

Benefits of the 3R approach for the agricultural waste management in Vietnam

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Objectives

- ▶ Address the waste management and environmental issues from the agricultural sectors of Vietnam (*cultivation, livestock, agricultural services*)
- ▶ Assess the potential benefits of the 3Rs approach for agricultural waste management (AWM)
 - *research on co-benefits of the climate benefits*
- ▶ Point out challenges and opportunities in promoting this 3Rs mission, then propose new options/policies to promote effectively the 3R approach for AWM

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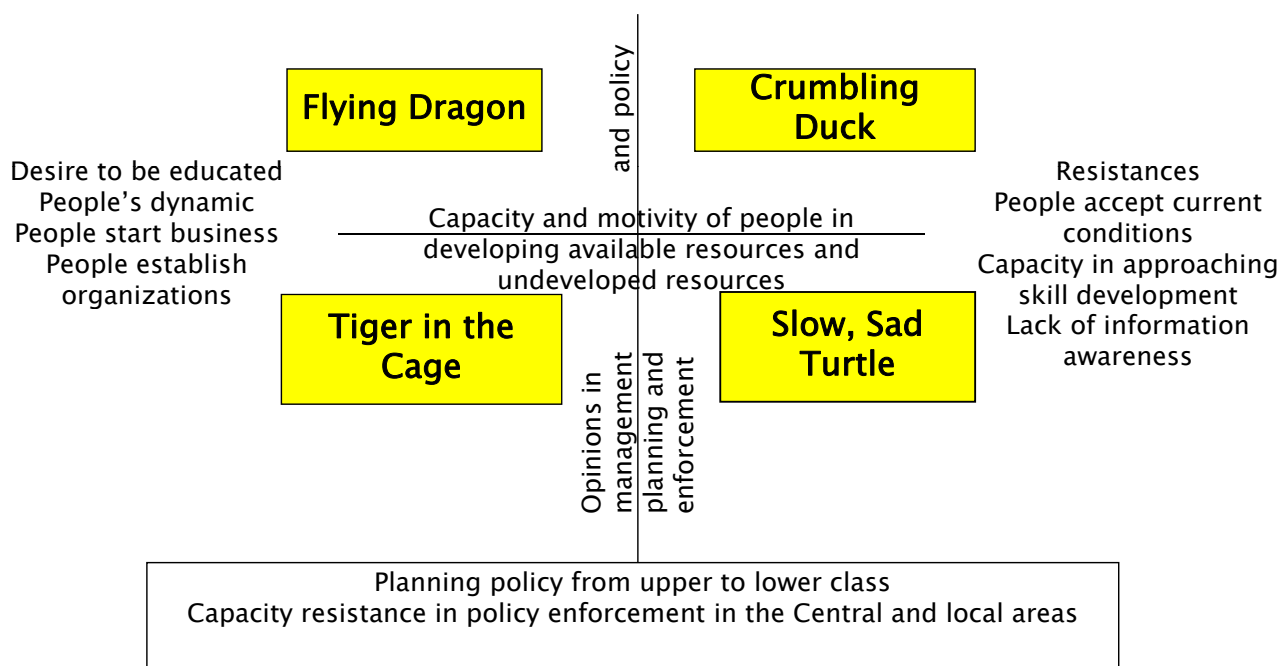
- ▶ Vietnam – an overview
- ▶ Overview of agricultural waste generation and management in Vietnam
- ▶ Policy background as well as opportunities related to 3R approach for AWM
- ▶ Benefit assessment & policy recommendation for appropriate AWM in Vietnam
- ▶ Outcome expected (of the research) for the year 2010

Vietnam – An Overview

- ▶ Area: 331,900 km²
- ▶ Population: 85.79 million
 - *74% live on farming areas*
- ▶ Pop. growth rate: 1.18%
- ▶ GDP 2009: \$91,41 billion
 - *Agriculture: 25% of GNP*
- ▶ GDP growth rate: 5.32 %
- ▶ National Capital: Hanoi
- ▶ Administrative divisions: 63 provinces



