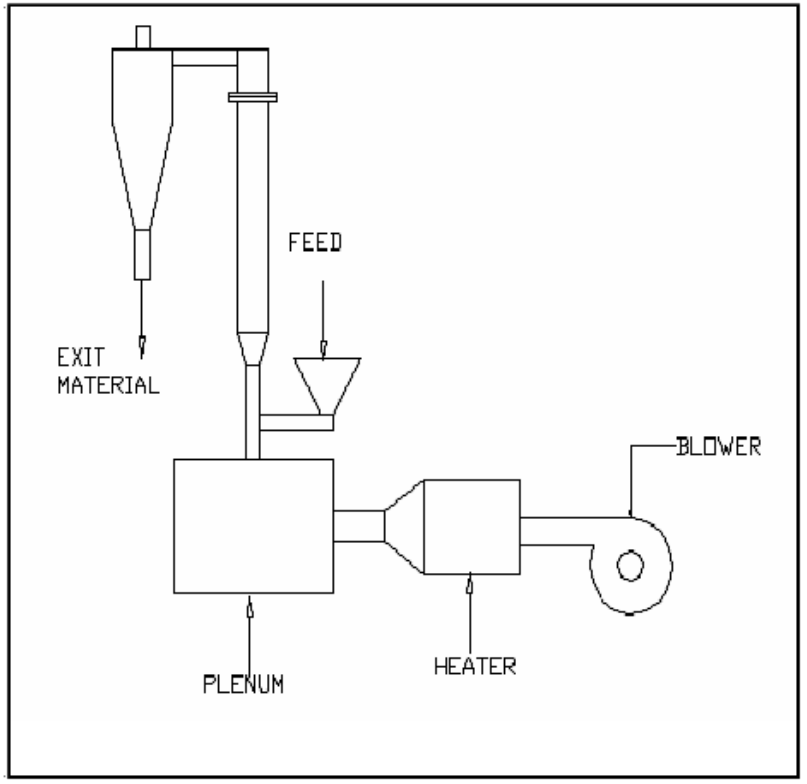
UPLB Flatbed Dryer

UPLB Multi Crop Dryer

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Primary Crop Processing

AMDP Mini Corn Mill



