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Assessing three nitrogen use performance indicators for pig supply chains in East and Southeast Asia



7th International Nitrogen Initiative Conference , 4th – 8th December 2016
Melbourne, Australia



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Outline

- Goal
- Nitrogen use performance indicators
- Results for Pig supply chains
- Take home messages

Key figures on livestock

25%

of the protein consumed

1/4

people depend on livestock

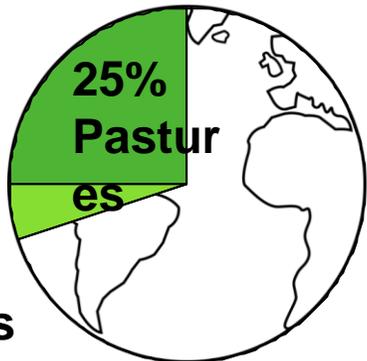
40%

of the global GDP of agriculture

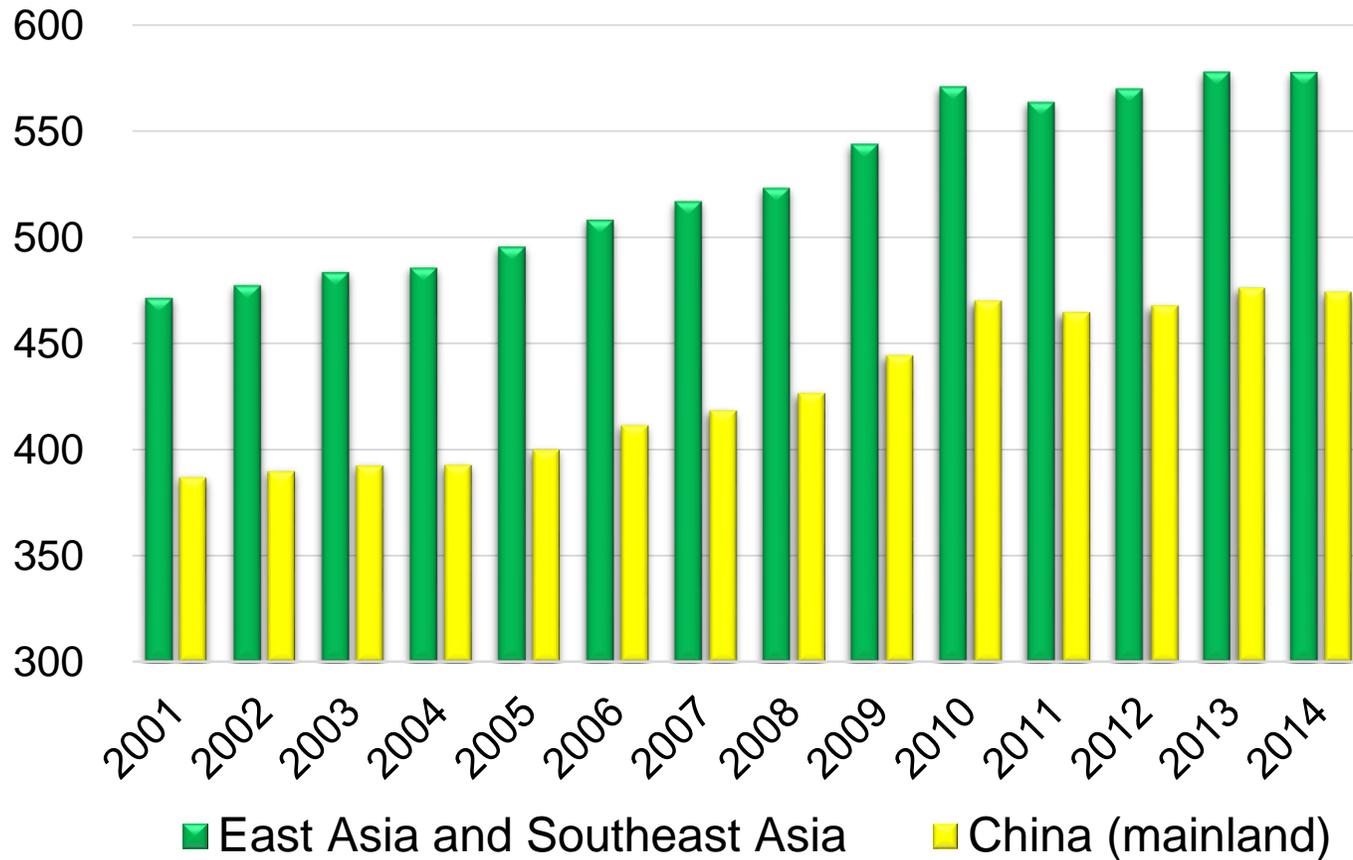
+70% ↑

demand for animal products by 2050

Land use



Growth of pig supply chains



Pig supply chains are developing rapidly with an average growth of 3%

1. Goal

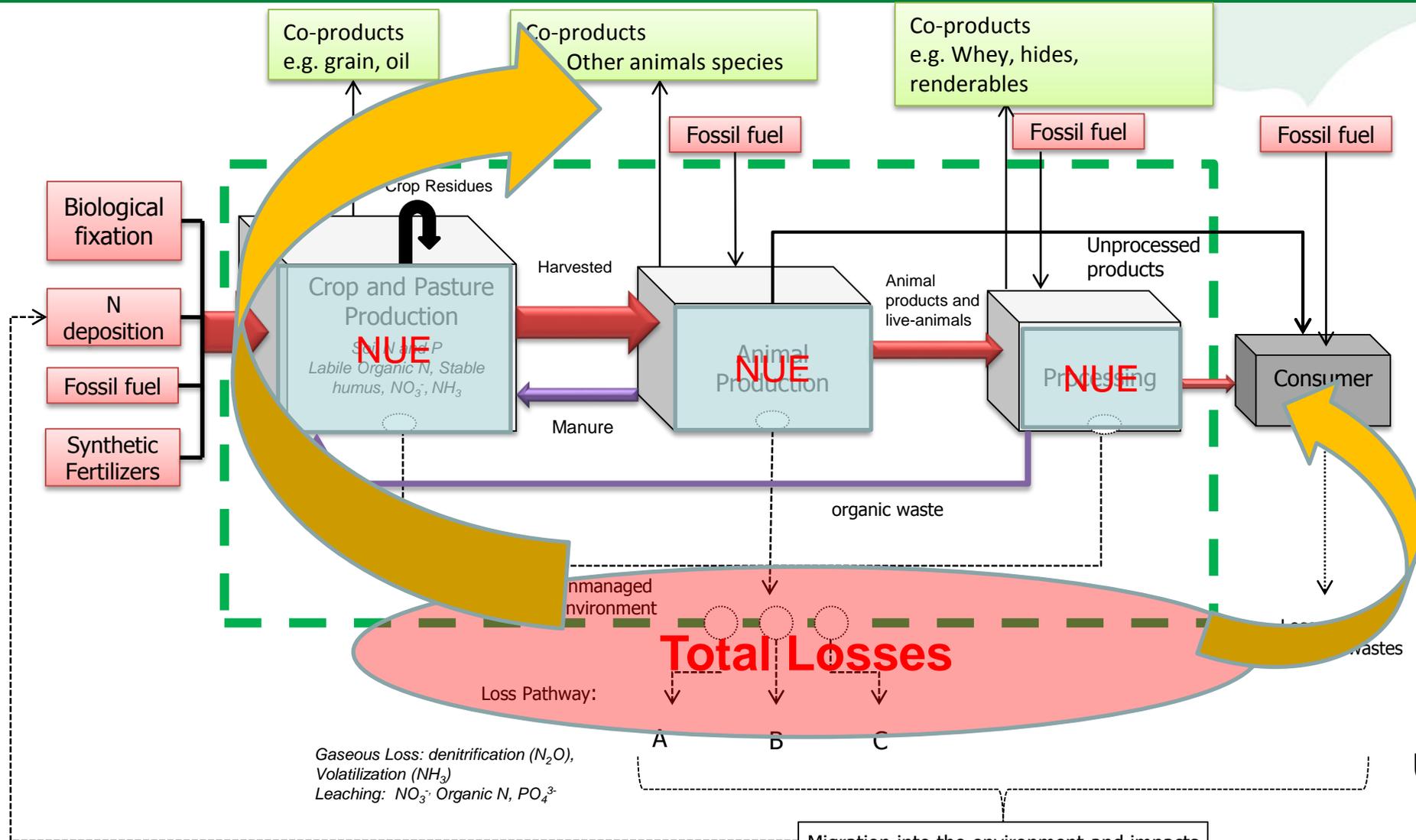
Evaluate the Nitrogen use performance indicators for pig supply chains in ESEA.



