

# Situation Analysis on Pig Manure and Effluent Management in Vietnam

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# Objectives

- Comprehensive review of data related to pig production, pig manure and effluent management in Vietnam
- Review of relevant law, regulations and policies, state management
- Investigation of necessary frameworks and enabling environment for strengthening institutions, regulations and enforcement
- Examination of existing and available technologies to control pollution load from pig farms
- Taking number of wastewater samples as well as conducting interviews & questionnaire survey
- Development of a scientific framework for better understanding of nutrient flows from pig farms in Vietnam, based on secondary and primary data
- Providing a significant input to the development of a draft technical guideline for pig wastewater management in Vietnam

# Research approach

Collected secondary data:

- Pig population growth in Vietnam from 2006 to 2016
- Distribution of pig population according to geographical locations
- Scale of pig farming in different areas
- Pig waste characteristics
- Current pig waste management in several provinces in Vietnam

# Research approach

Gather primary data

➤ Conducted household survey:

40 pig households

50 pig farms

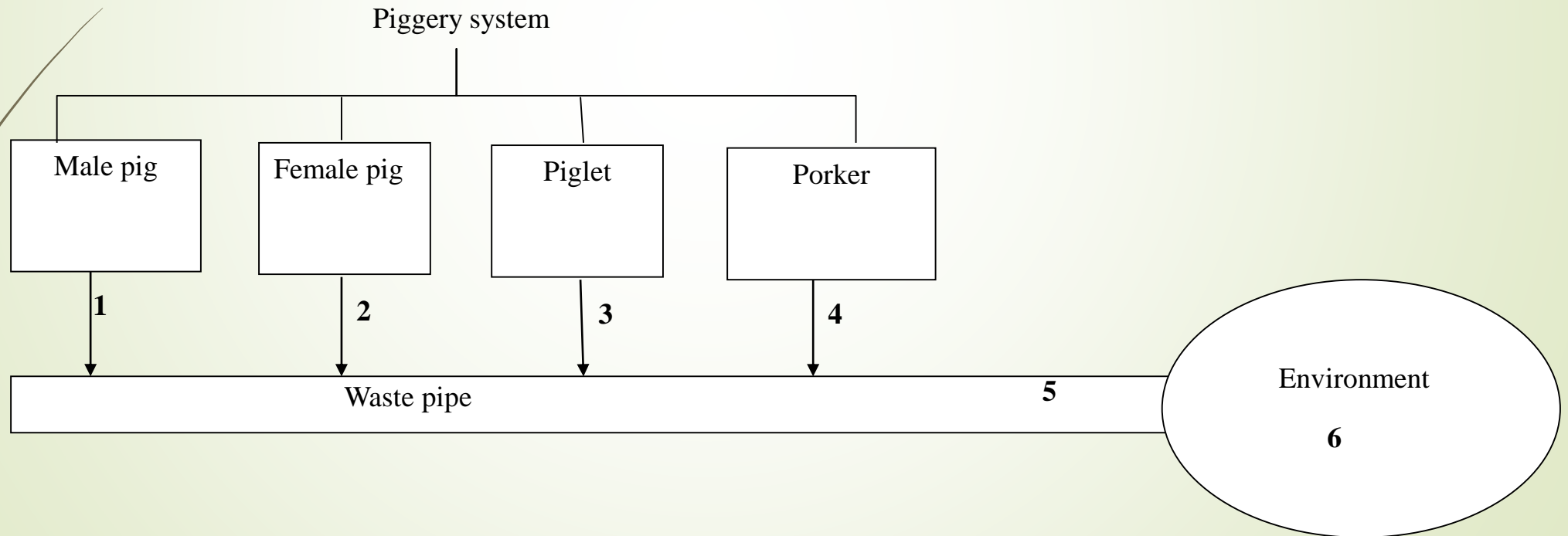
In Hanoi, Hung Yen, Thai Binh, Bac Giang and Thanh Hoa provinces