Schematic diagram of the AMDP Pneumatic Dryer

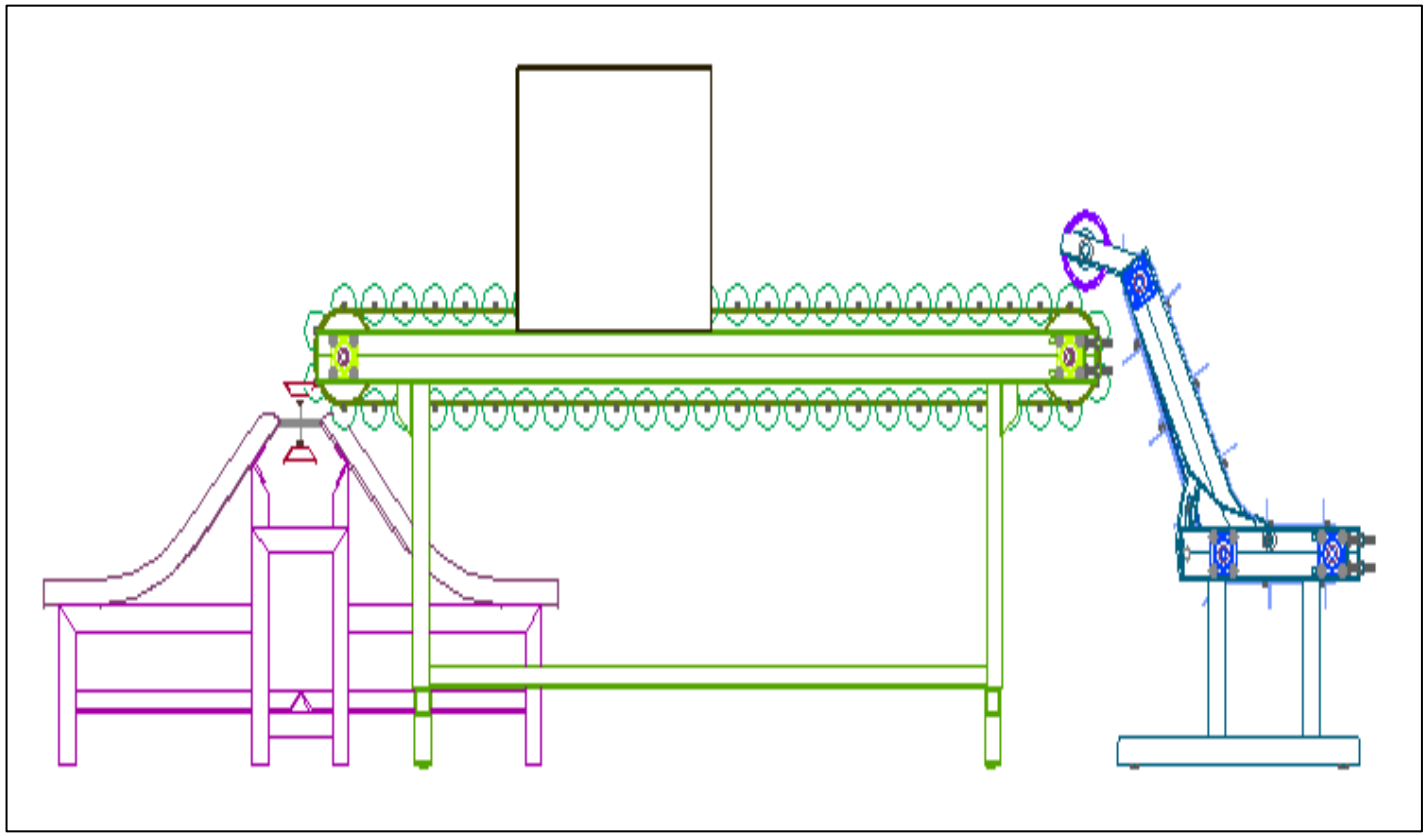
Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Post harvest Technologies