Opinions of the Government based on the advantageous environment
 Efficient concentration in the Central and local areas
 Strengthening on power and reliability
 Orienting the market



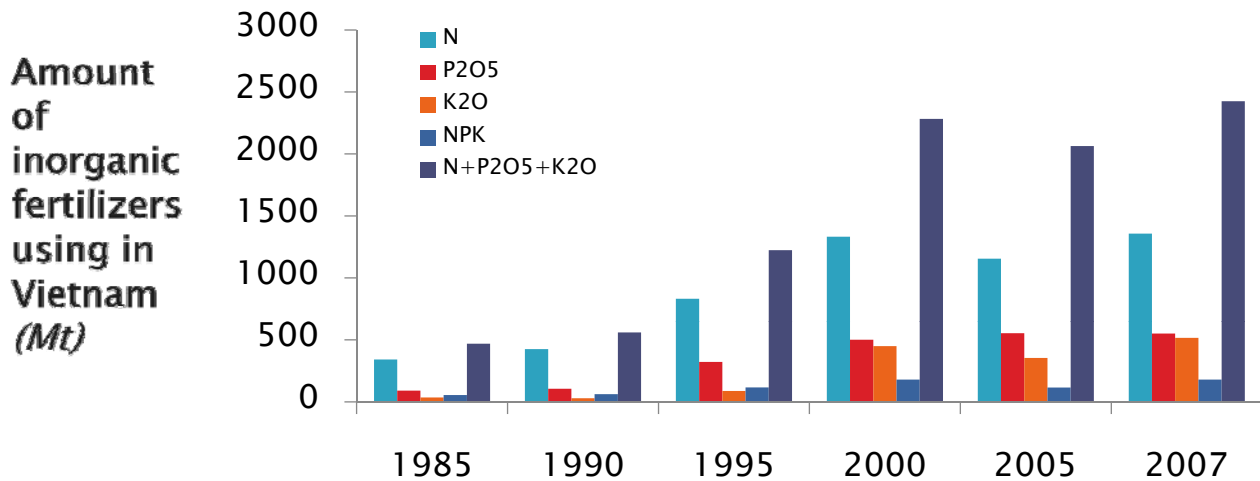
Matrix of Vietnam agriculture development scenarios up to 2020

Status of agricultural development in Vietnam

- ▶ Growth rate expected for cultivation sector:
 - 2011 – 2015: 2.7%
 - 2016 – 2020: 2.6%
 - focus on tropical plants
 - accepting imports
- ▶ Growth rate expected for livestock sector:
 - 2011 – 2015: 6 – 7%
 - 2016 – 2020: 5 – 6%
 - industrial scale
 - increase prod. efficiency
 - reducing feeding cost
 - safety and hygiene

Year	Gross output, 1000 bill. VND	Percentage, %		
		Cultivation	Live stock	Agr. services
2000	129.1	78.2	19.3	2.5
2001	130.2	77.9	19.6	2.5
2002	145.0	76.7	21.1	2.2
2003	154.9	75.4	22.4	2.2
2004	172.5	76.3	21.6	2.1
2005	183.3	73.5	24.7	1.8
2006	197.9	73.7	24.5	1.8
2007	236.9	73.9	24.4	1.7
2008	362.8	71.5	27.0	1.5

Source: GSO, 2008



Heads of livestock in V.nam

Animals	2006	2007	2008
Pig	26,855,300	26,560,700	25,580,000
Cow	6,510,800	6,724,700	7,220,000
Buffalo	2,921,100	2,996,400	2,900,000
Poultry	214,600,000	226,000,000	241,000

Source: GSO, 2009

Cultivation waste generation in 2007

Unit: Mt

Livestock waste	Agricultural residues (straw, bagasse, com cob, cassava, straw, rice husk, peanut and coffee husk)	Excess pesticides	Excess fertilizer		
			N	P	K
77.56	72.37 ^(*)	0,05	1.77	2.07	0.34

Source: Vietnam-Germany Symposium on Renewable Energy, HUT 16 Oct. 2009

In rural areas, agricultural wastes are treated as:

