

## ECONOMIC ANALYSIS OF VARIOUS ANIMAL WASTE TREATMENTS IN SELECTED PROVINCES IN VIETNAM

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### ABSTRACT

A survey was conducted in four city/provinces in Southern Vietnam in July and August 2002 within the framework of the Area-Wide Integration project. The main purpose of the survey was to collect information for economic analysis of practical measures in handling animal wastes and the application of manure to crops. The interviewed farm households consisted of livestock farms, crop farms and mixed farms –(crop & livestock production). The survey confirmed that currently, liquid wastes create much more serious environmental impacts than solid wastes that are often recycled on crops or fishponds. A considerable proportion of the interviewed crop farmers apply manure for their crops. The proportion is higher for mixed farms than for simple crop farms. Results of financial analysis show that farmers may get benefit from pig waste processing and utilization. Animal waste could potentially generate profits if farmers can sell the treated manure. It is suggested that policies to enhance manure market development may create favorable conditions for better animal waste management and reduced environmental impacts.

**Keywords:** *Manure treatment, manure management, farm survey, financial analysis.*

### INTRODUCTION

With increasing demand for livestock products in Vietnam, traditional crop-livestock mixed farms often disintegrate, in favour of specialised livestock farms. This often results in excessive nutrient loads around urban areas, which can lead to soil and water pollution, gaseous emissions and public health hazards. The handling of manure and wastewater varies from farm to farm. Most often, solid manure from urban farms do not create environmental problem as farmers can apply it to land, sell it to neighbouring farmers or middlemen. However, seldom is the wastewater recycling and the latter is mostly discharged into streams. The Area Wide Integration (AWI) pilot project in Vietnam, funded by the Livestock Environment and Development (LEAD) Initiative, aimed to integrate specialised livestock production with cropping activities on a regional scale, so that intensive livestock production becomes linked to a land-based system rather than an often profitable, but undesirable and polluting component of the urban industrial system. Within this framework, a survey was conducted in July and August 2002, with the purpose to collect information for economic analysis of various manure management and recycling practices.

### MATERIALS AND METHODS

The survey was conducted in four city/provinces in Southern Vietnam: Dong Nai, Long An and Binh Duong provinces and Ho Chi Minh city. In every province/city, two districts with intensive livestock production or programmes for livestock farms relocation were selected to implement the survey. Finally, three types of farms were considered: livestock farms, crop farms and mixed farms –(crop & livestock production). For each type of the two above-mentioned dis-

tracts of every province/city, 30 farm households were selected to interview with the assistance of local experts. Thus the total sample size was 360, consisting of 120 livestock farms, 120 crop farms and 120 mixed farms.

## RESULTS AND DISCUSSIONS

For animal waste, various management practices can be applied. These are: (i) biogas treatment (anaerobic digestion), (ii) fresh manure storage, (iii) composting, (iv) recycling into fish ponds, (v) direct discharge to land or stream, (vi) selling fresh manure, (vii) giving it for free, (viii) combination of various of these, and (ix) other practices (e.g. direct application to crops). Table 1 shows the proportion of livestock farms differentiated by waste treatment in the study site:

**Table 1.** Various waste treatments applied by the surveyed livestock farms (in %)

Waste treatment	Solid waste	Liquid waste
1) Biogas (anaerobic digestion)	21	25
2) Fresh manure storage	26	0
3) Composting	10	0
4) Recycling into fish ponds	8	12
5) Discharge to land/stream	19	60
6) Selling fresh manure	7	0
7) Given for free	2	0
8) Combined	2	0
9) Others	5	3
Total	100	100

Generally, fresh manure storage and biogas treatment are the most popular solid waste treatments. Figures in the table also show that liquid waste poses a major problem for environment, as many farm households directly discharge the liquid waste into land or stream. The percentage of interviewed farm households that directly discharge the liquid waste into the environment is 60% for the study site.