Collapsible cold room

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

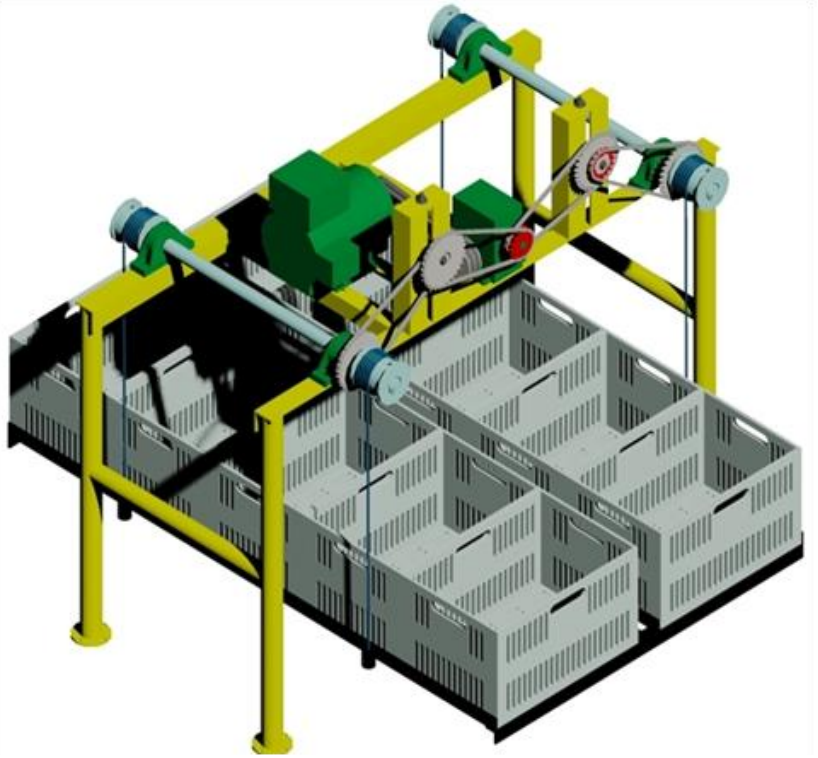
Post harvest Technologies



Machine vision system for mango sorting

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Post harvest Technologies



Designed lifting device

Hot Water Treatment

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

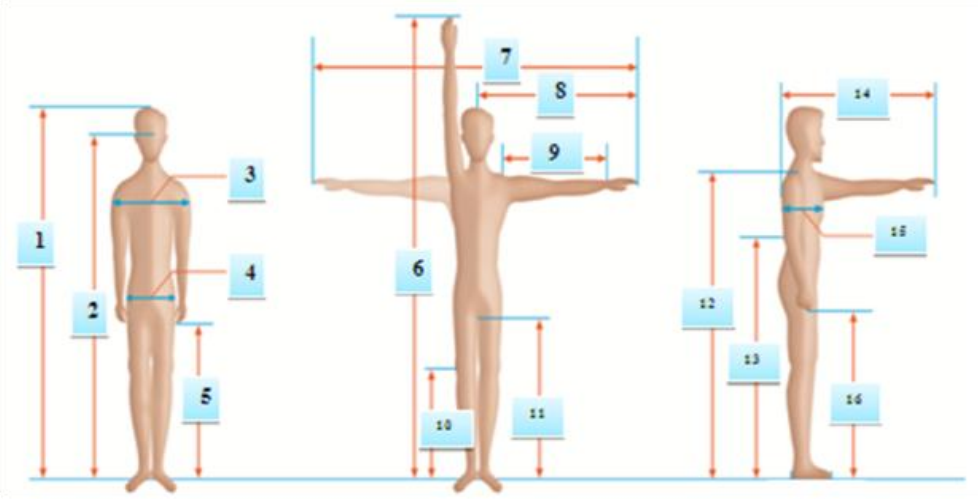
Other Crops

Hydroponic corn seedlings

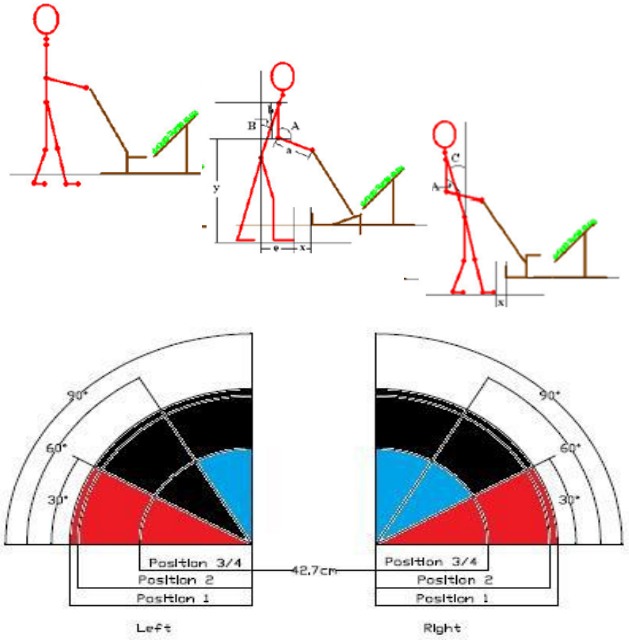
Backyard Airlift Aquaponics System

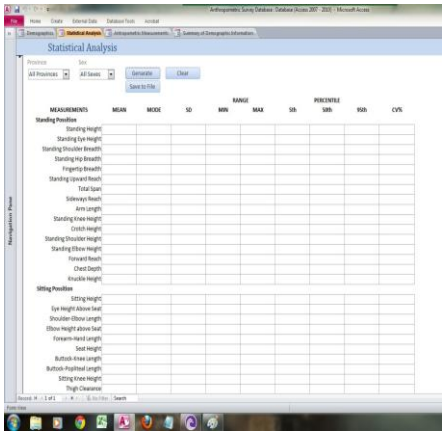
Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Human Factors Engineering