➤ Interviewed district officers: 7 veterinarians

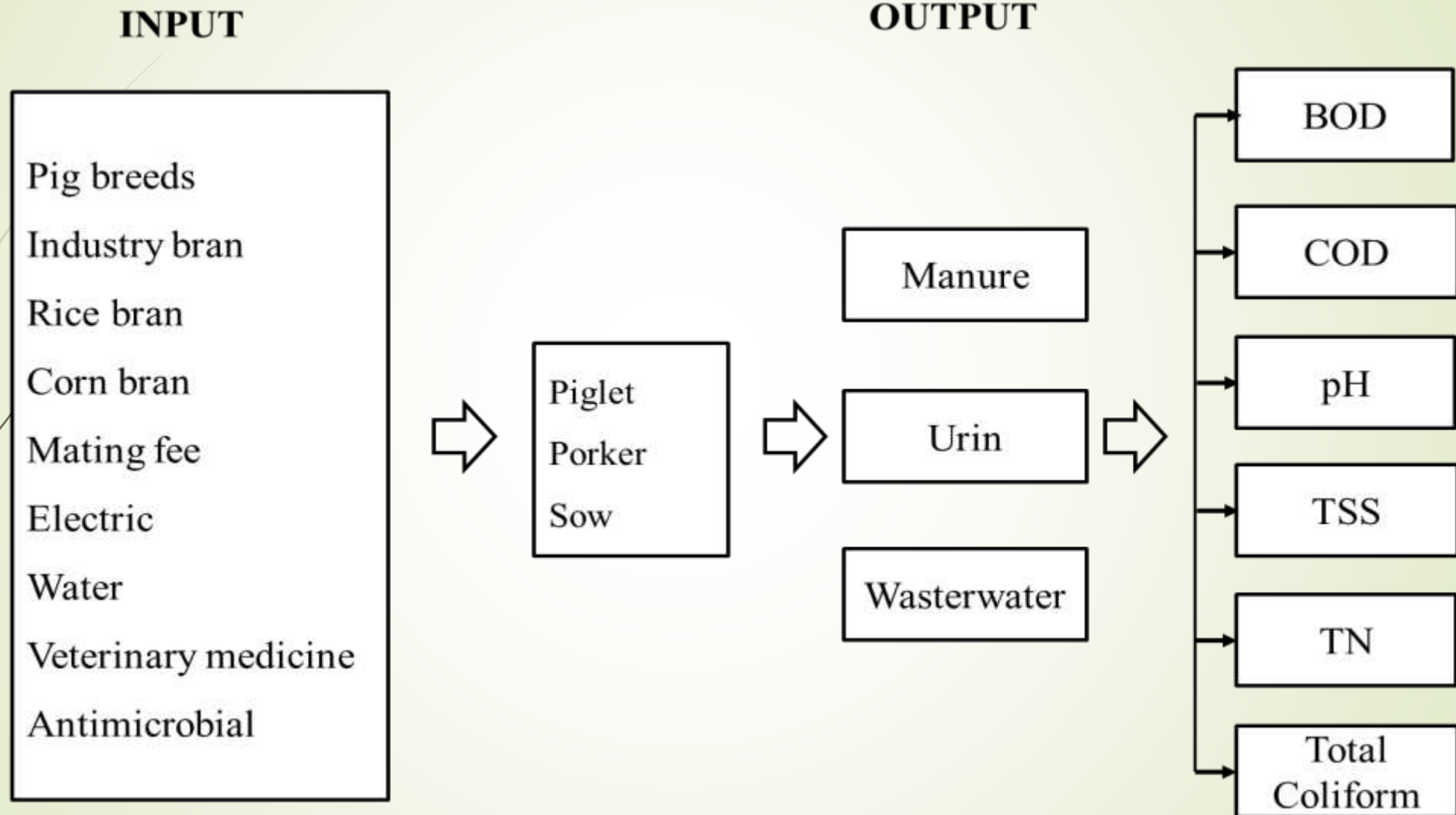
➤ Reported daily food feeding and weighted, measured urine and solid waste as well as waste management for 4 months

# Taking sampling

- 14 wastewater sampling taken in three times for analysing 9 environmental parameters (pH, DO, BOD, COD, T-N, T-P, TSS, TDS, Total Coliform)
- 6 manure sampling analysed 5 parameters (pH, CO, T-N, T-P, Coliform)

