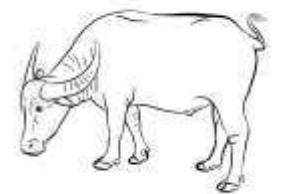


# Carabao-Based Enterprise Development: The Philippine Experience

L. C. CRUZ

NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY



# OUTLINE

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Background

Carabaos in the Philippine Setting

Changing Swamp buffalo population

Economic Contributions of water buffaloes

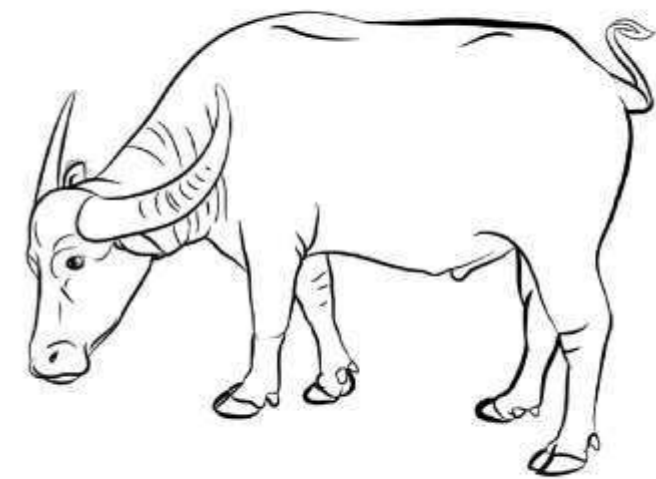
Carabao-Based Enterprise  
Development

**“ Putting the basics ”**

**“ Kick-start the Market ”**

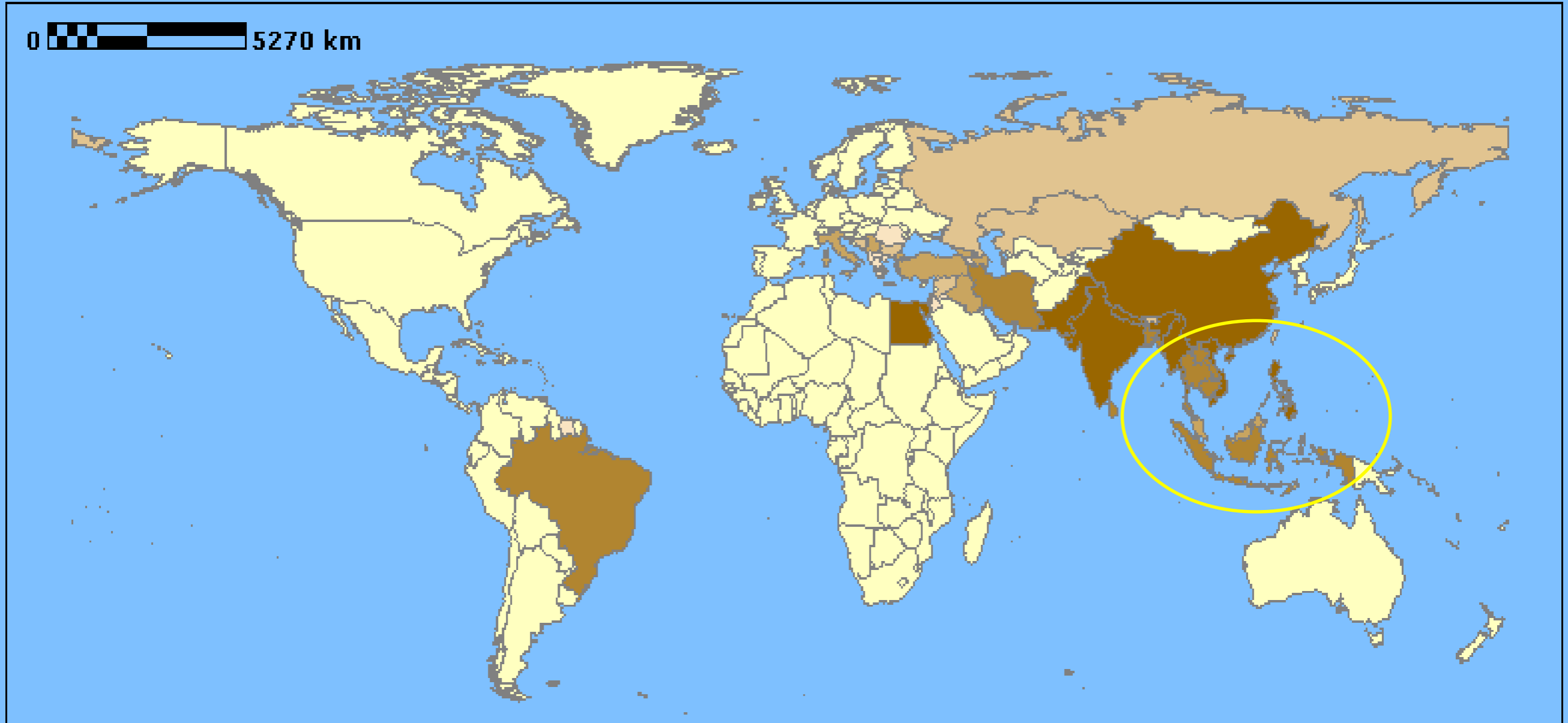
**“ Expanding the Market ”**

Concluding statement

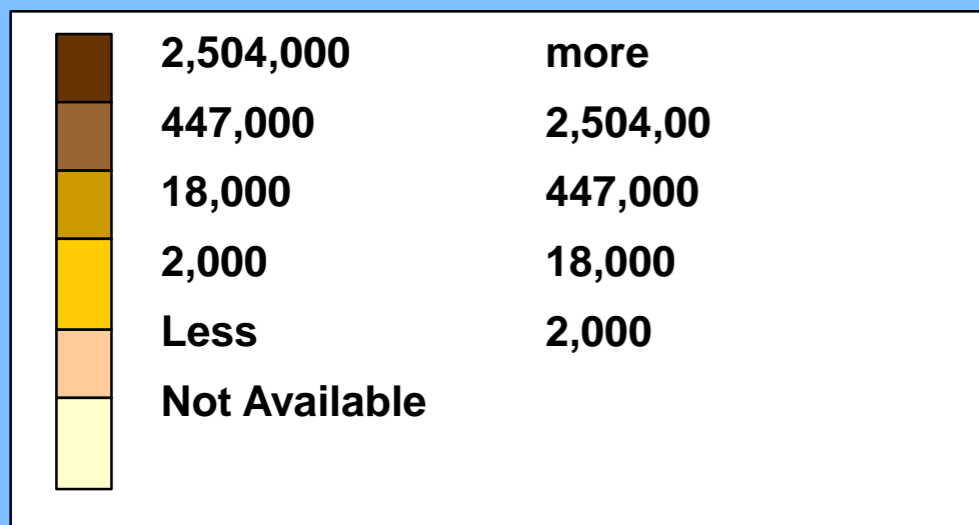


# ATLAS OF WORLD BUFFALO POPULATION

0 5270 km

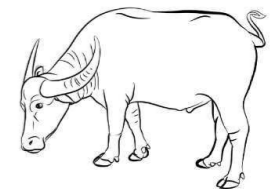
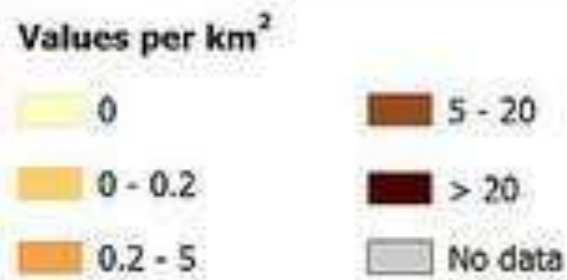
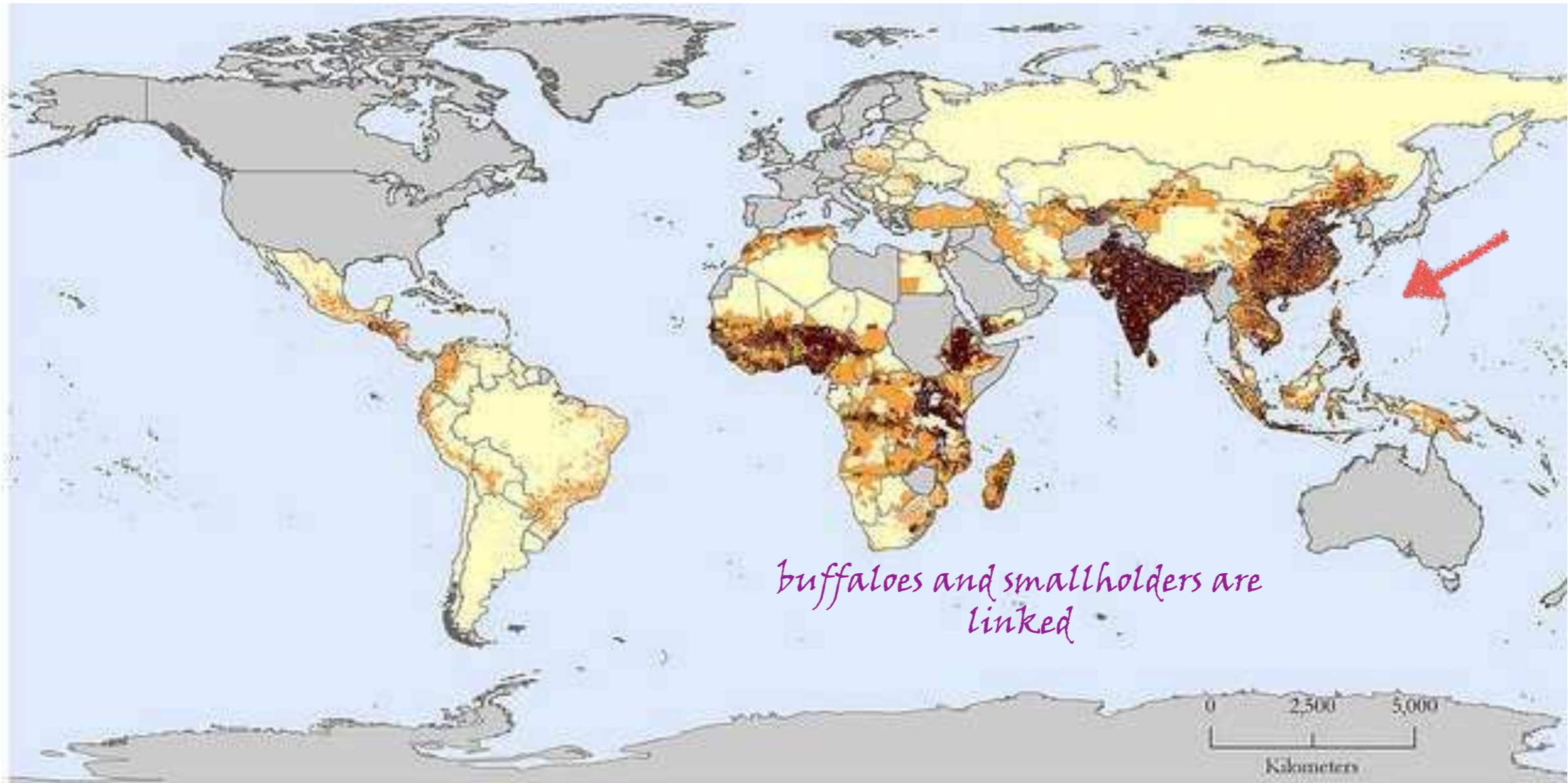