Anthropometric Measurements





Climate resilient AFMTs developed for sustainable agri-fisheries production systems

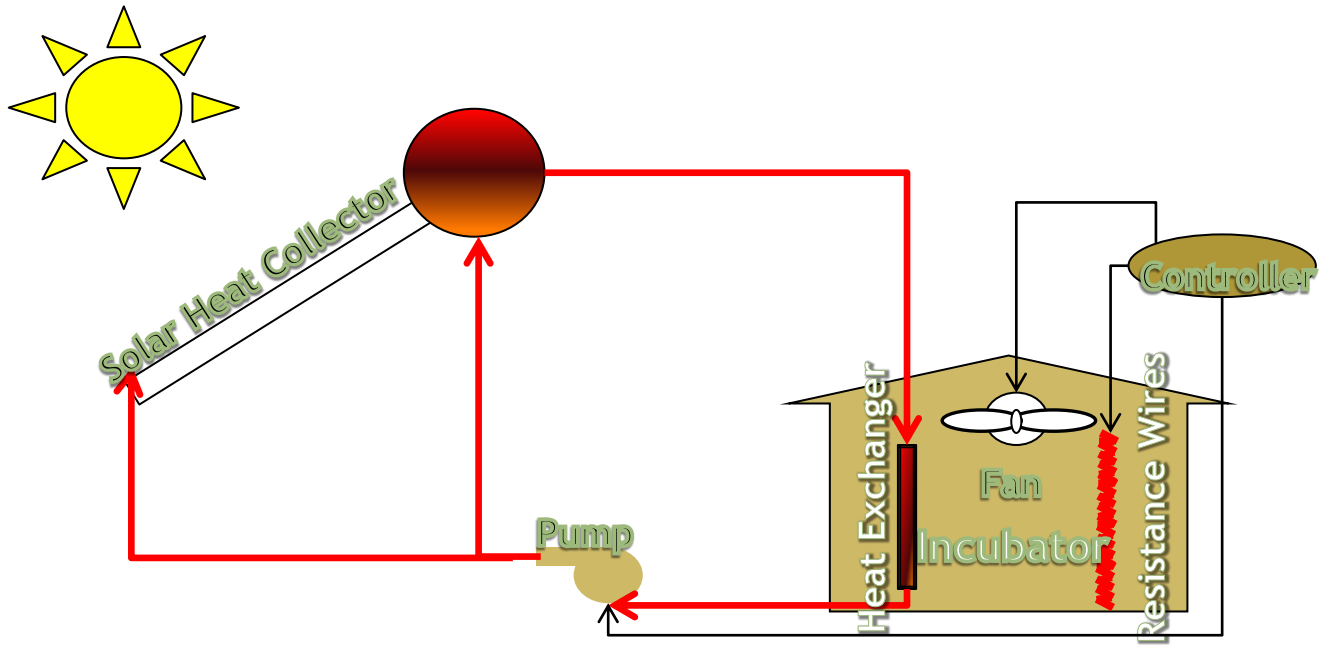
Renewable Energy Technologies

Village-level Ethanol Production System

Thermal Energy for drying –
Rice husks furnace for fruits and grain drying

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Renewable Energy Technologies