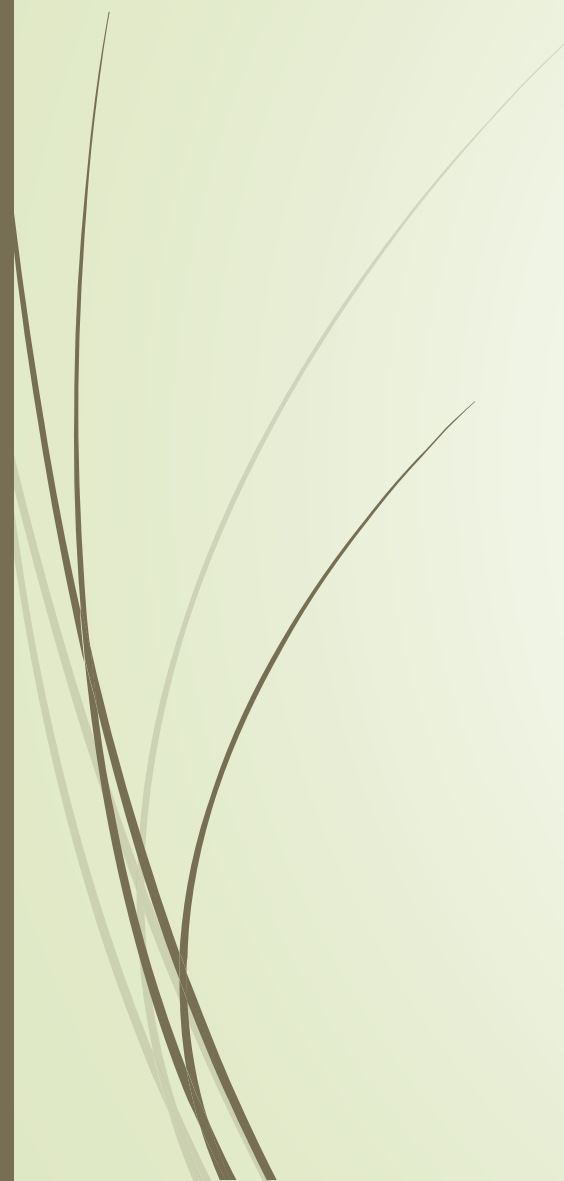


# Material flow analysis: Inputs - outputs

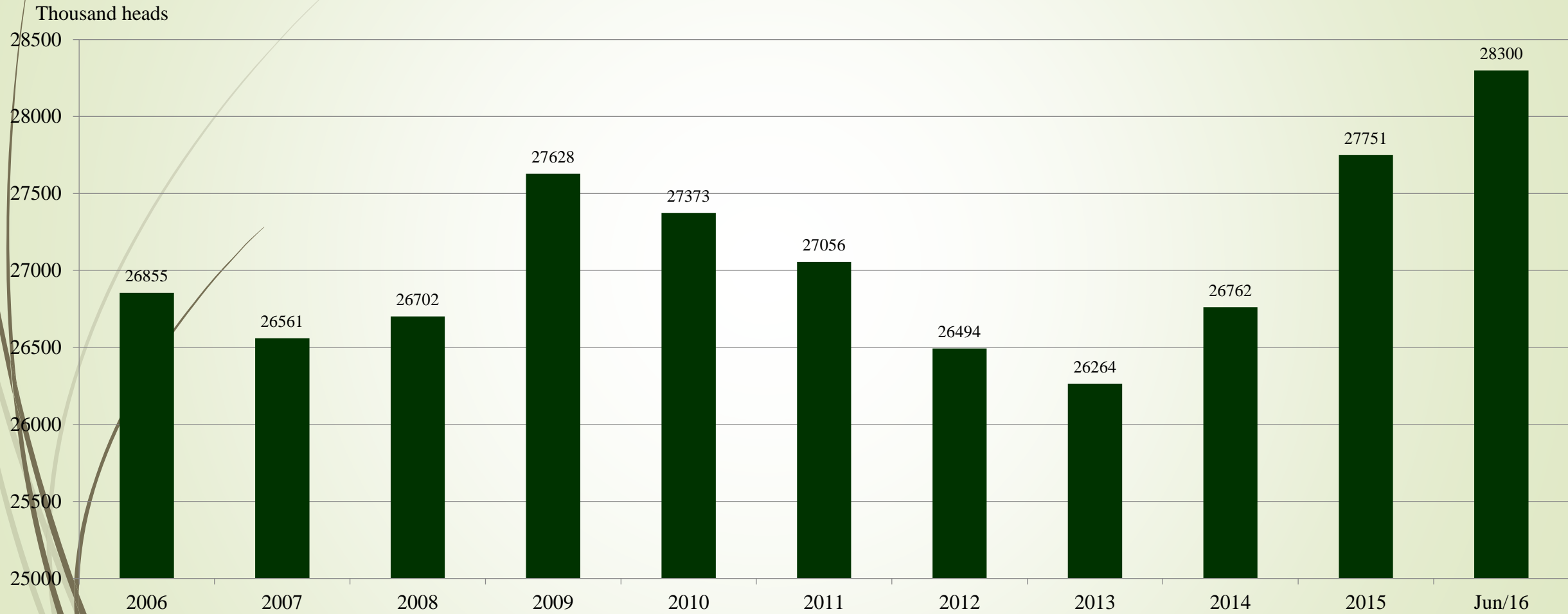




# RESULTS



# Pig population growth in Vietnam from 2006 to 2016





# Characteristic of pig wastewater in Gia Lam, Ha Noi

Parameters	Unit	Type of pig		
		Porker	Sow	Piglet
pH	-	6.73	6.55	6.41
TSS	mg/l	4,735	4,694	2,571
T-N	mg/l	106.03	67.16	65.03
NO <sub>3</sub> <sup>-</sup>	mg/l	4.21	3.13	2.94
NH <sub>4</sub> <sup>+</sup>	mg/l	97.72	65.81	73.68
T-P	mg/l	62.33	48.71	69.79

*Source: Nguyen Thi Thuy Dung et al, 2015*

# Proportion of pig waste treatment methods in some provinces of Vietnam

Effluent management	Province (Unit: %)			
	Hung yen <sup>1</sup>	Ha Noi <sup>2</sup>	Thai Binh <sup>3</sup>	Bac Giang <sup>3</sup>
Biogas	47.62	91.49	30	25
Compost	9.52	6.38	37	29
Used for plant	38.10	23.40	-	-
Directly discharge into environment	28.57	4.26	14,0	0
Discharge to fish ponds	52.38	17.02	-	-
Collection for sale	28.57	34.04	-	-
Stored	-	-	8	14