2. N use performance indicators?

- Life cycle approach
- Definition of system boundary (cradle to primary processing)
- Considerations of all N flows including crop residues and manure recycled
- All materials exported are considered as co-products e.g. Manure, maize stover
- Need for a hotspot indicator

N use performance framework



Uwizeye et al., 2016

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Supply-and-use matrix

PROD: Products of unit processes from the system

INP: Inputs to the unit processes (crop, animal, process) from the system

RES: Resources mobilization from the nature other sector "new N"

SC: Change in stock

NNB: Loss from unit processes

	Product	Process			
		anima eat&dairy	cropping	Breeding proces	
prod	crop prod		10.00	30.00	
	Animal prod		10.00	-	
	meat and dairy		2.00	-	
process	cropping	100.00			
	breeding		35.00		
	processing			14.50	
Resource	Change in stock		100.00	-	
	Waste generation		0.00	-	
			-22.00	-15.00	
	Total	100.00	35.00	14.50	
			100.00	35.00	
				14.50	
					12.50
					45.00
					0.00
					-42.50

N use performance indicators

Stage-NUE

$$NUE_i = \frac{PROD_i + SC_i}{INP'_i + RES_i}$$

Life-cycle-NUE

$$RES^* = RES \cdot (PROD - INP + \widehat{SC})^{-1} \\ = RES \cdot A^{-1}$$

$$Life_cycle_NUE = 1/RES^*_{processing}$$

Life-cycle Net
nitrogen balance

$$Life - cycle - NNB_i = \frac{\sum NNB_i \times AF_i}{A_i}$$

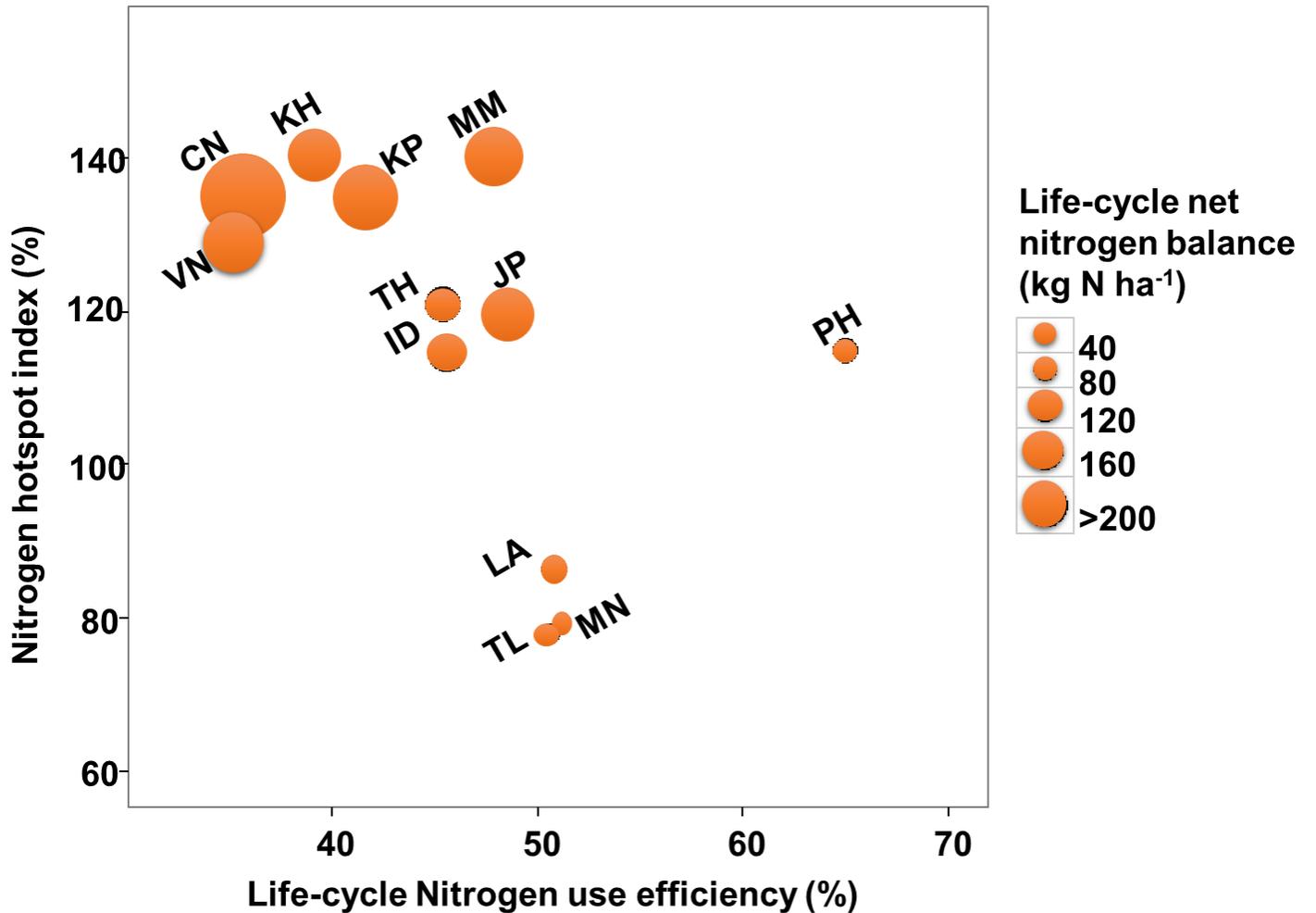
Nitrogen hotspot
index

$$NHI_i = \frac{\sigma_{(NNBi)}}{\mu_{(NNBi)}} \times 100$$

Backyard pig supply chains



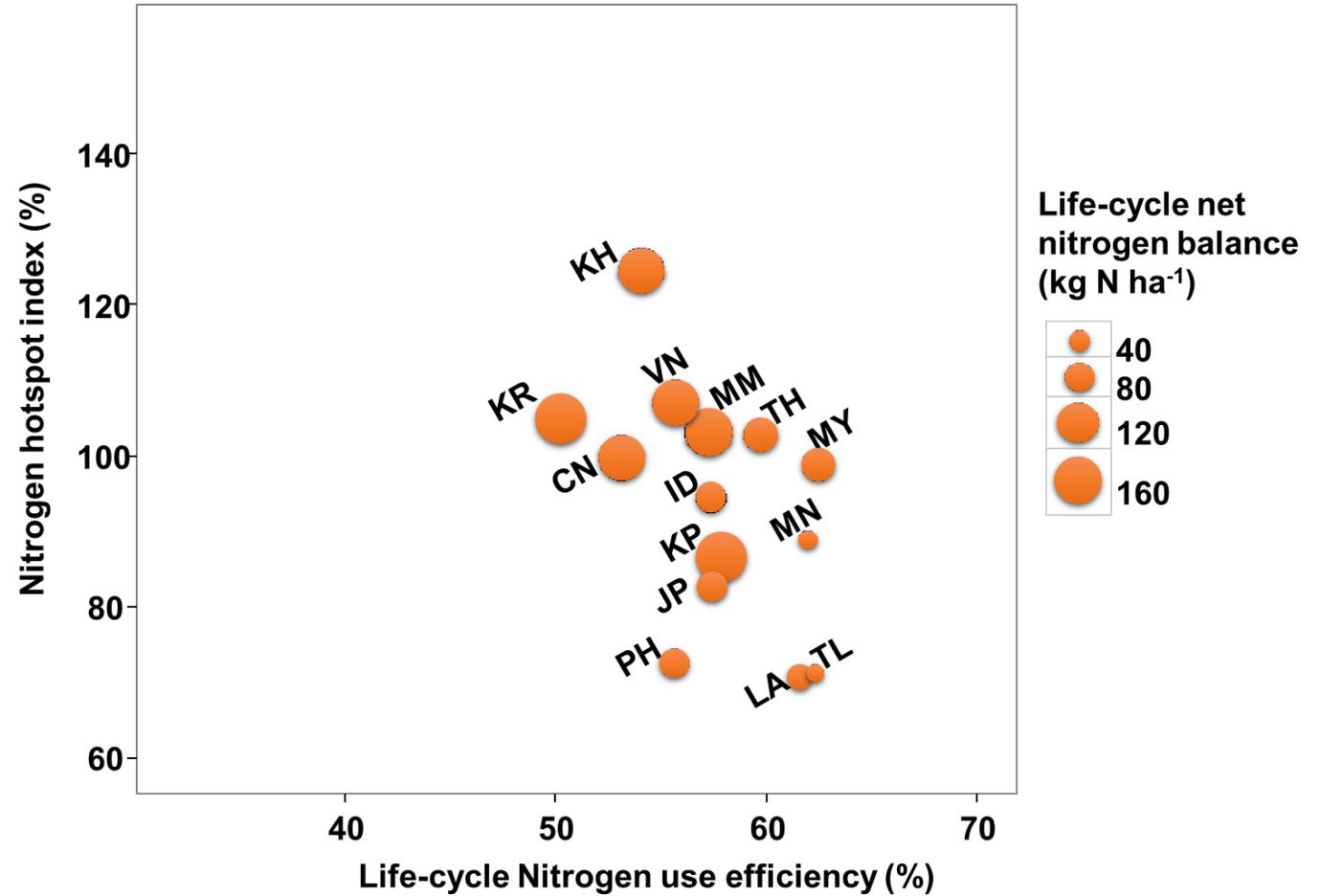
- 56% of total pig population
- Scavenging and swill from households.
- Poor MMS
- Livelihoods and food security