- uncontrolled dumping → *pollution, CH₄ emission*
- a source of fuel (*reused*)
- org. fertilizer, biomass, biogas → *recycling potential*

Availability of agro-industries residues

- ▶ **Hazardous wastes:** excess fertilizers and pesticides
- ▶ In 2007:
 - 1.77 million tons of excess nitrogenous fertilizers
 - 2.07 million tons of excess phosphate fertilizers
 - 0.34 million tons of excess potassium fertilizers
- ▶ Nearly 100% farming land are fertilized

Sources	million tons
Paddy straw	61.9
Rice husk	5.6
Maize husk	4.8
Cassava stem	0.6
Cane trash	1.5
Bagasse	5.0
Peanut shells	0.1
Peanut leaves	5.7
Coffee husk	0.3

Sources: IET-VAST

Livestock waste generated in 2008

- ▶ Total: 18,000 breeding farms – the proportion of larger scale farms is about 37%.
- ▶ Solid waste: 77.56 Mt
 - 26% used as fertilizer or food for fish
 - 21% used for tunnel biogas
 - 10% used for compost,
 - 43% discharged to the environment without any treatment

Kind of animal	1000 heads	Kg of solid waste/day	1000 ton of waste/year
Cow	6,337	10.0	23,132
Buffalo	2,897	15.0	15,864
Pig	26,701	2.0	19,492
Poultry	247	0.2	18,052
Goat, sheep	1,483	1.5	812
Horse	121	4	176
Stag	31	2.5	28

Source: National Institute of agricultural Planning and Projection, 2008

Environmental consequences

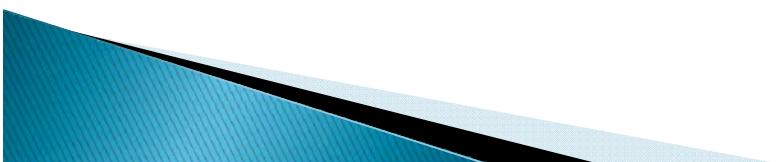
- ▶ Pollution in soil and surface water
- ▶ Land fund and soil quality have declined
- ▶ Alarming status of pesti. & ferti. abuse
- ▶ GHG emissions → contribute to the climate change
 - CH₄, CO₂ (non-control anaerobic digestion)
 - CO₂ (burning...)

Sector	Mt CO ₂ eq.	%
Energy	25.6	24.6
Agriculture	52.4	50.5
Industrial process	3.8	3.7
Land use change and forestry	19.4	18.7
Waste	2.6	2.5
Total	103.8	100.0


GHG inventory by agricultural sector in VN in 1994

3R policy background


- ▶ The *3R approach* in Vietnam has been emphasized in umbrella policies:
 - Viet Nam Agenda 21
 - National Strategy on Environmental Protection to 2010 with vision toward 2020 ▶
 - Law on Environmental Protection 2005



National strategy on 3R

- ▶ The National Strategy on Waste 3R to 2030 has been being developed and *reached to the Zero-Draft*
 - ▶ Overall objective :
 - Efforts will be made to shape a developed *recycling society* in which 3R are used as an effective means to prevent increased pollution, contribute to environmental protection, conserve and rationally utilize natural resources and improve people's quality of life
 - ▶ Specific targets (*related to the on-going research*):
 - The use of recycled things *up to 50%*
 - 30% annual energy consumed is clean (including bio-energy utilizing agricultural and organic wastes)
- 

Opportunities for 3R approach on agricultural waste management

- ▶ CH₄ generation from uncontrolled dumping activities will inevitably contribute to GHG generation which in turn can impact global climate change
 - *needs to reduce the amount of agricultural wastes*
 - ▶ Increasing environmental awareness among government agencies, business sector, and the general public
 - ▶ Rising cost of fossil fuels → *needs to raise the use of biomass and biogas*
 - ▶ Development of researches on biological decomposition and *new technologies that can take full advantages of agricultural by-product/waste* → potentials of new environmental sound products
 - ▶ Insightful policies have contributed to the success and potentials of waste bioconversion
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Characteristics and biogas output of some agricultural waste