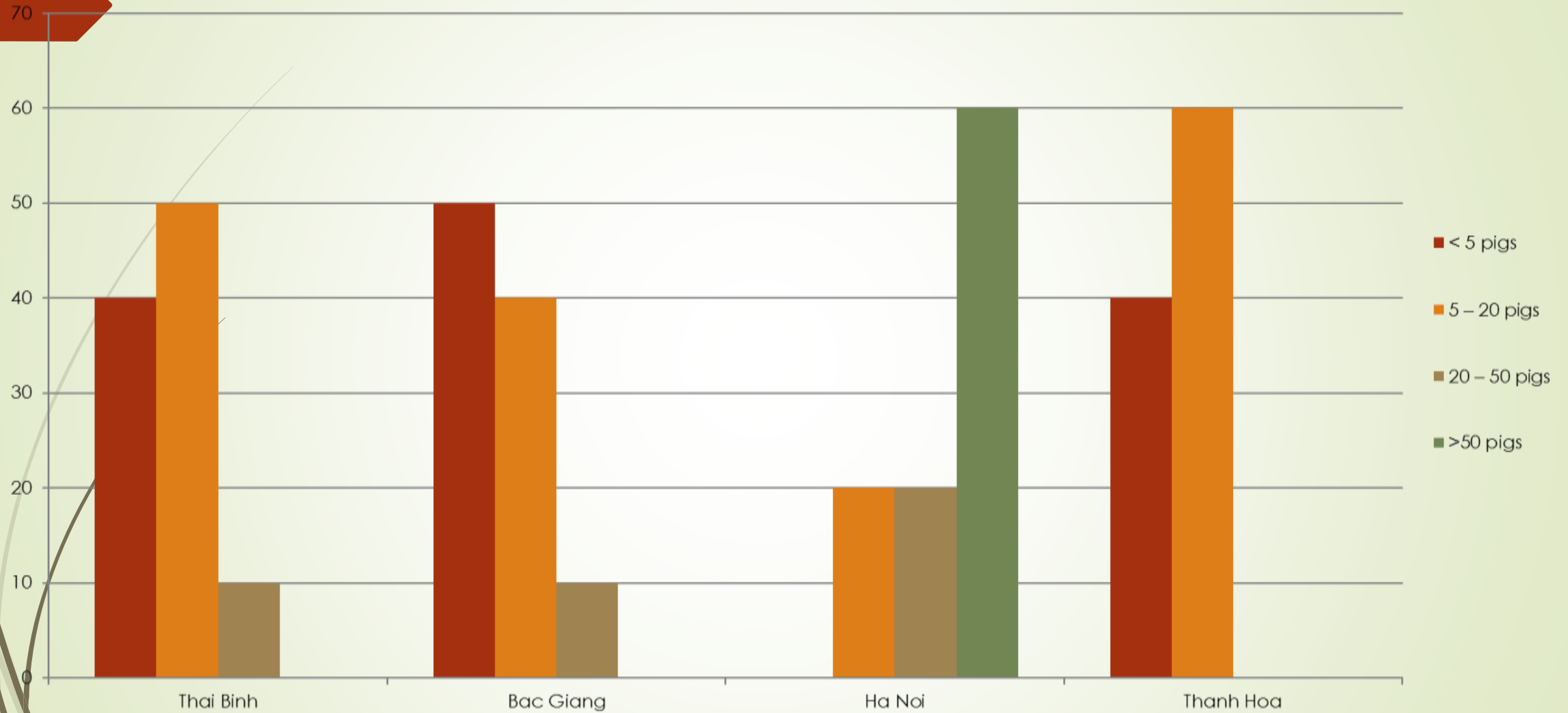
Source : <sup>1</sup>Cao Truong Son et al, 2014; <sup>2</sup>Bui Phung Khanh Hoa, 2014; <sup>3</sup>T.K.V.Vu et al, 2007

# Average number of pigs per households in some study site

Study sites	2015			2016		
	Piglet	Sow	Porker	Piglet	Sow	Porker
<b>Thai Binh</b>	50.1 ± 47.0	3.2 ± 2.5	4.0 ± 12.7	26.6 ± 23.8	3.7 ± 2.5	2.2 ± 6.3
<b>Bac Giang</b>	24.0 ± 0.0	1.0 ± 0.0	3.8 ± 1.7	20.0 ± 0.0	3.0 ± 0.0	5.9 ± 5.6
<b>Ha Noi</b>	147.6 ± 197.9	10.6 ± 11.5	109.6 ± 135.5	86.8 ± 152.8	35.0 ± 93.4	83.9 ± 136.8
<b>Thanh Hoa</b>	32.3 ± 24.8	1.3 ± 0.6	19.4 ± 11.4	26.0 ± 14.0	1.3 ± 0.5	18.6 ± 11.9
<b>Total</b>	87.4 ± 137.8	5.8 ± 8.3	36.7 ± 83.0	51.3 ± 101.6	14.7 ± 57.2	28.7 ± 76.9