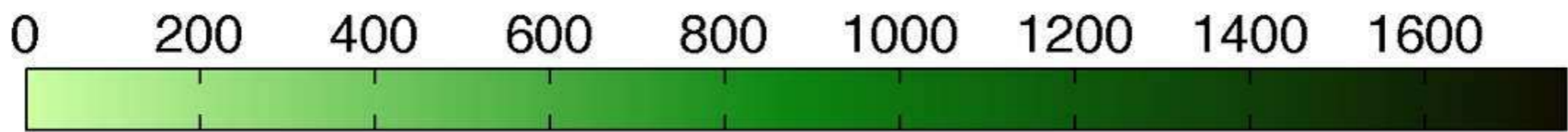
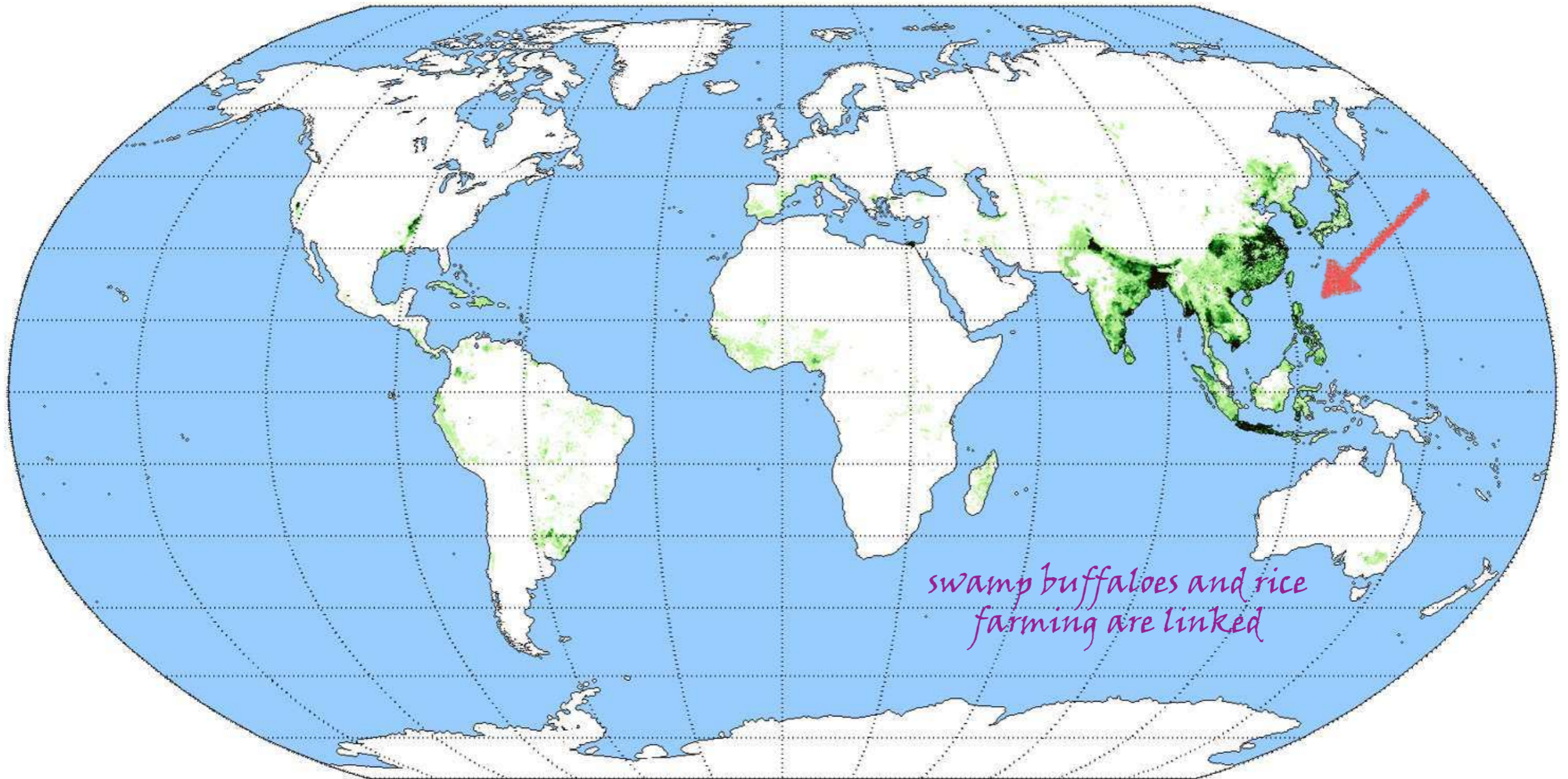
## Water Buffaloes – world population



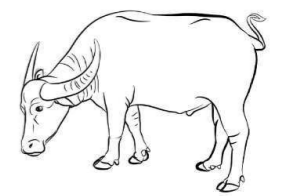
world pop. = 199.7 M (FAO, 2015)  
pop in Asia = 97%  
swamp type= SEA

# Distribution of poor livestock keepers



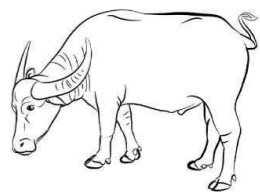


Average regional rice output (kg/ha)





*Farm  
mechanisation  
displaces the  
draft carabaos*





Even the labor-intensive farm income-generating activities such as rice planting and harvesting are displaced by farm machineries



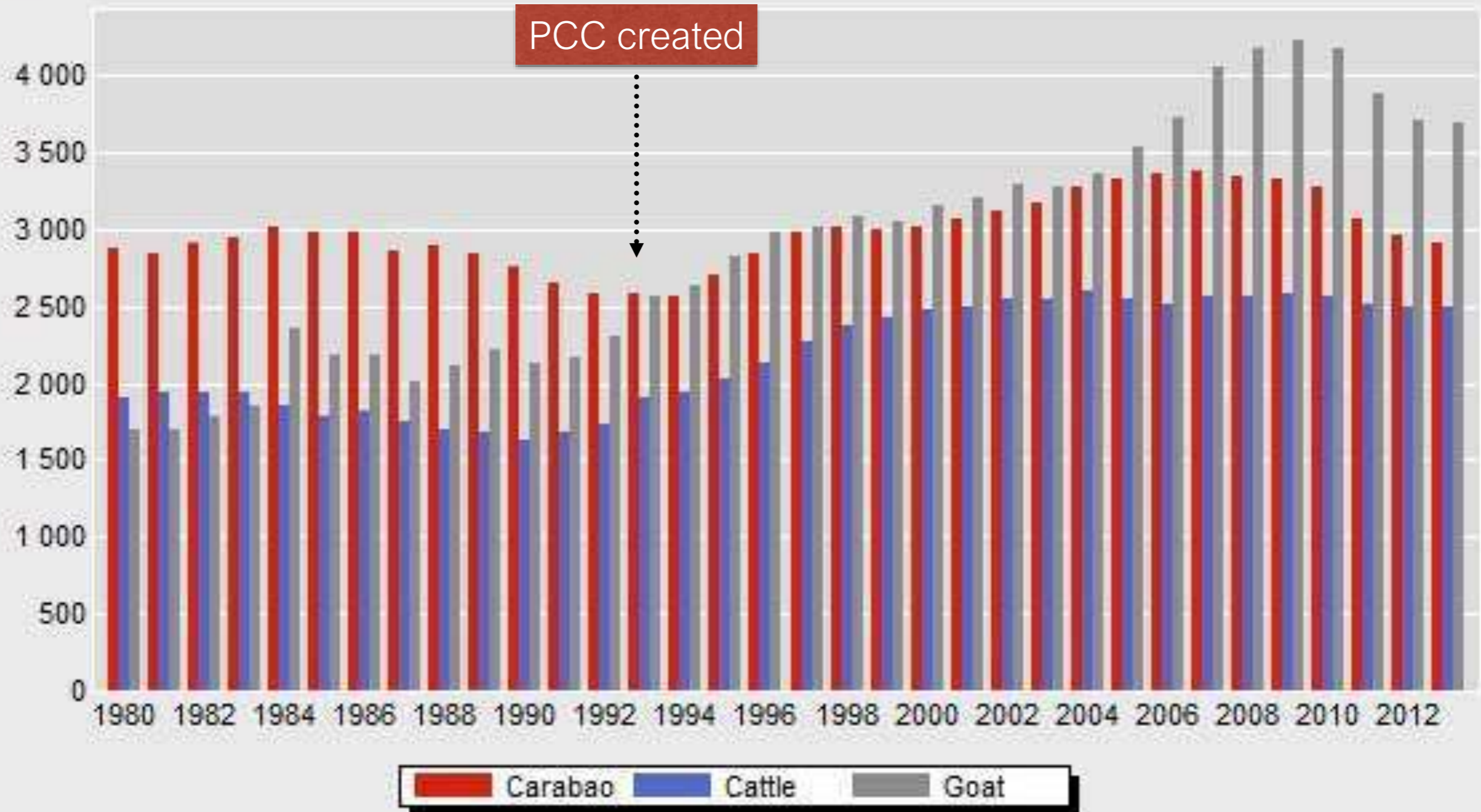
Selected SEA Countries with declining swamp buffalo population (million),  
~~1960-2013~~

Country	Year					
	1960	1970	1980	1990	2000	2013
Indonesia	2.8	2.8	2.4	3.3	2.4	1.4
Malaysia	0.3	0.3	0.2	0.2	0.1	0.1
Philippines	3.4	4.4	2.8	2.7	3.0	2.9
Thailand	4.9	5.7	5.6	5.0	1.7	1.2