Materials (<i>agricultural wastes</i>)	Waste generated (<i>kg/animal</i>)	Dry content (%)	C/N	Biogas output (<i>liter/kg of fresh material</i>)
Cow pat	15 – 20	18 – 20	24 – 25	15 – 32
Buffalo pat	18 – 25	16 – 18	24 – 25	15 – 32
Pig pat	1.2 – 4.0	24 – 33	12 – 13	40 – 60
Poultry	0.02 – 0.34	25 – 50	5 – 15	50 – 60
Night soil	0.18 – 0,34	20 – 34	2.9 – 10	60 – 70
Eichnorcia (fresh)		4 – 6	12 – 25	0.3 – 0.5
Straw (dry)		80 – 85	48 – 117	1.5 – 2.0

Source: Institute of Energy, 2008

Energy and environmental benefits

Benefits in GHG emission reduction:

- ▶ With 8483150 m³ (in 2008) of biogas could generate 12,118,785 kW electricity/day
→ it could **reduce a day: 1211.878 tons CO₂**
- ▶ Effect of GHGs would be reduced to 21/2.75 = **7.6 times^(**)**

Source: Author estimated, INEST 2009

Year	2008	2009	2010
Biogas yield, m ³	8,483,150	11,936,644	15,234,519
Gasoline, liter	6,786,520	9,549,315	12,187,615
Electrici., kW	12118,785	17,052,347	21,763,597
Charcoal, kg	11,876,410	16,711,302	21,328,326
Availability for cooking demand in rural areas	33,932 (thousand)	47746 (thousand people)	60938 (thousand people)
	54.7%		

Estimation of biogas potential in term of energy benefits

Agricultural benefits

Characteristics of the waste residues in biogas equip.:

- ▶ High protein content, easy to be absorbed
- ▶ Slow P-reducing, slow to be mineralized
- ▶ High potassium content
- ▶ Have micro quality elements those are essentials for plants:
 - *Cu, Fe, Zn, Mn...*
 - *humic acid, cellulose..*

Type of manures	N (%)	P ₂ O ₅ (%)	K ₂ O (%)
The waste of solid biogas	1,45	1,10	1,10
Dry waste residues of biogas	1,60	1,40	1,20
Manure	1,22	0,62	0,80
Incubated manure	1,30	1,00	1,00
The total content (NPK) of organic fertilizers			