*Source: Survey data, 2016*

# Size of pig households in study sites



*Source : Survey data, 2016*

# Some characteristics of piggery in households

Study sites	Value	Piggery system		Wastewater pipet		Type of wastewater pipet		Floor of piggery	
		Semi-solid	solid	Yes	No	Open	Close	Cement	Brick
Thai Binh	Number	10	0	10	0	0	10	10	0
	(%)	100.0	0.0	100.0	0.0	0.0	100.0	100.0	0.0
Bac Giang	Number	5	5	5	5	3	2	8	2
	(%)	50.0	50.0	50.0	50.0	30.0	20.0	80.0	20.0
Ha Noi	Number	5	5	10	0	0	10	10	0
	(%)	50.0	50.0	100.0	0.0	0.0	100.0	100.0	0.0
Thanh Hoa	Number	3	7	10	0	10	0	9	1
	(%)	30.0	70.0	100.0	0.0	100.0	0.0	90.0	10.0
Total									
	(%)	57.5	42.5	87.5	12.5	37.2	62.8	92.5	7.5

*Source : Survey data, 2016*

# Average inputs of pig production in study sites

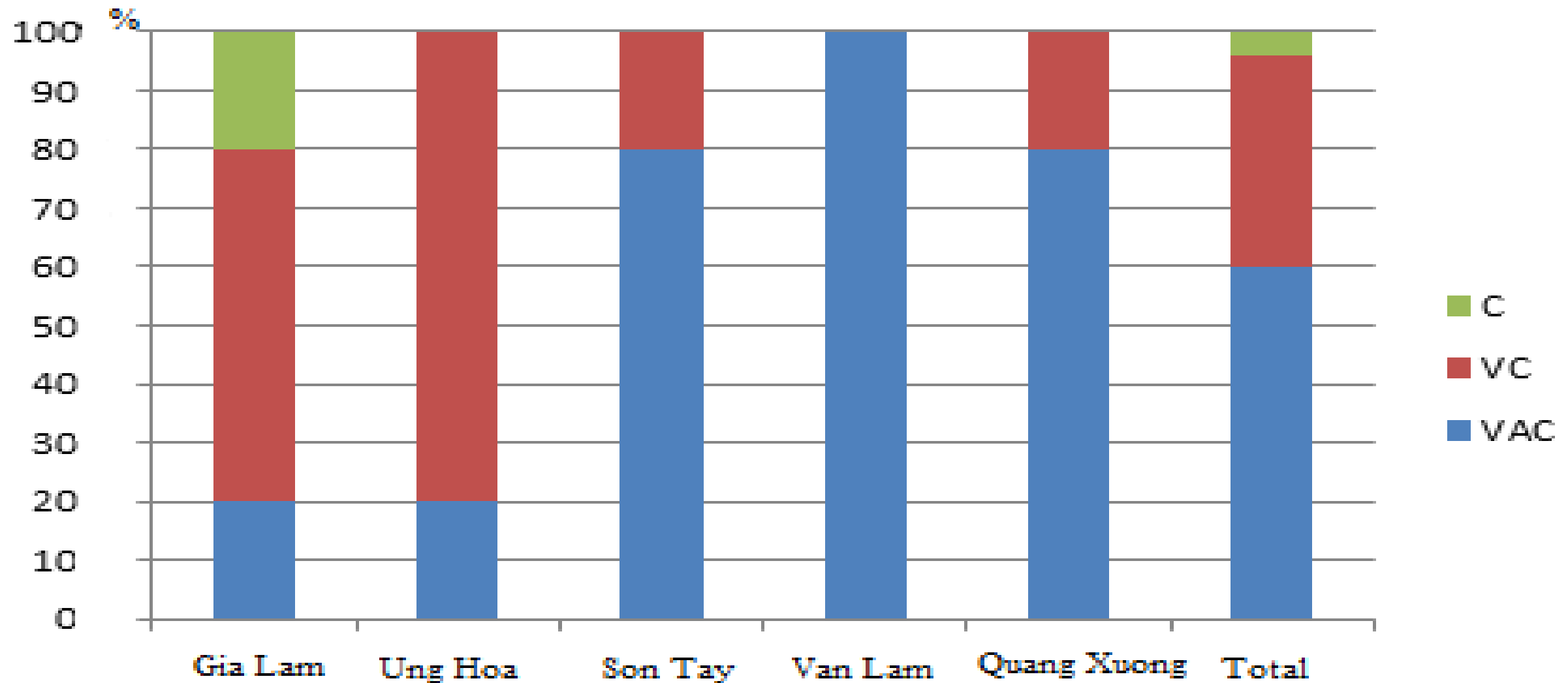
Study sites	Breed		Industry bran (kg/head)	Rice bran (kg/head)	Corn Bran (kg/head)	Eclectic (Thousand dong /head)	Water (m <sup>3</sup> /head)	Mating fee (thousand dong/head)	Veterinary medicine (Thousand dong/head)	Antimicrobial (Thousand dong/head)
	Number	Price (thousand dong/head)								
Thai Binh	1.5	926.67	264	236.4	50.4	456	13.2	16	-	34.44
Bac Giang	11	1220	1092	-	-	19.2	12	25.76	-	-
Ha Noi	22.1	2546.83	606	-	-	39.6	19.2	30.54	180.63	16.97
Thanh Hoa	13.2	1181.06	808.8	372	36	130.8	16.8	11.05	25.88	0