Source: FAO, 2015



# Livestock and Poultry: Inventory by Animal Type and Year. (thousand heads)

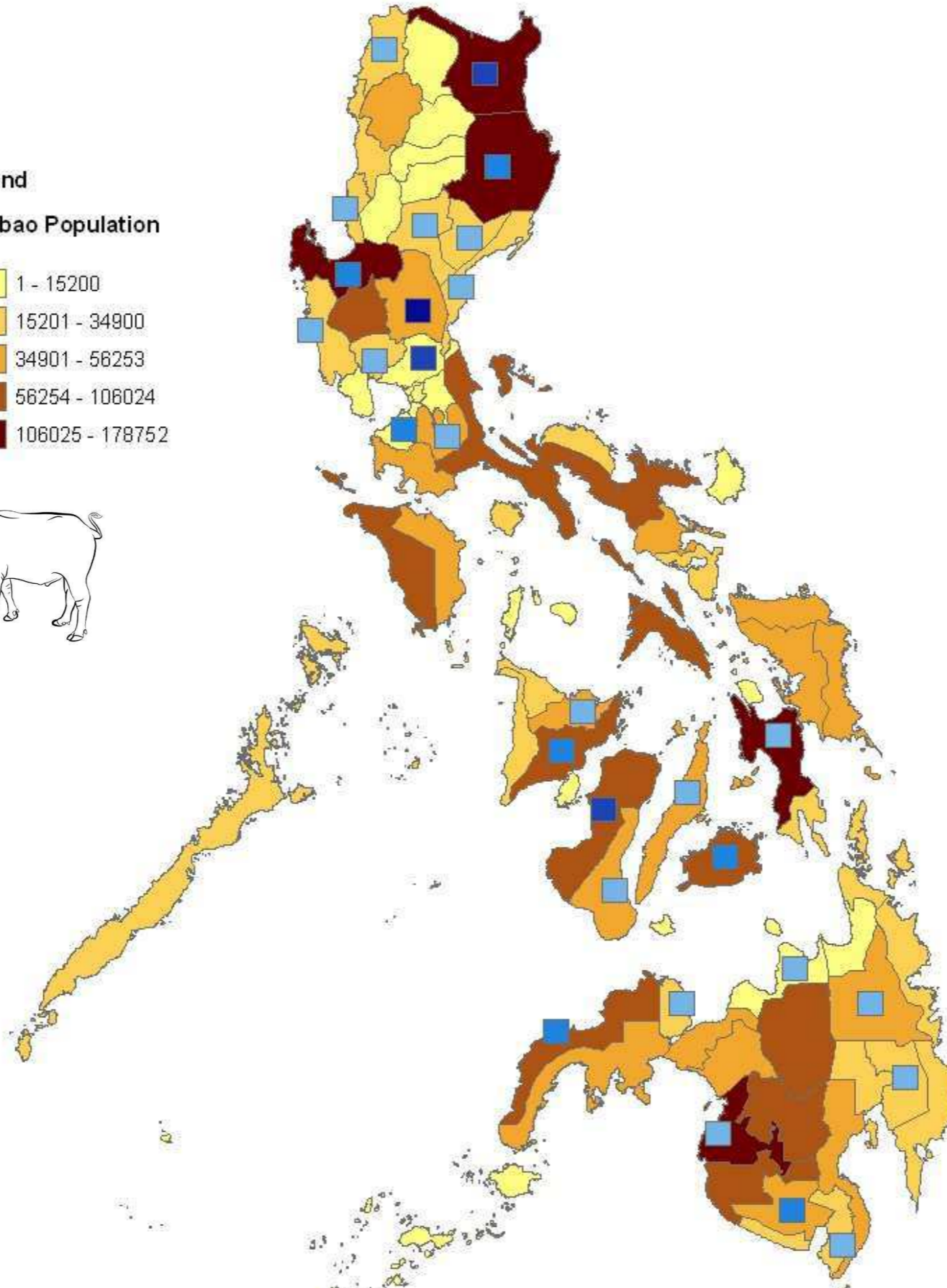
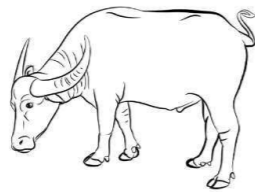
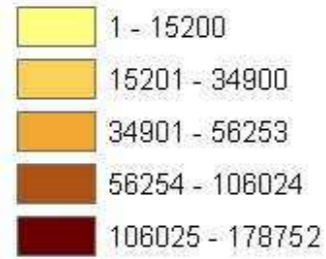


Bureau of Agricultural Statistics

# Distribution of Carabaos in the Philippines

## Legend

### Carabao Population



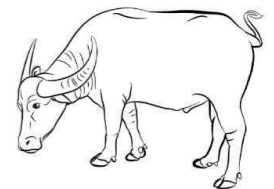
# Domestic Meat and Milk Production from Cattle and Buffalo, Philippines, 2016

---

SOURCE	MEAT, '000 ton	%	MILK, '000 ton	%
Carabao	144.68	34.85	14.20	52.30
Cattle	270.42	65.15	12.91	47.70
<b>TOTAL</b>	<b>415.10</b>	<b>100.00</b>	<b>27.15</b>	<b>100.00</b>

# Carabao is the symbol of Philippine Agriculture

Office of the Secretary  
Department of Agriculture





**Philippine Agriculture** is essentially **crop dominant**, carabao is but an input, just as is seed and fertiliser;  
income is essentially from crops;  
income is also seasonal



# Policy/policy reforms related to carabao-based enterprise

major policy/policy reforms  
related to carabao-based  
enterprise worth the review

# Policy Reforms

## Slaughter Ban

aims to prevent slaughter of carabaos to make work animals available for agriculture; legal to slaughter female carabaos after 11 years old and male carabaos after 7 years old; **abolition of the slaughter ban in 1985** permitted raising of buffalo for meat purposes



# Policy Reforms



Open Domestic Market  
to Indian Buffalo meat  
aims to reduce extraction rate from  
domestic carabao population; **if not**  
**implemented the domestic carabao**  
**population will be extinct in a period of**  
**ten years**



## BUFFALO POPULATION, SLAUGHTER AND MEAT IMPORTATION, PHILIPPINES, 1997-2016

YEAR	POPULATION,hd	Slaughtered, M hd	% of population	BUFFALO MEAT IMPORTATION	
				VOLUME, kg	Live animal Equivalent, hd
<b>1997</b>	2,987,780	228,614	7.58	30,733,625	173,636
<b>2000</b>	3,024,400	267,060	8.83	36,395,226	205,622
<b>2005</b>	3,326,830	265,345	7.97	62,418,781	352,648
<b>2010</b>	3,270,410	218,208	6.67	43,146,025	243,762
<b>2015</b>	2,855,000	219,062	7.67	44,388,540	250,782
<b>2016</b>	2,877,000			30,903,126	
<b>Average</b>		<b>243,644</b>	<b>7.84</b>	<b>49,002,132</b>	<b>283,684</b>
<b>Total</b>		<b>4,654,334</b>			<b>4,937,969</b>

*the volume of import is more than the domestic slaughter volume!*

# Policy Reforms

## Infusion of dairy buffalo genetics

aims to introduce dairy buffalo genetics as early as 1917-1957; resumed in bigger number after the establishment of the PCC in 1993; the breed include Murrah, Nili Ravi, Bulgarian Murrah, Brazilian Murrah and the Italian Mediterranean buffalo



## Infusion of Live Riverine Buffaloes to Philippines

Year	Source	Breed	No. (hd)		
			male	female	total
1917	India	Murrah			57
1918	India	Nili-Rav			85
1947	India	Murrah	7	43	50
1947	India	Murrah	1	21	22
1950-56	India	Murrah	108	554	662
1994	USA	Am-Murrah	70	154	224
1995-99	Bulgaria	Bul-Murrah	216	2926	3142
2010	Brazil	Murrah	11	2027	2038
2013	Italy	Italian Mediterranean		1025	1025

# Recorded transport of riverine frozen semen to the Philippines

Year	Origin	Breed	# Straw/dose
1981	Pakistan	Nili-Rav	1000
1983	Pakistan	Nili-Rav	1000
1987	Pakistan	Nili-Rav	1000
1982	India	Murrah	1000
1984	India	Murrah	1000
1985	India	Murrah	1000
1995	Bulgaria	Bulgarian Murah	13,000
2013	Italy	Italian Mediterranean	5000

# Policy Reforms



## Creation of Carabao research Commodity

DOST-PCARRD created a separate research team on Carabao Commodity; this allowed in-depth research on crossing swamp buffalo with the riverine breed assisted by UNDP/FAO (1982-1992)

- 3 times more milk
- 2 times growth rate
- Double farmers' income

# Policy Reforms

Created by R.A. 7307:  
“Philippine Carabao Act of 1992”

Establishment of  
the Philippine  
Carabao Center





“why will government support the development of carabao, a symbol of backward agriculture in the era of modernization?”

Question at the Phil Congress 1993, initial budget deliberation of PCC

“when can we develop a machine that feeds on grass to produce milk or feed on rice straw and rice bran to produce meat?”





# PCC National Headquarters and Gene Pool



## Network of Centers

**Philippine Carabao Center**  
Headquarters and National Gene Pool  
Science City of Muñoz, Nueva Ecija

- 1 PCC at Mariano Marcos State University  
Batac, Ilocos Norte
- 2 PCC at Cagayan State University  
Piat, Cagayan
- 3 PCC at Don Mariano Marcos Memorial  
State University  
Rosario, La Union
- 4 PCC at Central Luzon State University  
Science City of Muñoz, Nueva Ecija
- 5 PCC at University of The Philippines  
at Los Baños  
Los Baños, Laguna
- 6 PCC at Leyte State University  
Baybay, Leyte
- 7 PCC at West Visayas State University  
Calinog, Iloilo
- 8 PCC at La Carlota Stock Farm  
La Granja, La Carlota City, Negros Occidental
- 9 PCC at Ubay Stock Farm  
Ubay, Bohol
- 10 PCC at Mindanao Livestock Production Complex  
Kalawit, Zamboanga Del Norte
- 11 PCC at Central Mindanao University  
Musuan, Bukidnon
- 12 PCC at Mindanao State University  
Marawi City, Lanao Del Sur
- 13 PCC at University of Southern Mindanao  
Kabacan, North Cotobato



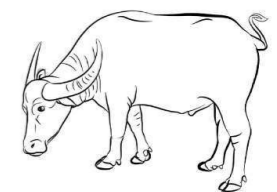
## Regional Centers:

Luzon = 5

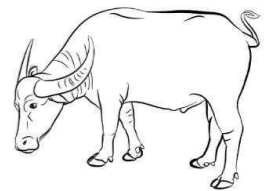
Visayas = 4

Mindanao = 4

Regional Centers carry out  
field extension activities in  
concert with the Local  
Government Units ( LGUs)



Carabao Development program is more than the carabao, it is about human, income and general well being of smallholders