Source: IE, 2008

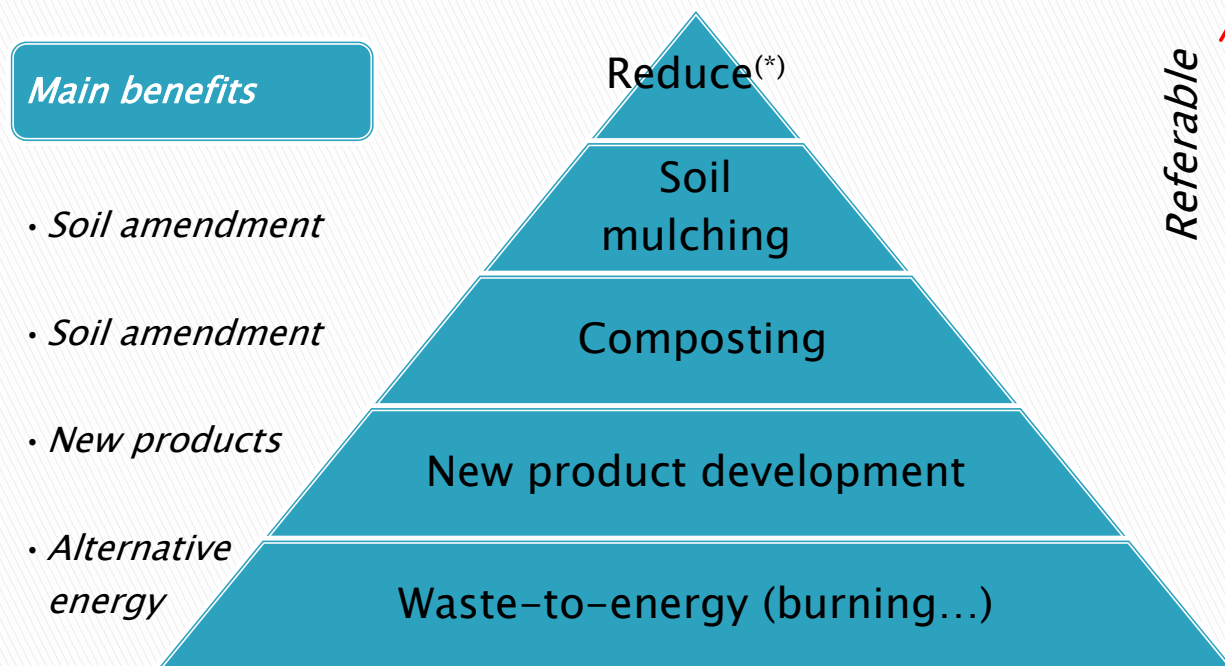


Fig. Recommended cultivation waste management hierarchy

(*) -reasonable use of fertilizer and pesticides
Source: Author developed, INEST 2009

Main benefits

- Direct nutrient recovery for animals
- Soil amendment
- New products
- Energy recovery

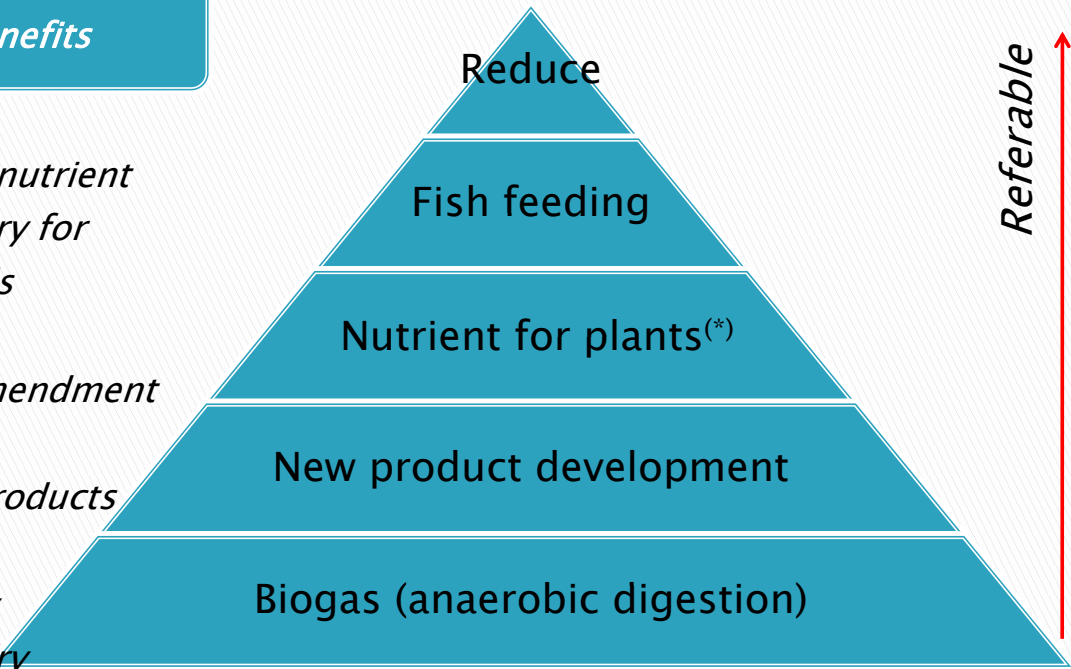


Fig. Recommended livestock waste management hierarchy

(*)- with pre-treatment

Source: Author developed, INEST 2009

Outcomes expected (of research) in 2010

- ▶ Implications of sustainable resource circulation:
 - Examine how to develop policies to establish environmentally sound resource cycles in Vietnam which contributes better resource utilization



Thank you for your attention!