*Source : Survey data, 2016*

# Correlation analysis of characteristic of pig household to environmental pollution

	Odor	Colour	Water smell/odor	Noise
Livestock area	0.4287	0.3004	0.2611	0.2911
Stable	0.0173	0.1977	0.2229	0.1916
Number of pig	0.4703	0.4185	0.3398	0.2446
Industry bran	0.4298	0.2913	0.2212	0.1199
Rice bran	0.0597	-0.2069	-0.2131	-0.1344
Corn bran	0.2583	0.0968	0.0439	0.0136
Number of time stable washing	0.3078	0.4448	0.4179	0.3475
Times of stable washing	0.5125	0.2523	0.3803	0.2054
Antimicrobial	-0.1341	-0.3701	-0.2197	-0.2102
Environmental communication	0.1558	-0.033	0.081	0.2873
Environmental fee	0.6134	0.5147	0.4062	0.4503

# Percentage of the pig farm type in study sites



*Source : Survey data, 2016*

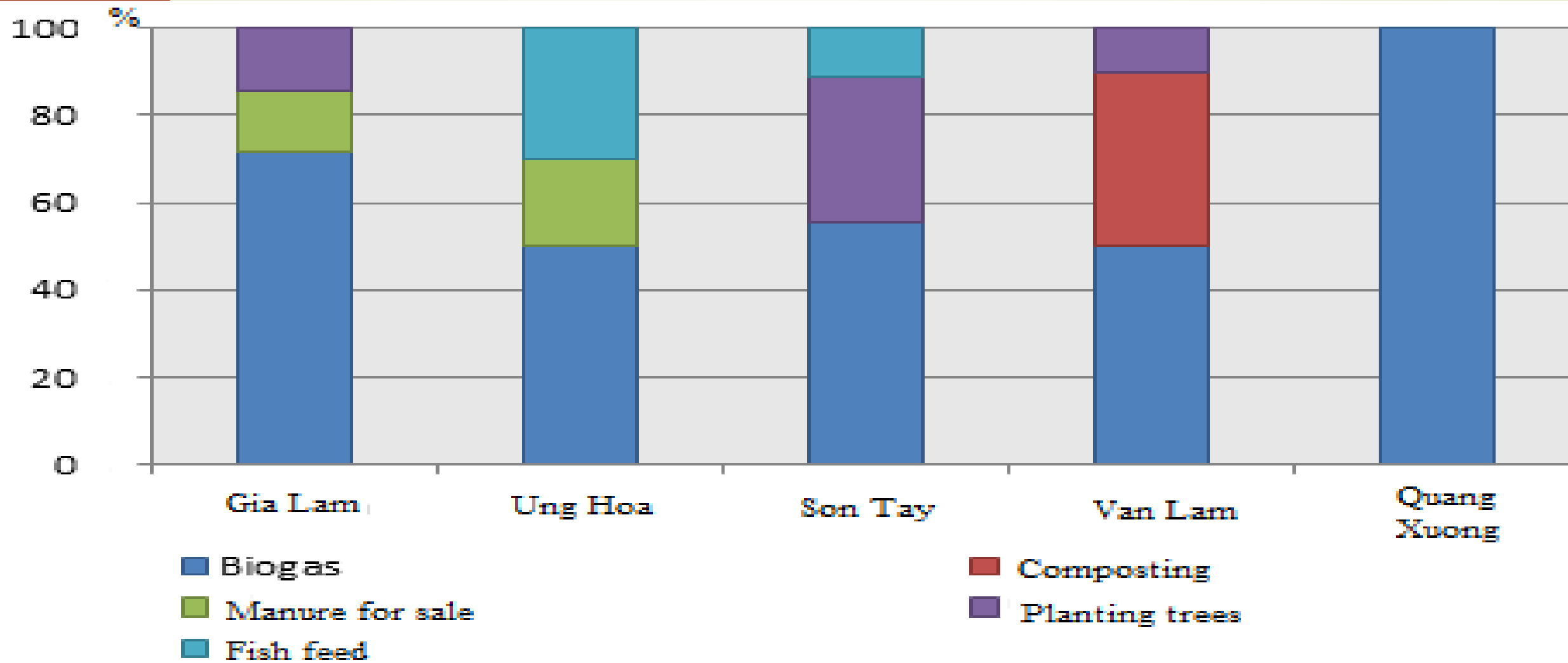


# Average inputs of pig production of pig farm in study sites

Study sites	Breed			Industry bran (kg/head/d)	Rice bran (kg/head)	Corn Bran (kg/head)	Eclectic (Thousand dong /head/d)	Water (m <sup>3</sup> /head/d)	Mating fee (thoud dong/year)	Veterinary medicine (Thoud dong/head/d)	Antimicrobial (Thoud dong)
	Porker	Sow	Piglet								
<b>Gia Lam</b>	1216	82.6	294	0.58	-	-	0.15	0.004	-	128.75	-
<b>Ung Hoa</b>	344	26.2	48	2.39	-	-	0.2	0.015	-	240	-
<b>Son Tay</b>	3440	-	-	0.46	-	-	0.002	0.003	-	300	-
<b>Van Lam</b>	90.8	2.8	26.4	-	-	-	-	-	-	-	-
<b>Quang Xuong</b>	1264	16	-	0.59	-	-	0.175	-	-	300	-