Table 2 shows the estimation of costs and benefits for pig waste anaerobic treatment. The benefit from biogas production is estimated as a substitute for liquid petroleum gas. Biogas is mainly used for cooking food and feed. The average benefit – cost ratio for biogas treatment is 1.96. This ratio is greater than 1, i.e., the benefit from biogas use is higher than the cost for the installation of the biogas treatment facilities. However, this does not mean that all farmers are willing and able to install a biogas production unit. Establishing a biogas system need the average costs of 1.5 – 2 million Vietnamese dong (US\$ 100 to 135) and many farmers cannot afford

**Table 2.** Financial analysis for biogas treatment of manure on livestock farms, average for the farms included in the survey.

ITEMS	Measurement Unit	Quantity
1. Average installation cost for biogas treatment *	000dong/hh/year	578
2. Estimated benefit from biogas treatment (LPG substitute)	000dong/hh/year	1134
3. Savings amount (= 2 – 1)	000dong/hh/year	556
4. Benefit – Cost Ratio (= 2/1)	Times	1.96

Note: \* Total investment cost for a plastic-tube biogas system is about 1.5 - 2 million Vietnamese dong and it may last for 3 years.

such an investment. It should also be mentioned that farmers usually discharge biodigester effluent into streams (farm ditch or river) and the fact that for larger farms the fuel demand is often not sufficient to utilize all the gas produced.

The average benefit – cost ratios for solid waste composting of the interviewed livestock farm households are shown in Table 3. The treatment costs are estimated on the basis of labor and equipment costs. The benefits from composting are estimated from the current market value of compost. For all farms composting solid waste (31), the calculated benefit – cost ratio is greater than 1, with no clear scale or species effect. This implies that composting could potentially generate profits if farmers can sell the compost. This represents a so-called win-win situation in which both society and private farmers could benefit from the activity. However, not all livestock farms can sell their compost (nor the fresh manure). Indeed, in some areas manure markets do not currently exist. It is suggested that policies to enhance manure market development may create favorable conditions for better animal waste management and reduced environmental impacts.

**Table 3.** Benefit - cost ratio of composting for the interviewed livestock farm households.

Farm scales (animal heads/household)	No. of households			Benefit – Cost Ratios		
	Cattle	Chicken	Swine	Cattle	Chicken	Swine
<10	3	-	1	1.52	-	-
10 – 20	-	-	6	-	-	2.68
20 – 50	1	-	4	3.20	-	5.49
50 – 100	-	-	3	-	-	2.57
100 – 200	-	-	6	-	-	2.60
200 – 500	-	-	2	-	-	2.45
500-1000	-	1	1	-	2.78	4.17
>1000	-	3	-	-	2.68	-

Table 4 shows information on the application of manure by crop farms and mixed crop/livestock farms. 38% of the interviewed crop farmers apply manure to their crops. For mixed farms, the proportion of farmers who apply manure for their crops is even higher (57%). One possible reason for this difference is that manure transportation is easier for mixed farms than for crop farms. Crop farmers must find a supplier and transport manure to their farms. In addition, while a mixed farmer knows the quality of the manure produce on his own farm, a crop farmer has no control over the quality of purchased manure. Thus, manure transportation and manure quality control need to be considered when designing policies related to manure recycling on cropland.

**Table 4.** Information on manure application on crops, average for the interviewed farm households.

Items	Unit of measurement	Producer types	
		Crop producers	Mixed producers
(1) Number of crop cycles	No. of cycles	203	157
(2) Number of crop cycles with manure applied	No. of cycles	78	90
(3) Percentage of (1)/(2)	%	38%	57%

## **CONCLUSIONS**

From the survey results, it seems that animal solid waste does not induce major environmental issues as a large proportion are currently recycled. However, liquid waste mismanagement creates serious environmental problems as many livestock farms discharge their liquid waste directly to land or streams. Thus, there is a need to develop and enforce regulations to encourage farmers to use less water in cleaning animals and to find out techniques to treat liquid waste efficiently.

Manure markets existed to a certain extent in the study region. A policy to enhance manure market development may create favorable conditions for livestock farmers to improve animal waste management practices.

There is a clear tendency of farmers to apply manure on crops. The proportion of crop farmers applying manure on their crops is lower than the one for mixed farmers. Beyond manure quality, manure transportation is certainly a major constraint for applying manure on crop farms. This supports the hypothesis that manure transportation, and more generally transportation costs (related to the siting of the livestock production) are core issues to the concept of area wide integration of livestock and crop production.

## **REFERENCES**

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