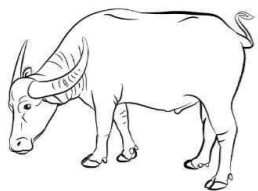


# Carabao Development Program (CDP)

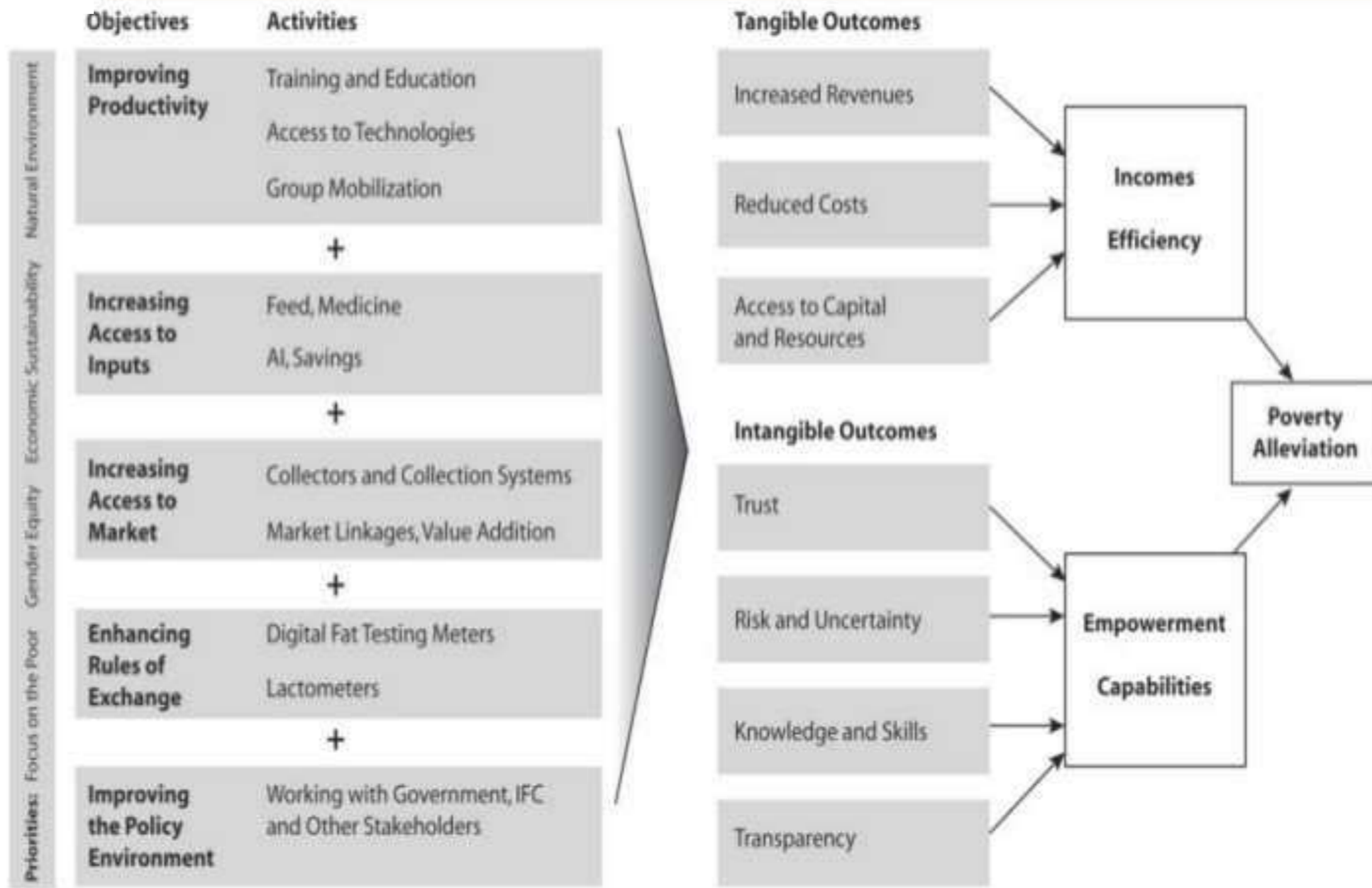
## Carabao-Based Enterprise Development (CBED)

### Matrix of the Carabao Sector Value Chain

	PRE-FARMGATE	IN-FARM		POST-FARM GATE	
		Production	Product	Post production/Processing	Market and marketing
<b>Input</b>					
	Policies ( regulation/tariff/taxes)	Feeds	Transport	Transport	Transport
	Credit system	Labor	Collection	Processing Facilities	Advertising/ Info
	Environment	Vet Products/MOOE	Technologies	Technologies	Technologies
	Socio-Economic Systems	Technologies	Storage	Storage	Distribution
	Human Resources	Semen/Bull	Fund/Money	Fund/Money	Storage
	R, D and E	Fund/Money	R, D and E	R, D and E	Fund/money
		R, D and E			R, D and E
<b>Players</b>					
	Banks/Funding Institutions	Animal Raisers	Traders	Butcher	Whosellers
	Regulatory agencies	Feed Suppliers/Input providers	Milk collector	Trader	Retailers
	Universities/Training Centers	Veterinarian	Testing Lab	Processors ( for meat and milk)	Tranporters
	Research Centers/ Agencies	AI Technician	Extensionist	Storage Person	Storage Person
	Policy Makers(Legislators, LGUs)	Extensionist	Scientists/Reseachers	Scientists/Reseachers	Consumers
	Development Agencies	Scientists/Reseachers			Scientists/Reseachers
<b>END TARGET OF PLAYERS</b>	<b>COMPETITIVENESS, PROFITABILITY, SUSTAINABILITY</b>	<b>COMPETITIVENESS, PROFITABILITY, SUSTAINABILITY</b>	<b>COMPETITIVENESS, PROFITABILITY, SUSTAINABILITY</b>	<b>COMPETITIVENESS, PROFITABILITY, SUSTAINABILITY</b>	<b>COMPETITIVENESS, PROFITABILITY, SUSTAINABILITY</b>

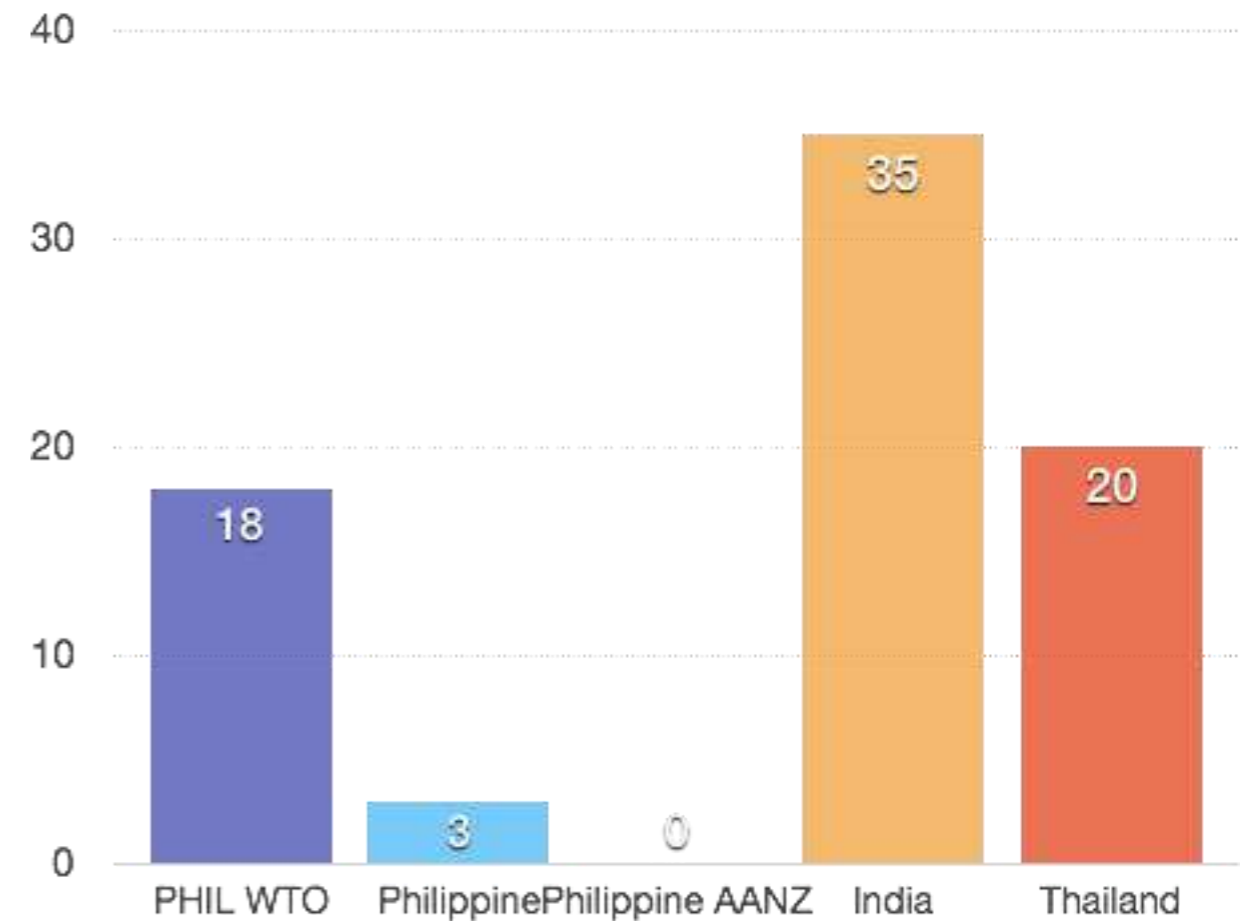


# Theory of Value Chain Enhancement



## TARIFF ON IMPORTED MILK

COUNTRY	TARIFF (%)
PHIL WTO	18
Philippine	3
Philippine AANZ	0
India	35
Thailand	20
Japan	21
China	20



