Carabao-Based Enterprise Development: The Philippine Experience

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OUTLINE

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

International Conference on CBED, 26-27 Oct 2017, PCC, Munoz, Nueva Ecija
Water Buffaloes – world population

- 2,504,000: more
- 447,000: 2,504,000
- 18,000: 447,000
- 2,000: 18,000
- Less: 2,000
- Not Available

world pop. = 199.7 M (FAO, 2015)
pop in Asia = 97%
swamp type= SEA
Distribution of poor livestock keepers

buffaloes and smallholders are linked
swamp buffaloes and rice farming are linked
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

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>2.8</td>
<td>2.8</td>
<td>2.4</td>
<td>3.3</td>
<td>2.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Philippines</td>
<td>3.4</td>
<td>4.4</td>
<td>2.8</td>
<td>2.7</td>
<td>3.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Thailand</td>
<td>4.9</td>
<td>5.7</td>
<td>5.6</td>
<td>5.0</td>
<td>1.7</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Source: FAO, 2015
Distribution of Carabaos in the Philippines

Legend:
Carabao Population
- 1 - 15200
- 15201 - 34900
- 34901 - 58253
- 58254 - 108024
- 108025 - 178752
Domestic Meat and Milk Production from Cattle and Buffalo, Philippines, 2016

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>MEAT, ‘000 ton</th>
<th>%</th>
<th>MILK, ‘000 ton</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carabao</td>
<td>144.68</td>
<td>34.85</td>
<td>14.20</td>
<td>52.30</td>
</tr>
<tr>
<td>Cattle</td>
<td>270.42</td>
<td>65.15</td>
<td>12.91</td>
<td>47.70</td>
</tr>
<tr>
<td>TOTAL</td>
<td>415.10</td>
<td>100.00</td>
<td>27.15</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Carabao is the symbol of Philippine 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

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

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>Breed</th>
<th>No. (hd)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>male</td>
</tr>
<tr>
<td>1917</td>
<td>India</td>
<td>Murrah</td>
<td>57</td>
</tr>
<tr>
<td>1918</td>
<td>India</td>
<td>Nili-Rav</td>
<td>85</td>
</tr>
<tr>
<td>1947</td>
<td>India</td>
<td>Murrah</td>
<td>7</td>
</tr>
<tr>
<td>1947</td>
<td>India</td>
<td>Murrah</td>
<td>1</td>
</tr>
<tr>
<td>1950-56</td>
<td>India</td>
<td>Murrah</td>
<td>108</td>
</tr>
<tr>
<td>1994</td>
<td>USA</td>
<td>Am-Murrah</td>
<td>70</td>
</tr>
<tr>
<td>1995-99</td>
<td>Bulgaria</td>
<td>Bul-Murrah</td>
<td>216</td>
</tr>
<tr>
<td>2010</td>
<td>Brazil</td>
<td>Murrah</td>
<td>11</td>
</tr>
<tr>
<td>2013</td>
<td>Italy</td>
<td>Italian Mediterranean</td>
<td>1025</td>
</tr>
</tbody>
</table>
Recorded transport of riverine frozen semen to the Philippines

<table>
<thead>
<tr>
<th>Year</th>
<th>Origin</th>
<th>Breed</th>
<th># Straw/dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>Pakistan</td>
<td>Nili-Rav</td>
<td>1000</td>
</tr>
<tr>
<td>1983</td>
<td>Pakistan</td>
<td>Nili-Rav</td>
<td>1000</td>
</tr>
<tr>
<td>1987</td>
<td>Pakistan</td>
<td>Nili-Rav</td>
<td>1000</td>
</tr>
<tr>
<td>1982</td>
<td>India</td>
<td>Murrah</td>
<td>1000</td>
</tr>
<tr>
<td>1984</td>
<td>India</td>
<td>Murrah</td>
<td>1000</td>
</tr>
<tr>
<td>1985</td>
<td>India</td>
<td>Murrah</td>
<td>1000</td>
</tr>
<tr>
<td>1995</td>
<td>Bulgaria</td>
<td>Bulgarian Murrah</td>
<td>13,000</td>
</tr>
<tr>
<td>2013</td>
<td>Italy</td>
<td>Italian Mediterranean</td>
<td>5000</td>
</tr>
</tbody>
</table>
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