Intermediate Pig supply chains



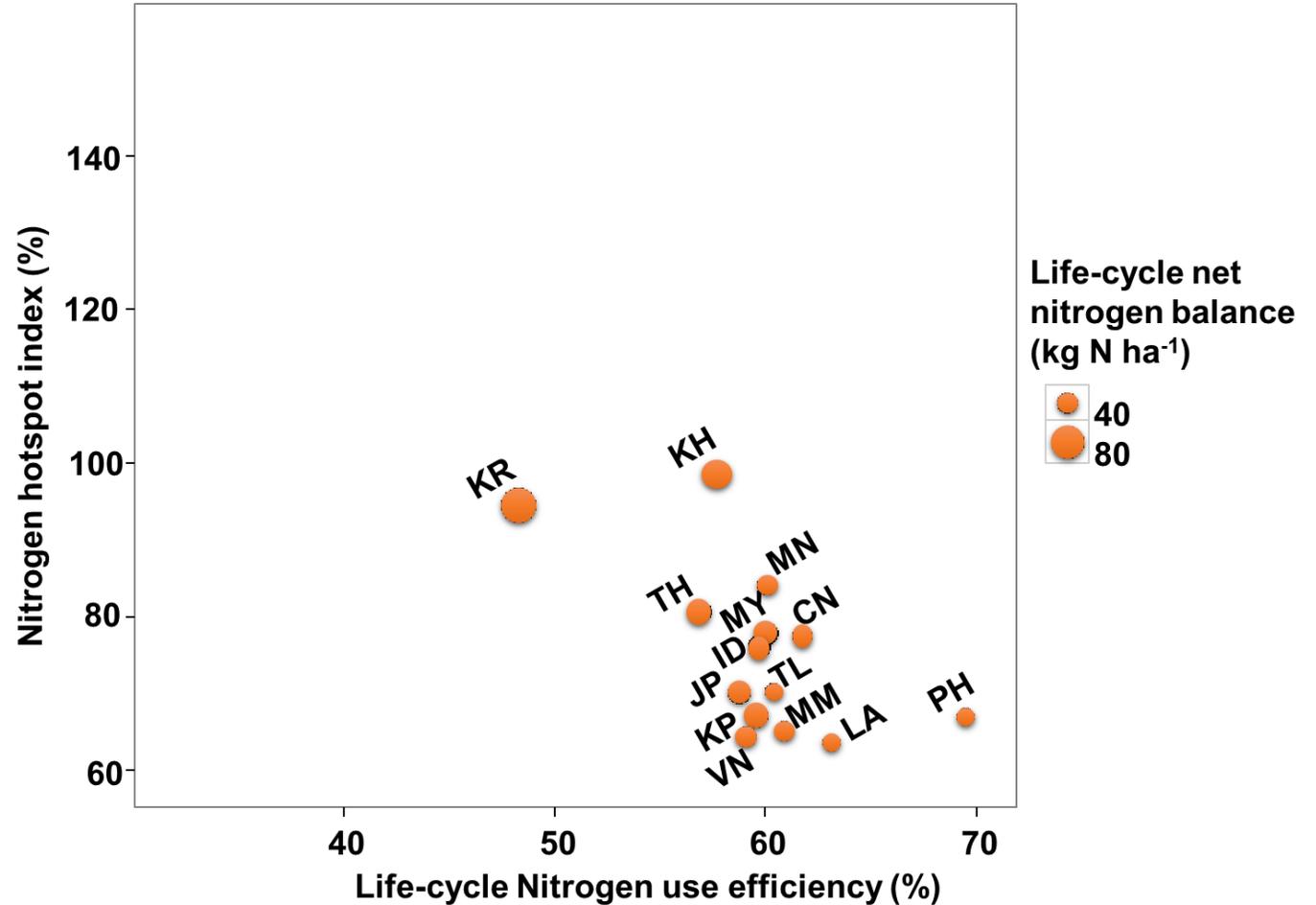
- 24% of total pig population
- Imported feed and swill from households.
- Poor MMS
- Market oriented



Industrial Pig supply chains



- 20% of total pig population
- Imported feed.
- Confined
- Developed MMS
- Market oriented (export)



Take home message

- Manure management system, production inefficiencies, and animal health are relatively the drivers of poor N use performance indicators in backyard and intermediate supply chains;
- Export of manure to no-feed crop may relatively increase the efficiency of industrial pig supply chains as the subsequent losses are not allocated to the animal production;
- Combination of three indicators, “NUE”, “NHI”, “NNB” can facilitate the design of smart improvement interventions of N use management
- Large potential improvements in N management at the crop production and manure management stage;

Contact

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