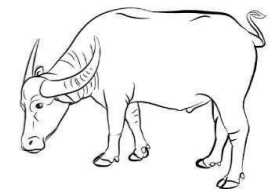
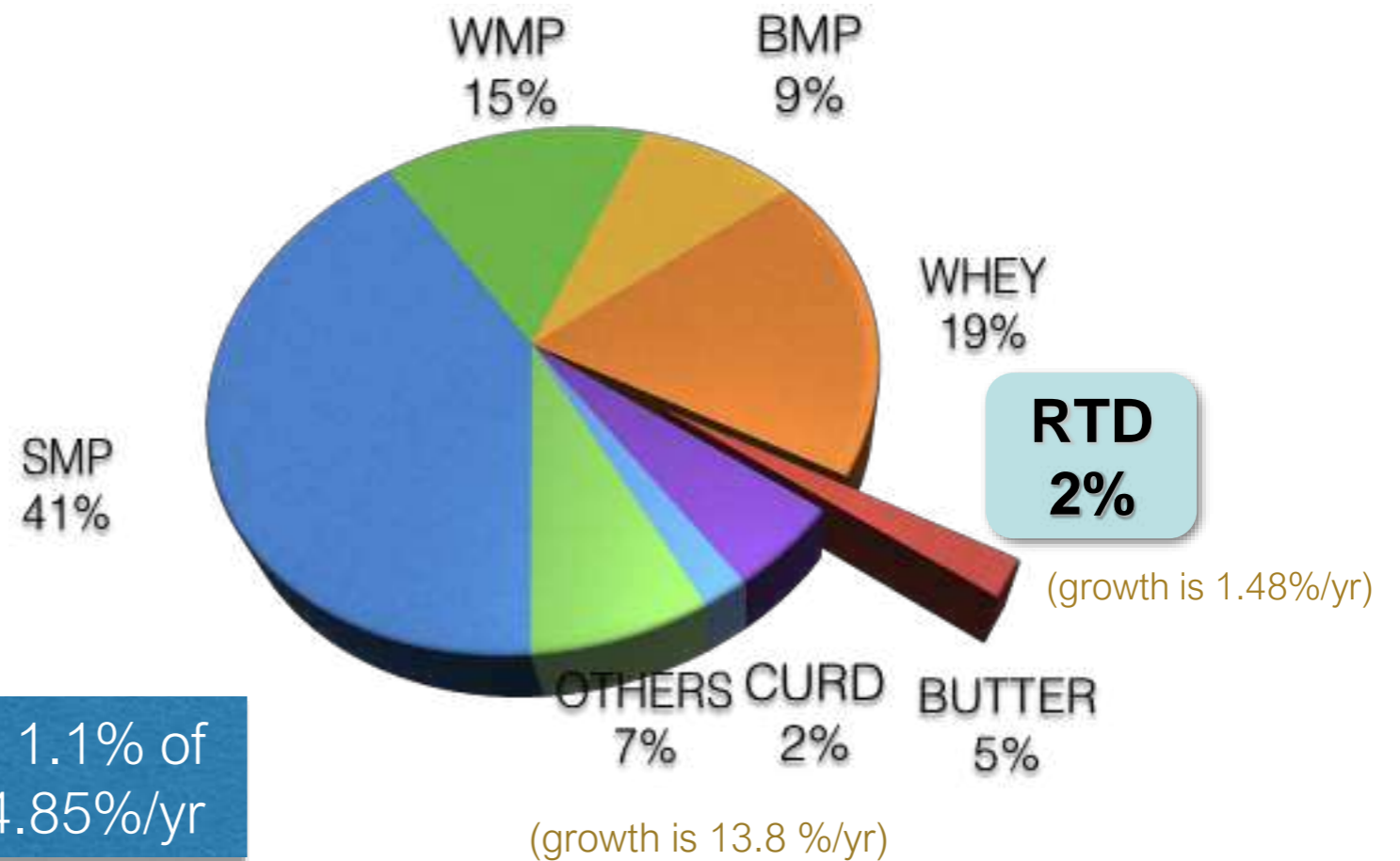
## Domestic Milk and Dairy Products Market

Philippines, 2016

- Volume of total import in LME = 1.79 B liters  
(growth is +1.63%/yr)
- Import is 84% Powdered Milk  
(growth is - 3.6%/yr)
- Average Annual Import = US\$450.00
- Value of local Industry = P75B

Domestic Production is 1.1% of total supply; growth is 4.85%/yr

Competitive area is only 16% of total supply (P 3.6Billion)

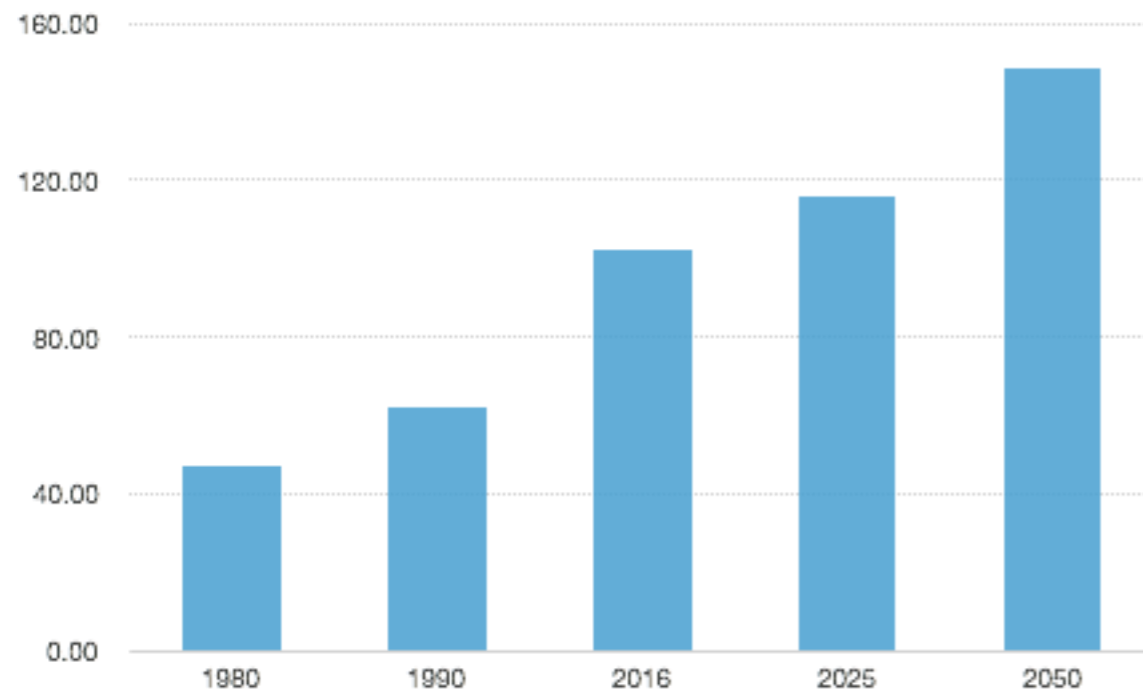


Self sufficiency (%), milk consumption (kg ME/caput)  
Selected Countries, 2013

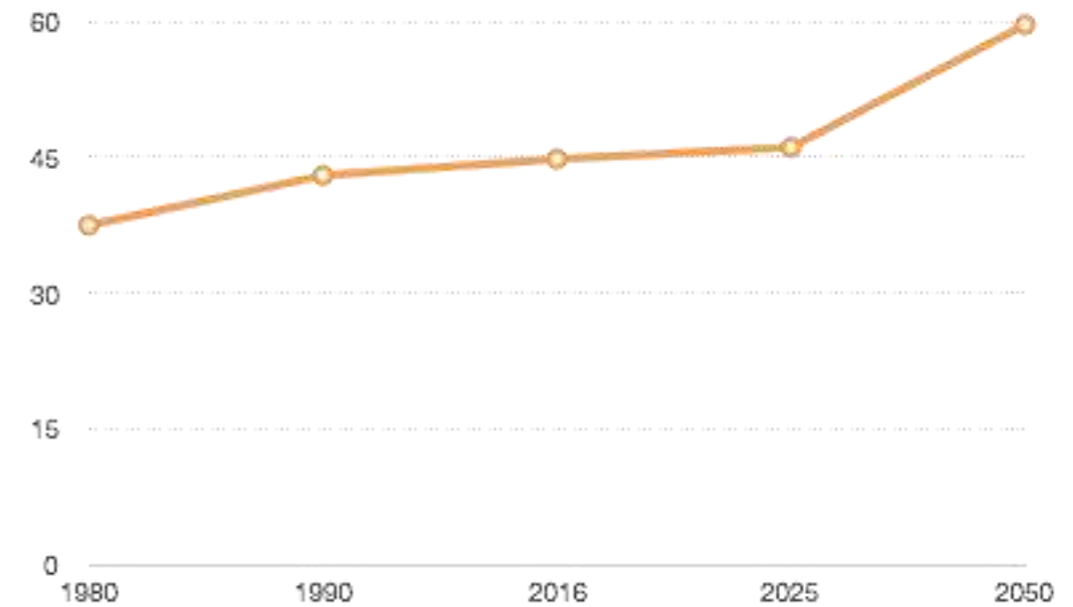
COUNTRY	SELF SUFFICIENCY, %	MILK CONSUMPTION (KG ME/CAPUT)
<b>Australia</b>	127	328
<b>New Zealand</b>	855	593
<b>China</b>	81	31
<b>India</b>	101	123
<b>Indonesia</b>	49	13
<b>Japan</b>	77	77
<b>Korea</b>	60	68
<b>Malaysia</b>	8	28
<b>Philippines</b>	1	13
<b>Taiwan</b>	31	50
<b>Thailand</b>	69	24
<b>Vietnam</b>	33	15