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
Regional Centers:
Luzon = 5
Visayas = 4
Mindanao = 4

Regional Centers carry out field extension activities in concert with the Local Govermenr 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

<table>
<thead>
<tr>
<th></th>
<th>PRE-FARMGATE</th>
<th>IN-FARM</th>
<th>POST-FARMGATE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policies (regulation/tariff/taxes)</td>
<td>Feeds</td>
<td>Transport</td>
<td>Transport</td>
</tr>
<tr>
<td>Credit system</td>
<td>Labor</td>
<td>Collection</td>
<td>Processing Facilities</td>
</tr>
<tr>
<td>Environment</td>
<td>Vet Products/MOOE</td>
<td>Technologies</td>
<td>Technologies</td>
</tr>
<tr>
<td>Socio-Economic Systems</td>
<td>Technologies</td>
<td>Storage</td>
<td>Storage</td>
</tr>
<tr>
<td>Human Resources</td>
<td>Semen/Bull</td>
<td>Fund/Money</td>
<td>Fund/Money</td>
</tr>
<tr>
<td>R, D and E</td>
<td>Fund/Money</td>
<td>R, D and E</td>
<td>R, D and E</td>
</tr>
<tr>
<td>R, D and E</td>
<td></td>
<td></td>
<td>R, D and E</td>
</tr>
<tr>
<td><strong>Players</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banks/Funding Institutions</td>
<td>Animal Raisers</td>
<td>Traders</td>
<td>Butcher</td>
</tr>
<tr>
<td>Regulatory agencies</td>
<td>Feed Suppliers/Input providers</td>
<td>Milk collector</td>
<td>Trader</td>
</tr>
<tr>
<td>Universities/Training Centers</td>
<td>Veterinarian</td>
<td>Testing Lab</td>
<td>Processors (for meat and milk)</td>
</tr>
<tr>
<td>Research Centers/Agencies</td>
<td>AI Technician</td>
<td>Extensionist</td>
<td>Storage Person</td>
</tr>
<tr>
<td>Policy Makers (Legislators, LGUs)</td>
<td>Extensionist</td>
<td>Scientists/Researchers</td>
<td>Scientists/Researchers</td>
</tr>
<tr>
<td>Development Agencies</td>
<td>Scientists/Researchers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**End Target of Players:**
- Competitiveness, Profitability, Sustainability
- Competitiveness, Profitability, Sustainability
- Competitiveness, Profitability, Sustainability
- Competitiveness, Profitability, Sustainability
- Competitiveness, Profitability, Sustainability
- Competitiveness, Profitability, Sustainability
Theory of Value Chain Enhancement

Objectives

- Improving Productivity
  - Training and Education
  - Access to Technologies
  - Group Mobilization

- Increasing Access to Inputs
  - Feed, Medicine
  - AI, Savings

- Increasing Access to Market
  - Collectors and Collection Systems
  - Market Linkages, Value Addition

- Enhancing Rules of Exchange
  - Digital Fat Testing Meters
  - Lactometers

- Improving the Policy Environment
  - Working with Government, IFC and Other Stakeholders

Activities

Tangible Outcomes

- Increased Revenues
- Reduced Costs
- Access to Capital and Resources

Intangible Outcomes

- Trust
- Risk and Uncertainty
- Knowledge and Skills
- Transparency

Incomes

Efficiency

Poverty Alleviation

Empowerment Capabilities
### TARIFF ON IMPORTED MILK

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>TARIFF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL WTO</td>
<td>18</td>
</tr>
<tr>
<td>Philippine</td>
<td>3</td>
</tr>
<tr>
<td>Philippine AANZ</td>
<td>0</td>
</tr>
<tr>
<td>India</td>
<td>35</td>
</tr>
<tr>
<td>Thailand</td>
<td>20</td>
</tr>
<tr>
<td>Japan</td>
<td>21</td>
</tr>
<tr>
<td>China</td>
<td>20</td>
</tr>
</tbody>
</table>