*Source : Survey data, 2016*

# Waster management



Source : Survey data, 2016

# Inputs for porker and female pigs in Van Duc commune, Gia Lam district, HN

Parameters	PORKER				SOW			
	Types	Farm 1	Farm 2	Farm 3	Types	Farm 1	Farm 2	Farm 3
Industrial bran (kg/head/day)	<15 kg	0.51			<b>GILT</b>		2.36	2
	15-30 kg	0.9	0.95	0.6	<b>Preparing for pregnant pig</b>		2.02	2
	30-50 kg	1.8	1.3	1.5	<b>Pregnant pig</b>	2.59	2.1	2
	50-60 kg	3.6			<b>sow</b>	3.82	3.45	3.68
	>60kg		2	2.1				
Average		1.7025	1.42	1.4		3.205	2.4825	2.42
Other food (kg/head/day)	<15 kg	-	-	-	<b>GILT</b>	-	-	-
	15-30 kg	-	-	-	<b>Preparing for pregnant pig</b>	-	-	-
	30-50 kg	-	-	-	<b>Pregnant pig</b>	-	-	-
	50-60 kg	-	-	-	<b>sow</b>	-	-	-
	>60kg	-	-	-		-	-	-
Growing duration (day)		180	180	180		-	-	-
Drink water (liter/day/head)	<15 kg				<b>GILT</b>	-	8.06	7.75
	15-30 kg	-	1.22	3.4	<b>Preparing for pregnant pig</b>	-	7.76	9.8
	30-50 kg	-	3.05	4.3	<b>Pregnant pig</b>	-	8.69	9.02
	50-60 kg	-			<b>sow</b>	-	13.01	14.8
	>60kg	-	8.65	5.4		-		
Average			4.31	4.37		-	9.38	10.34

# Outputs for porker and female pigs in Van Duc commune, Gia Lam district, HN

Parameters	PORKER				SOW			
	Types	Farm 1	Farm 2	Farm 3	Parameters	Farm 1	Farm 2	Farm 3
urine (litle/day/head)	<15 kg	0.06			<b>GILT</b>	2.31	2.31	2.9
	15-30 kg	0.15	0.2775	1.825	<b>Preparing for pregnant pig</b>	2.7	2.7	3.3
	30-50 kg	0.16	1.15	4	<b>Pregnant pig</b>	2.69	3.8	3.8
	50-60 kg	0.87	0.87	0.87	<b>sow</b>	5.1	1.7	4.3
	>60kg	2.775	2.775	3.975				
Average		0.803	1.268125	2.6675		3.2	2.6275	3.575
Manure (kg/day/head)	<15 kg	0.07			<b>GILT</b>	1.07	1.07	1.08
	15-30 kg	0.27	1.25	0.7675	<b>Preparing for pregnant pig</b>	0.89	0.89	0.83
	30-50 kg	0.52	1.8	1.25	<b>Pregnant pig</b>	1.5	1.33	1.15
	50-60 kg	0.6	0.6	0.6	<b>sow</b>	1.25	1.39	1.98
	>60kg	2.755	2.755	1.675				
Average		0.843	1.60125	1.073125		1.1775	1.17	1.26
Wastewater (litle/day/head)	<15 kg				<b>GILT</b>		23.2	19.7
	15-30 kg		23.9	5.6	<b>Preparing for pregnant pig</b>		19.7	19.7
	30-50 kg		27.2	16.7	<b>Pregnant pig</b>		24.1	19.7
	50-60 kg			38.4	<b>sow</b>		24.1	19.7
	>60kg		31.2					
Average			27.43333	20.23333			22.775	19.7

# Wastewater characteristics in pig farm in Van Duc, Gia Lam, Ha Noi (9/2016)

Location	TDS	TSS	TS	pH	COD	BOD	TN	TP	Coliform
	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	10 <sup>6</sup> CFU/ml
Urine of male pig	1395	10.8	1405.80	6.6	5479	3520	591	8812	0.013
Wastewater of prenatcy pig	2710	3.62	2713.62	7.3	2192	1762	486	5593	1.024
Wastewater of sow (female pig that has given birth)	524	2.39	526.39	7.4	767	432	45	3013	9.2670
Urine of prenatcy pig	4470	2.88	4472.88	7.0	3178	1954	2271	6600	11.8000
Urine of wastewater of sow	9930	9.26	9939.26	7.8	2411	1236	6275	7829	22.4670
Wastewater of porker < 15 kg	515	2.69	517.69	6.6	767	490	115	3873	0.0290
Wastewater of porker 15 - 30 kg	486	2.13	488.13	7.4	877	678	143	2275	0.4390
Wastewater of porker 30 - 50 kg	612	1.63	613.63	7.7	767	510	17	2005	9.2000
Wastewater of porker 50 - 60 kg	2580	2.77	2582.77	8.4	1425	975	115	5445	6.0670
Wastewater of porker >60kg	2400	1.62	2401.62	8.7	932	648	52	2767	0.1120
Urine porker < 15 kg	4120	2.05	4230.22	7.0	2178	984	2164	5012	4.2000
Urine porker 15 - 30 kg	4630	2.69	4632.69	7.2	2959	2140	2355	4192	3.8330
Urine porker 30 - 50 kg	3390	2.18	3392.18	6.8	2411	1832	2425	7878	3.03
Urine porker 50 - 60kg	4510	2.81	4512.81	6.3	3397	2542	3972	7632	1.8450
Urine porker > 60kg									
Pond	589	1.97	590.97	7.8	877	526	31	4045	0.0013