# enterprise environ 4

## HUMAN POPULATION (MILLION)

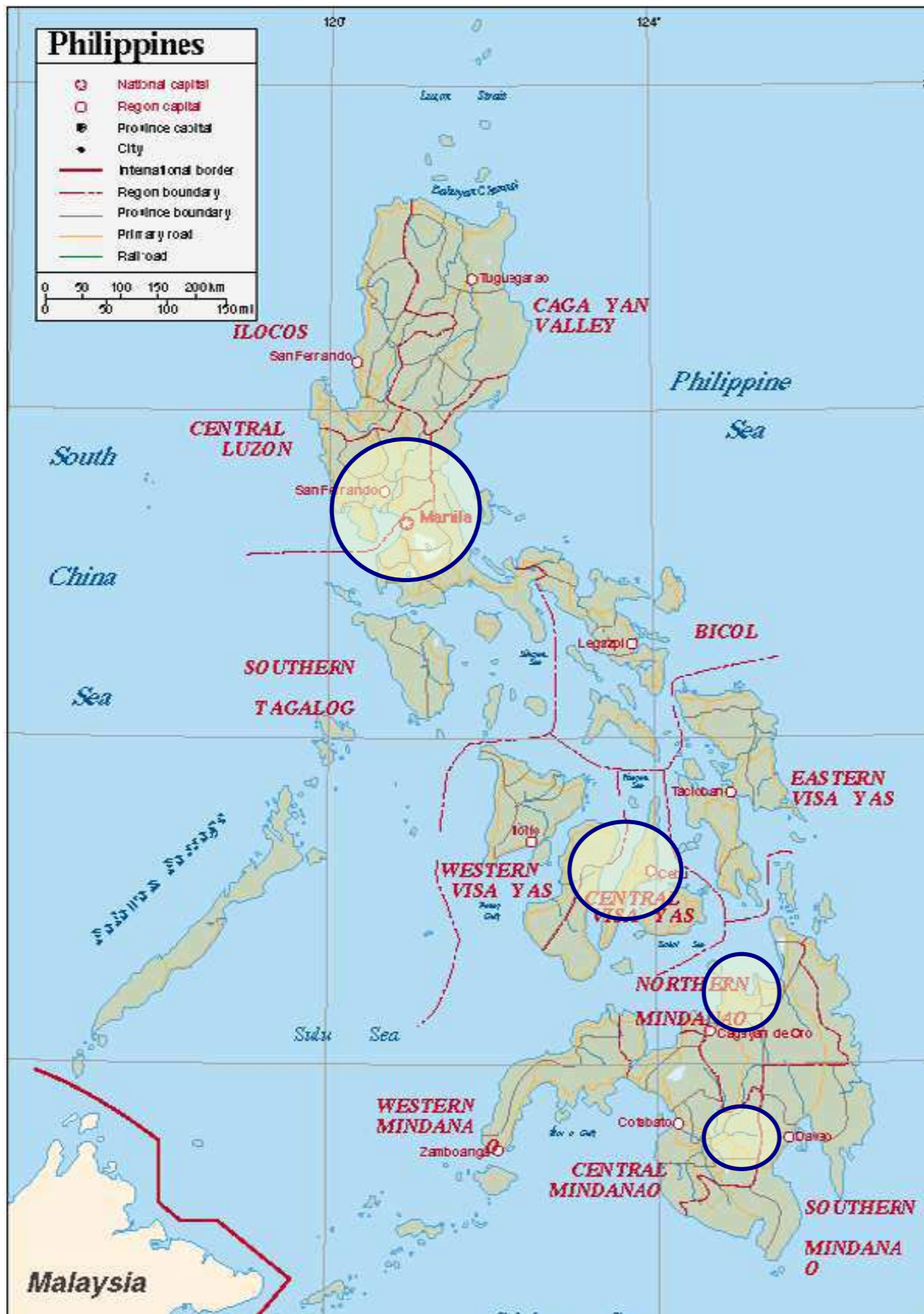


## URBAN POPULATION (PERCENT)



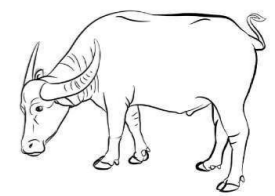
YEAR	HUMAN POPULATION (MILLION)	URBAN POPULATION (MILLION)
1980	47.30	37.5
1990	61.90	43.0
2016	102.20	44.8
2025	116.10	46.1
2050	148.20	59.6





✓ **Establish four DAIRY/BEEF ZONES linked with the urban markets**

- Metro Manila grid
- Cebu grid
- Cagayan de Oro grid
- Davao grid



# Institutionalization of Carabao Development

---

## Establishing ground for Genetic Improvement

### Gene Pools

Indigenous breeds  
Riverine breeds

### Reproductive Biotech Labs

ET, IVM/IVF, OPU, ICSI, SCNT

### Genetic Evaluation System

BIUP, MAS

### Cryobanking of AnGR

Semen, Oocytes, Embryo, Cells/Tissue, DNA

### Superior Germplasm Utilization

AI, Bull Loan

## Support to Business Process

### Research

### Extension services

### Cooperatives

### Credit system

### Collection Centers

### Marketing assistance

# Backcrossing to the 4th Generation

---

Swamp (S) 100 % x Murrah (M) 100%

F<sub>1</sub> SM (50:50)

SM x M (25 : 75)

SMM x M (12.5 : 87.5)

SMMM x M (6.25 : 93.75)

# Providing the basics

public actions to allow poor livestock producers to have secure and adequate access to basic production inputs;

- a) genetics ( live animals and frozen semen)
- b) technology
- c) risk coping mechanism

# GENETIC IMPROVEMENT

---



✓ **Establish Gene Pool of Murrah (Dairy)**

✓ **Establish gene pool of Indigenous Water Buffalo**

✓ **Establish gene bank (semen, embryos, somatic cells)**



# GENETIC IMPROVEMENT (Utilization)

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## ✓ Massive AI in cooperation with

- LGUs
- Village-based private technician

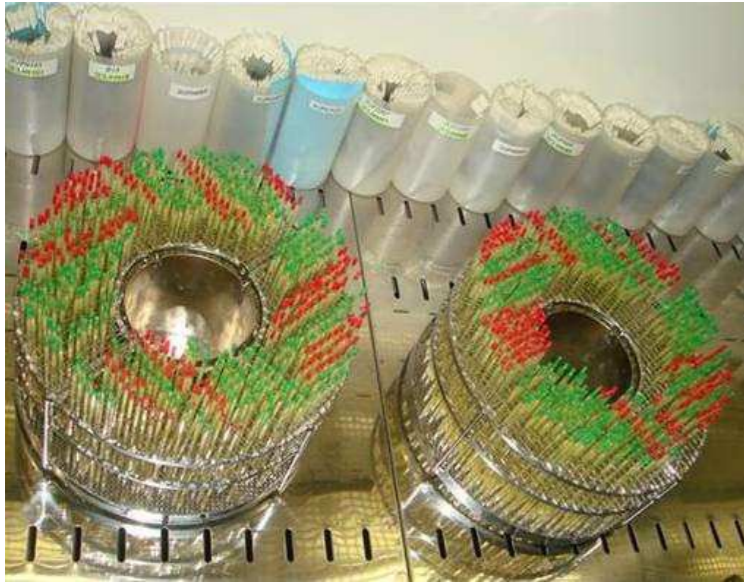
( with PCC conducting training of AI tech,  
processing/distribution of high genetic  
semen, technical assistance)

## ✓ Massive bull loan (dairy breed bulls) in cooperation with LGUs, FAs & coops



# Enhancing dairy/meat based enterprises

## REPRODUCTIVE BIOTECHNIQUES



### 1. Artificial Insemination

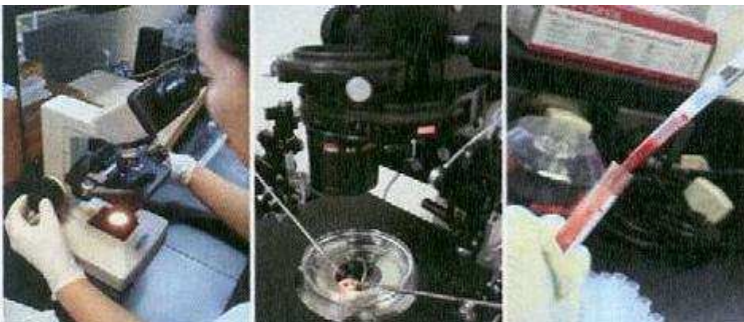
- a). Cryopreservation of semen  
(allow expanded usage of superior males and for indefinite period)
- b). Estrus synchronization  
(enable breeding many females at pre-determined time)
- c). Sperm sexing – (predetermined sex)



### 2. Embryo Technologies

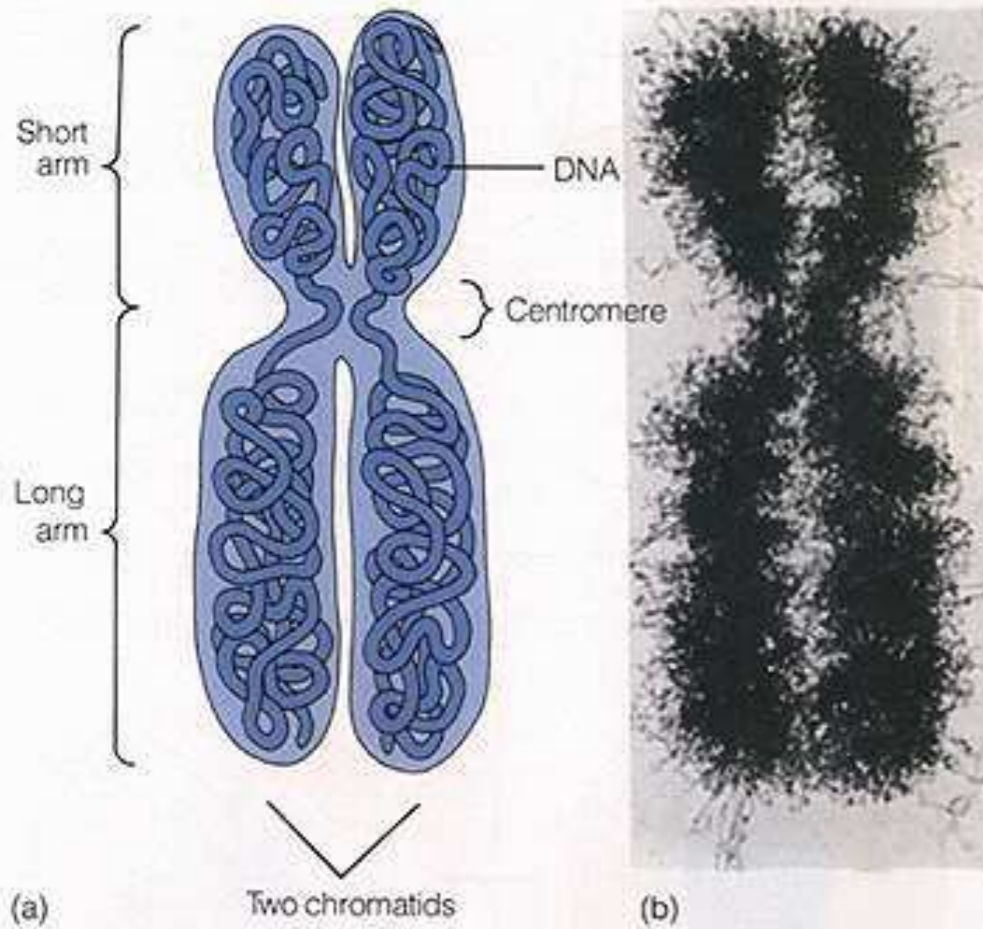
- a). Superovulation and Embryo Transfer (goat & cattle) for faster multiplication of superior stocks
- b). Cryopreservation of oocytes, IVM/IVF & OPU (dairy cattle & dairy buffalo)

For production of purebred stocks (oocytes from US Holstein Freisein and oocytes of Buffaloes from India)



### 3. AnGR Cryobanking (genetic diversity & conservation)

# DNA-Based Technologies



**DNA Marker Assisted Selection** significantly shorter the time to select best animals

**DNA-based diagnostics** for FMD, mastitis, etc. (to reduce risks of diseases)

**For Imported Genetics**

**DNA-based screening for genetic defects**

BLAD in cattle (poor reproduction)

PPS for swine (poor quality pork)

SCRAPIE for goat (high mortality)