The SINAG system

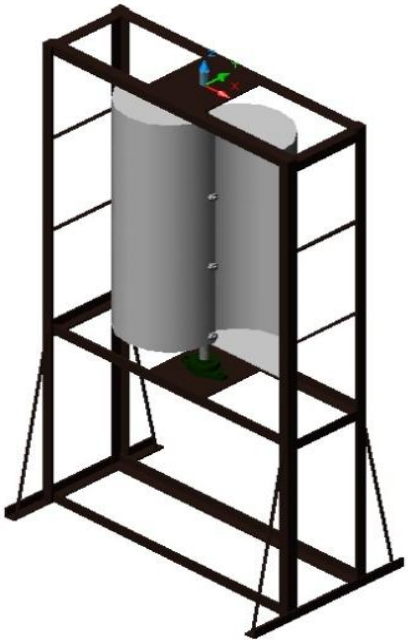
Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Renewable Energy Technologies

Micro hydro system for electricity and mechanical power generation

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Renewable Energy Technologies



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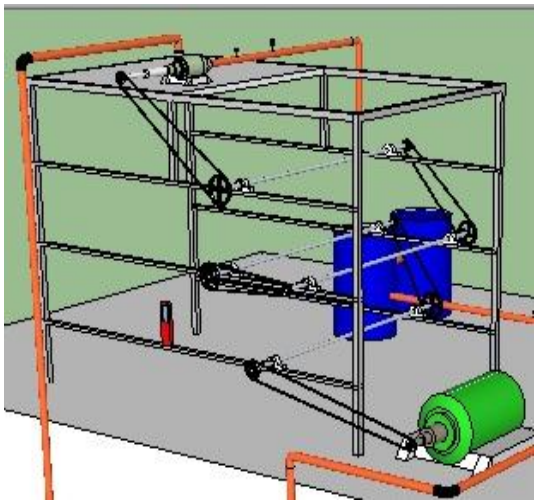

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Wind pump system for supplemental irrigation

Climate resilient AFMTs developed for sustainable agri-fisheries production systems

Renewable Energy Technologies

Micro hydro system for electricity and mechanical power generations

Climate resilient AFMTs developed for sustainable agri-fisheries production systems- DA

PhilRice- Coping with Climate Change Program (2013)

"Attaining food self-sufficiency amidst the challenges of climate change"

Generating and managing local knowledge and information on climate change

- Analyzing climate effect on rice using long term data
- Identification of the growing degree-day (GDD) requirements at different phenological stages of public hybrid rice parental and other inbreeds
- Impact of increasing temperature on rice insect pests and natural enemies

Developing technologies that would help farmers adapt to or manage the impact of climate change

- Optimal planting dates based on recent agro climatic indices for rice and rice-based crops in Ilocos region
- Design and development of prefabricated components for a low cost, easy to build and typhoon-resistant multi-purpose farm structure
- Irrigation by capillarity: development of an efficient method of irrigation for extreme drought

Climate resilient AFMTs developed for sustainable agri-fisheries production systems- DA

PhilRice- Coping with Climate Change Program (2013)

Enhancing rice farmers' resilience by providing opportunities to produce additional sources of food and income.

- Maximizing the use of the continuous rice hull (CtRH) carbonizer in generating additional sources of income for enhanced climate change resiliency of rice-based farming communities
- Rice-duck-based farming system for enhanced climate change resiliency of farming households

Incorporating Decision Support System for Agrotechnology Transfer (DSSAT) in RDE Projects

Farming Without Fossil Energy Program

- Development of Renewable, Alternative, Diversified and Decentralized Energy Resource System for and from Rice-Based Agriculture
- Adaptation of Low External Energy Input in Rice-Based Farming
- Evaluation and utilization of alternative and potential non-fossil fuel based (nFFB) nutrition for rice farming

Climate resilient AFMTs developed for sustainable agri-fisheries production systems- DA