Source : Analysis data, 2016

# Material flow analysis

Symbol	Description of data	Unit	Value farm 1	Value farm 2	Value farm 3
a feed_porker	Daily food for porker	kg food/head/day	1.762	1.416666667	1.4
d porker	Growing duration of porker	day	180	180	180
a feed_sow	Daily food for sow	kg food/head/day	3.205	2.4825	2.42
d sow	Growing duration of sow	day	150	150	150
CN feed_pig	Nitrogen content in commercial food for pig	gN/kg food	26	26	26
n man-porker	Daily manure of porker	kg/head/day	0.843	1.60125	1.073125
n man-sow	Daily manure of sow	kg/head/day	1.1775	1.17	1.26
aN man-porker	Nitrogen load in porker' manure	gN/kg	3	3	3
n urine_porker	Daily urine of porker	l/head/day	0.803	1.268125	2.6675
n urine_sow	Daily urine of sow	l/head/day	3.2	2.6275	3.575
aN urine_porker	Nitrogen load in porker' urine	g/l	2.729	2.729	2.729
aN urine_sow	Nitrogen load in sow' urine	g/l	4.273	4.273	4.273
n wastewater_porker	Daily wastewater of porker	l/head/day		27.43	20.23
n wastewater_sow	Daily wastewater of sow	l/head/day		22.78	19.70
aN wastewater_porker	Nitrogen load in porker' wastewater	g/l	0.1284	0.1284	0.1284
aN wastewater_sow	Nitrogen load in sow' wastewater	g/l	0.2655	0.2655	0.2655
rN emis_pig man	Ratio of N gas losses to N manure pigs		0.2	0.2	0.2
Y pork	Yield of porker	kg/head	130	130	110
CN pork	Nitrogen content in pork	gN/kg meat	26	26	26
N piglet	Number of piglet	No/head	12	12	12
Weight of pitlet	Weight of pitlet	kg	7	7	7

# Inputs of porker and sow

Symbol	Description of data	Unit	farm 1	farm 2	farm 3
IN_porker	$a \text{ feed\_porker} \times d \text{ porker} \times \text{CN feed\_pig}$	gN/head	8246.16	6630	6552
Input_sow	$a \text{ feed\_sow} \times d \text{ sow} \times \text{CN feed\_pig}$	gN/head	12499.5	9681.75	9438


# Outputs of porker and sow

Symbol	Description of data	Unit	farm 1	farm 2	farm 3
Output_porker	OUT_1 + OUT_2 + OUT_3 + OUT_4+OUT_5	gN/head	4320.71366	5040.54	4865.71
Output_sow	OUT_6 + OUT_7 + OUT_8 + OUT_9	gN/head	4870.89	4499.90	5155.80
OUT_1_man_porker	n man_porker x d porker x aN man_porker	gN/head	455.22	864.68	579.49
OUT_2_urine_porker	n urine_porker x d porker x aN urine_porker	gN/head	394.45	622.93	1310.33
OUT_3_wastewater_porker	n wastewater_porker x d porker x aN wastewater_porker	gN/head	0	0.00	0.00
OUT_4_emis_porker	n man_porker x aN man-porker x d porker x rN emis_pig man	gN/head	91.04	172.94	115.90
OUT_5_pork_porker	Ypork x CN pork	gN/head	3380.00	3380.00	2860.00
OUT_6_man_sow	n man_sow x d sow x aN man_Sow	gN/head	529.88	526.50	567.00
OUT_7_urine_sow	n urine_sow x d sow x aN urine_sow	gN/head	2051.04	1684.10	2291.40
OUT_8_wastewater_sow	n wastewater_sow x d sowx aN wastewater_sow	gN/head	0	0.00	0.00
OUT_9_emis_sow	n man_sow x d sow x aN man_sow x rN emis_pig man	gN/head	105.975	105.3	113.4
OUT_10_weight of piglet	n piglet x weight of pitlet x CN pitlet	gN/head	2184	2184.00	2184.00





# Next steps

- Calculate for MAF at 3 pig farm
  - Consult with policy makers of MARD and MONRE
  - Discuss about the input for a draft guideline of pig waste management
- 



**Thank you for Attention!**