![Bar chart showing tariff percentages for different countries](image-url)
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 3.6 Billion)

(growth is 13.8 %/yr)

(growth is 1.48%/yr)
## Self sufficiency (%), milk consumption (kg ME/caput)
### Selected Countries, 2013

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>SELF SUFFICIENCY, %</th>
<th>MILK CONSUMPTION (KG ME/CAPUT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>127</td>
<td>328</td>
</tr>
<tr>
<td>New Zealand</td>
<td>855</td>
<td>593</td>
</tr>
<tr>
<td>China</td>
<td>81</td>
<td>31</td>
</tr>
<tr>
<td>India</td>
<td>101</td>
<td>123</td>
</tr>
<tr>
<td>Indonesia</td>
<td>49</td>
<td>13</td>
</tr>
<tr>
<td>Japan</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Korea</td>
<td>60</td>
<td>68</td>
</tr>
<tr>
<td>Malaysia</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>Philippines</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Taiwan</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>Thailand</td>
<td>69</td>
<td>24</td>
</tr>
<tr>
<td>Vietnam</td>
<td>33</td>
<td>15</td>
</tr>
</tbody>
</table>
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
Swamp (S) 100 % x Murrah (M) 100%

F₁ 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
Establish Gene Pool of Murrah (Dairy)

Establish gene pool of Indigenous Water Buffalo

Establish gene bank (semen, embryos, somatic cells)
GENETIC IMPROVEMENT (Utilization)

- 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 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**
2.9 M Total Carabao Population

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

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

AI techs target is 2000
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
Distribution of Carabao-based dairy coops

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, packaging 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.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Institution/Entity</th>
<th>Date</th>
<th>Area of Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetics</td>
<td>Govt of India</td>
<td>1917 to 1956</td>
<td>Live Animals, Murrah (854 hd at various years)</td>
</tr>
<tr>
<td></td>
<td>Govt of Pakistan</td>
<td>1981 to 1987</td>
<td>Frozen Semen of Nili Ravi (3000 doses)</td>
</tr>
<tr>
<td></td>
<td>FAO-UNDP</td>
<td>1982 to 1992</td>
<td>Research on Crossbreeding between swamp x riverime</td>
</tr>
<tr>
<td></td>
<td>FAO</td>
<td>1994</td>
<td>Risk assessment on importation of live animals from India</td>
</tr>
<tr>
<td></td>
<td>Govt of Bulgaria</td>
<td>1995 to 1999</td>
<td>Live Animal Importation, Bulgarian Murrah (3142 hd various years)</td>
</tr>
<tr>
<td></td>
<td>Govt of Brazil</td>
<td>2010</td>
<td>Live Animal Importation, Murrah Breed (2038 hd)</td>
</tr>
<tr>
<td></td>
<td>Govt of Italy</td>
<td>2013</td>
<td>Live Animal Importation. (1200 hd, Mediterranean breed; 4000 straw of frozen semen)</td>
</tr>
</tbody>
</table>
### Summary of International collaborations related to transformation of swamp buffaloes from draft to milk and meat in the Philippines.

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

**Approach: Solution-driven R4D to achieve impact**

- **Major intervention with development partners**
  - Value chain development team + research partners
    - **Strategic L&F CRP Cross-cutting Platforms**
      - Technology Generation
      - Market Innovation
      - Targeting & Impact

- **Interventions to scale out regionally**
- **Global research public goods**

- **Competitiveness**
- **Profitability**
- **Sustainability**
Funding Agencies
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.
unfinished homework

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Take Home Message

➢ 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!