PHilMech

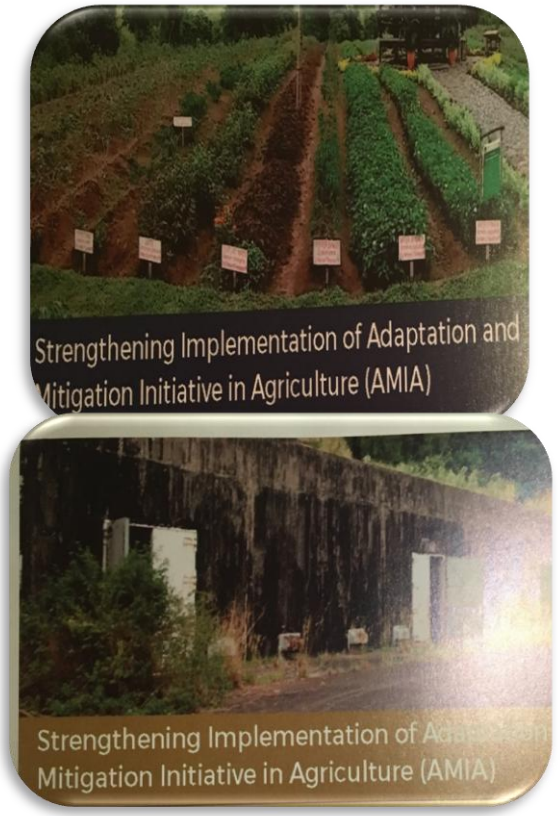
Some of the projects of PHilMech on AFMTs:

- ✓Cold chain system for high value crops
- ✓Computer Vision System for the Physical Quality of Milled Rice
- ✓Coconut Water Pasteurizer/Chiller
- ✓Far Infrared and Convection Heating System for Dried Mango
- ✓Controlled Atmosphere for Philippine Mango
- ✓Rubberized Conveyor for Onion Sorting
- ✓Soybean Sorter
- ✓Soybean Postharvest and Mechanization system
- ✓Soybean Processing System

Climate resilient AFMTs developed for sustainable agri-fisheries production systems- DA

Strengthening the Implementation and Adaptation and Mitigation Initiative in Agriculture (AMIA)

- ✓ bunker- based storage systems for seed production
- ✓ water harvesting and sustainable agricultural productivity.
- ✓policies on research and development
- ✓ policies on agricultural extension
- ✓analysis and evaluation on renewable energy utilized in the production systems
- ✓best practices and disaster risk reduction and management due to typhoons, drought and floods in agriculture,
- ✓ language of disaster in major language groups in farming and fishing areas



Conclusion

Utilization and application of agriculture and fisheries mechanization technologies has been brought about by many challenges. Among others:

climate change
energy security
food sufficiency and security
environmental protection and conservation
population growth

Conclusion

As a logical response, regional and government planners, RDE practitioners, concerned stakeholders had taken steps to address these challenges and problems.

On the government side strong policy commitment and guidelines are necessary towards achieving the vision of a climate risk-resilient Philippine Agriculture and Fisheries Sector.

On the RDE side, technology innovations and climate resilient agriculture and fisheries mechanization technologies are imperative to adapt and mitigate the impacts of the combined effects of the challenges of climate change.

Conclusion

In the Philippines, the necessary policy environment in the agriculture and fisheries sector is in placed for implementation. RDE efforts had already been pursued by research, development and extension agencies on AFMTs.

National Building Code 1972
AFMA Law 1997
IP Code 1998
Solid Waste Management 2000
Biofuels Act 2006
Renewable Energy Act 2008
Climate Change Act 2009
AFMech Law 2013
SIDA Law 2014
ABE Law 2016

Challenges Ahead

1. **inadequacy in the implementation structure on the development and implementation and promotion of AFMTs in the grassroots level.**

2. **need to strengthen the other stakeholders particularly at the local government units' level.**

3, **greater challenge lies on the technology innovators and technology change agents to comprehensively and cohesively develop and extend**

4. **capacity building of AFMTs that will help empower farmers and communities achieve farming efficiencies and productivity in a safe and healthy environment.**

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Thank you for listening!

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