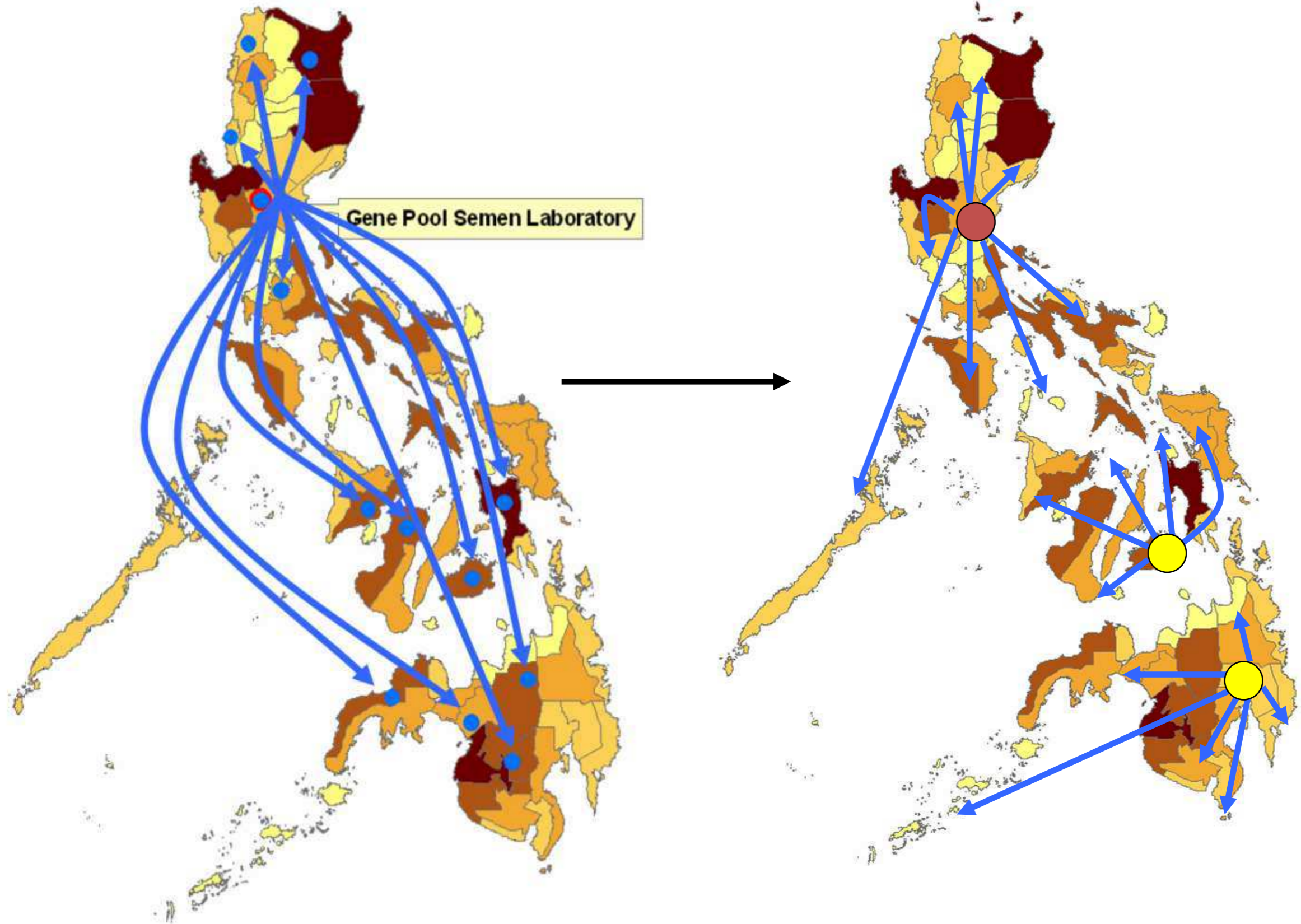


**For Export of Product**

**DNA-based traceability**



# FROZEN SEMEN PRODUCTION AND DISTRIBUTION





2.9 M Total Carabao Population

AI techs target is 2000

**Legend**

**Carabao Population**

- 1 - 15,200
- 15,201 - 34,900
- 34,901 - 56,253
- 56,254 - 106,024
- 106,025 - 178,752

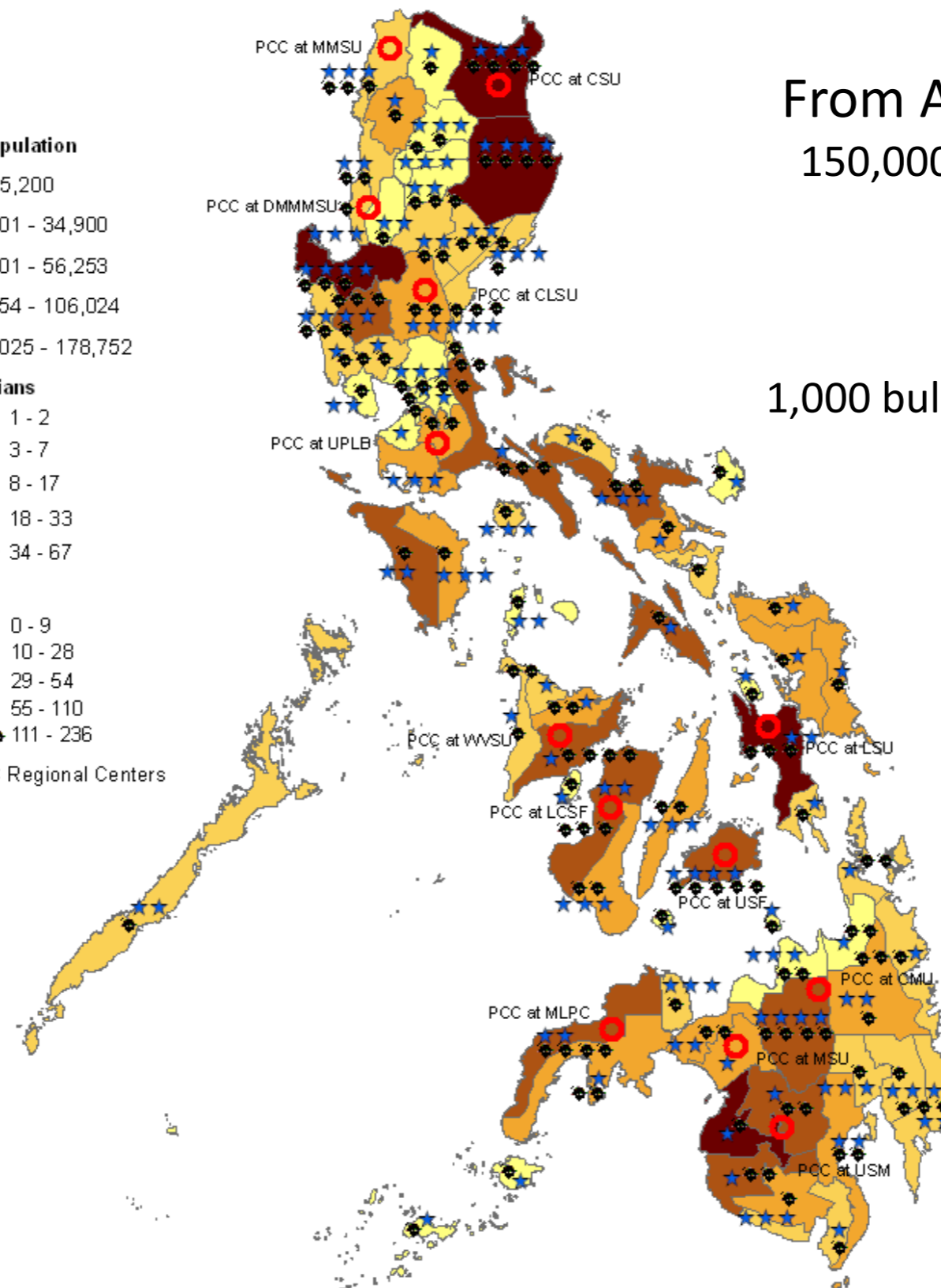
**AI Technicians**

- ★ 1 - 2
- ★★ 3 - 7
- ★★★ 8 - 17
- ★★★★ 18 - 33
- ★★★★★ 34 - 67

**Bulls**

- 0 - 9
- 10 - 28
- 29 - 54
- 55 - 110
- 111 - 236

○ PCC Regional Centers



From Artificial Insemination  
150,000 to 350,000 services/year

From Bull Loan  
1,000 bulls on loan and new 250 bulls  
every year



# Kick-start the Market

public actions to allow poor livestock producers to exploit market opportunities;

- a) training on milking, milk handling
- b) training on processing
- c) credit on milk collection equipment
- d) support to milk collection centres
- e) support to value adding (milka krem)

# beyond technologies

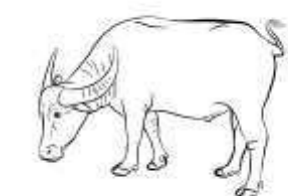
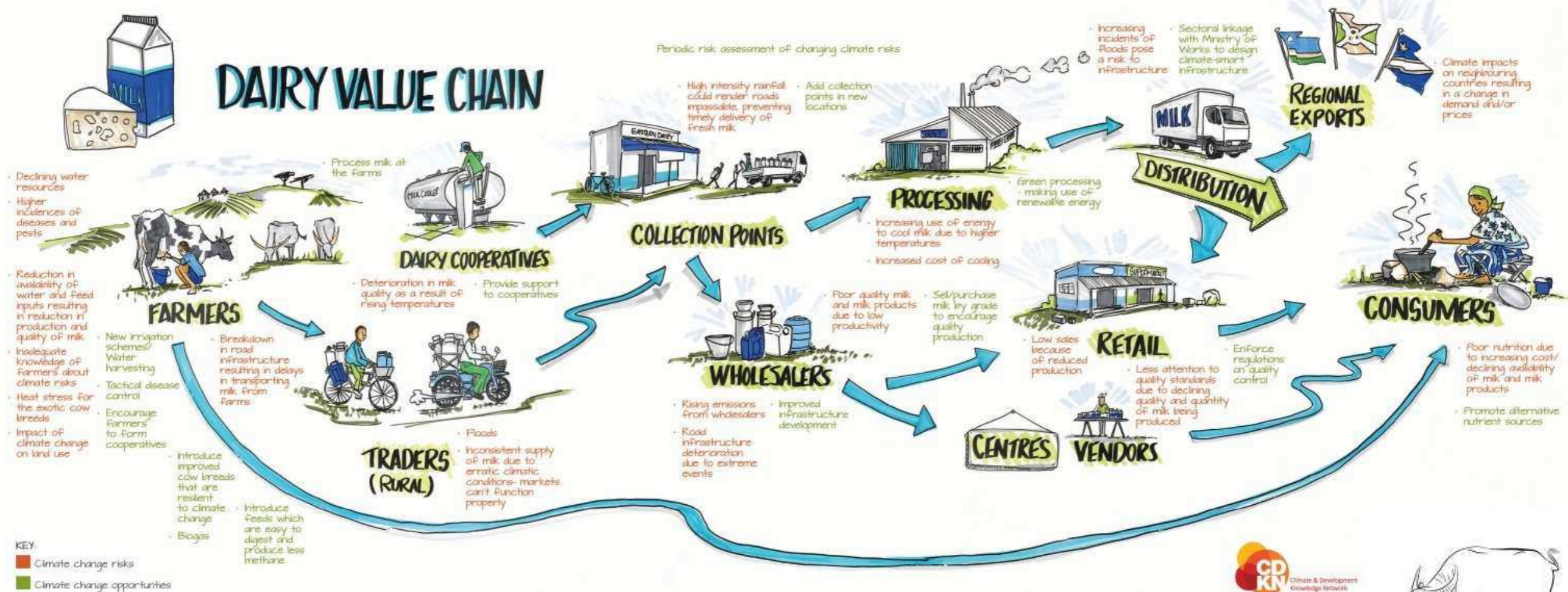
CREATING ENTERPRISES for SMALL HOLDERS



carabeef



# DAIRY VALUE CHAIN



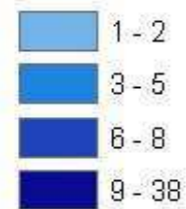
# Distribution of Carabao-based dairy coops

## Legend

### Carabao Population

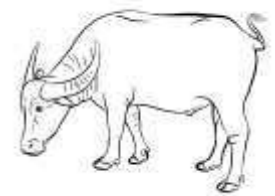
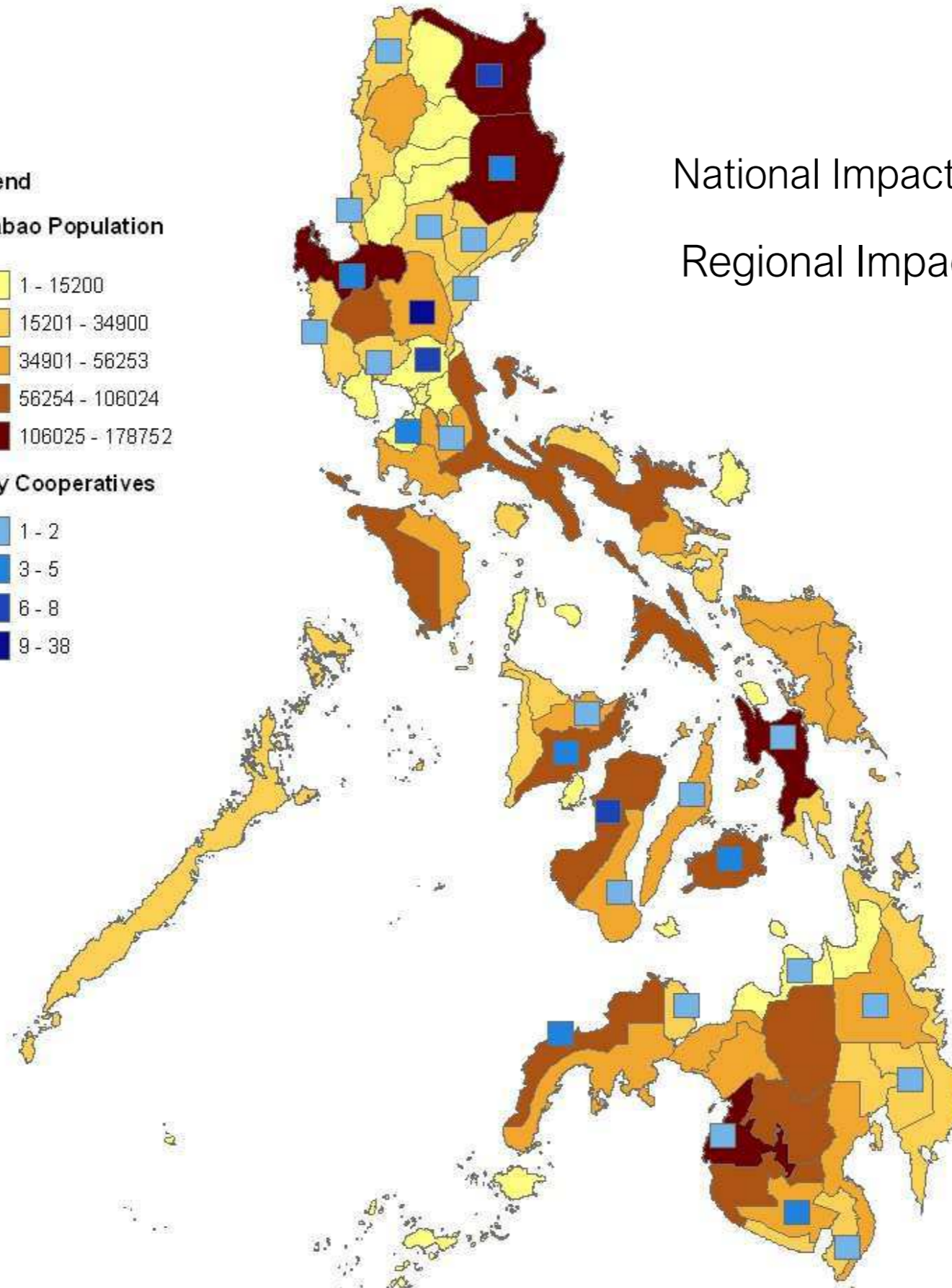


### Dairy Cooperatives



National Impact Zone = 74 coops

Regional Impact zone = 190 coops





Milk producers  
and  
milk collectors  
and  
processors







variety of buffalo derived products





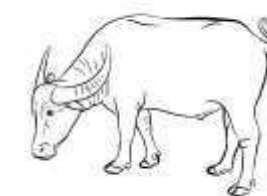
variety  
of  
products  
,  
packagin  
g and  
brands





Milka Krem was established to link the smallholder producers to commercial market that demand quality and safety, good packaging, sustainability of supply, among others

the scheme is to pay smallholder producers added price on top of the farm gate price right away (derived from the value adding activities)





## buffalo meat -derived processed products



a new entrepreneur with focus on feed base supply, contracting smallholder farmers to plant corn for silage for dairy buffaloes

## Summary of International collaborations related to transformation of swamp buffaloes from draft to milk and meat in the Philippines.

Theme	Institution/Entity	Date	Area of Collaboration
Genetics	Govt of India	1917 to 1956	Live Animals, Murrah (854 hd at various years)
		1982 to 1985	Frozen Semen, Murrah (3000 doses)
	Govt of Pakistan	1981 to 1987	Frozen Semen of Nili Ravi (3000 doses)
	FAO-UNDP	1982 to 1992	Research on Crossbreeding between swamp x riverine
	FAO	1994	Risk assessment on importation of live animals from India
	Govt of Bulgaria	1995 to 1999	Live Animal Importation, Bulgarian Murrah (3142 hd various years)
	Govt of Brazil	2010	Live Animal Importation, Murrah Breed (2038 hd)
	Govt of Italy	2013	Live Animal Importation. (1200 hd, Mediterranean breed; 4000 straw of frozen semen)

## Summary of International collaborations related to transformation of swamp buffaloes from draft to milk and meat in the Philippines.

Theme	Institution/Entity	Date	Area of Collaboration
System Development and Utilization of Genetics	Japanese Govt thru JICA	2000 to 2005	Genetic Improvement, AI improvement, Semen Processing
	Australian Govt thru ACIAR	1999 to 2004	Genetic Improvement focused on Animal ID, recording system and data analysis
	Korean Govt thru KOICA	2010 to 2012	Cryobanking of AnGR, DNA based biotechnology, Semen Processing
	US Govt thru its PL480 Program	2010 to 2013	Research and Development, Biotechnology Laboratories, Human Resource Development
	Taiwan Livestock Research Institute	2008 to date	DNA-based technologies, Screening of Genetic Defects, Cryobanking
	USDA	2012	Human Resource Development focused on Cryobanking of AnGR
	International Buffalo Genome Consortium	2011 to date	DNA-based MAS, Buffalo Genome
Enterprise Development	Japanese Govt thru it 2KR fund	2010 to 2013	Dairy Product Processing, Establishment of Milk Collection Scheme for smallholders
	Korean Govt thru KOICA and KAPE	2010 to date	Product Development, Product Standard, Product Traceability

# Expanding the Market

long-term public actions that encourage and support the sustainable production of high quality and competitive products in a crowded market:

- a) continuing research on animal production tech
- b) research on improving feed base
- c) continuing genetic improvement program
- d) addressing quality standards
- e) strengthening producers cooperatives
- f) certification and grading
- g) environmental protection
- h) strengthening institutions



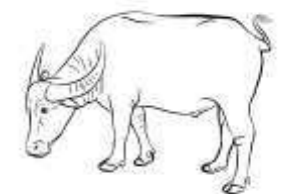
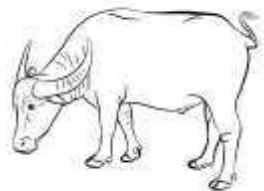
*Approach: Solution-driven R4D to achieve impact*

- #1: Addressing the whole value chain
- #2: Working directly to design and support intervention at scale
- #3: In partnership with development actors

R4D integrated to transform the whole value chain



*competitiveness  
profitability  
sustainability*





# Funding Agencies



# unfinished homework

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Basic to the carabao-based enterprise development (milk and meat) is creating the **critical production base**, appearing to be the current major limitation. The challenge to achieve this is considerable considering the slow rate of reproduction and the time needed to genetically upgrade the existing population to achieve acceptable level of productivity.

**Bold Government support is needed to entice private partners to invest** in herd-build up and enterprise development. Dedicated livestock credit window with relatively low interest rate and a national milk feeding program are essential push and pull factors.

The Philippine Carabao Center should seize the opportunity to take the lead in **increasing its internal and partners' (essentially the LGUs) capacities** in developing human resources attuned to the requirements of the enterprise, both in research and in extension

Serious efforts should be channelled to increasing per capita consumption among young through the school milk feeding program. This is the future market of domestic fresh milk. This is benefitting the dairy sector by way of expanding the market and at the same time creating a better and healthy generation

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# Take Home Message

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- There are enough compelling reasons on the need to harness the huge existing swamp buffalo population to address socio-economic concerns of rural farming communities in most of South East Asia
- There are enough scientific data and sufficient field experience to indicate that crossing and backcrossing swamp buffaloes with riverine breeds is feasible
- For **wide-scale** and **sustainable** crossbreeding and backcrossing, it is essential to set-up needed institutional mechanism; **Legislation** of national Policy
- Research and Development to improve productivity, and Support to enterprise development aimed at improving market access by smallholders is critical for sustained growth and development
- International collaborations in the areas of germplasm and technology sharings will hasten the envisaged development



*THANK YOU!*