

# Food safety from a global perspective to a country perspective addressing challenges along smallholder pig systems in Vietnam

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Australian Government  
Australian Centre for  
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# Outline

- Global health from a food safety perspective
  - Trends over time and by region
- Food safety in Vietnam
- ILRI work along the pig/pork value chain in Vietnam
- Search for feasible interventions

# Health constraints and causes in developing and developed countries

## Measured as DALY (Disability Adjusted Life Years)

- Quantifying the burden of disease from mortality and morbidity
  - Expressed in health statistics as the number of years lost due to ill-health, disability and early death
- or
- one lost year of healthy life

# Leading causes of DALY in developed countries

1990	2013
Ischemic heart disease	Ischemic heart disease
Stroke	Stroke
Back and neck	Back and neck
Road injury	Lung cancer
Lung cancer	Depression (MDD)
Depression (MDD)	COPD
COPD (Chronic obstructive pulmonary d.)	Diabetes
Self harm	Sense related diseases
Other musculoskeletal diseases	Self harm
Diabetes	Falls

Source: IHME, 2016. <http://vizhub.healthdata.org/gbd-compare/>

Modified from Haessler

# Health constraints and causes in developed countries

## Only minor changes over 23 years:

- Cardiovascular including stroke diseases on top (16%\*)
- Minor role of infectious diseases (HIV 0.52%\*) including **diarrhoeal diseases** (0.12%\*)

## Risk factors for leading diseases:

- Lifestyle and dietary issues

# Leading causes of DALY in developing countries

1990	2013
Lower respiratory infections	Ischaemic heart disease (IHD)
Diarrhoeal diseases	Lower respiratory infections
Neonatal pre-term complications	Stroke
COPD	Back and neck
Malaria	Diarrhea diseases (3.5%*)(8.7%**)
Stroke	Neonatal pre-term complications
Protein energy malnutrition	HIV
TB	Road accidents
Neonatal encephalopathy	Malaria
Ischaemic heart disease	TB

\*Percentage of total DALYs

# Health constraints and causes in developing and developed countries

## **Some changes over 23 years others remain unchanged:**

- Cardiovascular diseases has come up as the leading cause (1990 no. 10)
- No. 2 still: respiratory infections (often preventable by vaccine)
- Infectious diseases still a major cause
- **Diarrhoeal diseases still among first 5**

## **Risk factors for diarrhoeal diseases:**

- Poor sanitation, poor food safety standards

# Leading causes of DALY in central sub-Saharan Africa

1990	2013
Malaria (13%*)	Lower respiratory infections (11%*)
Lower respiratory infections (12%*)	Diarrhoeal diseases (11%*)(15%**)
Diarrhoeal diseases (11%*)(14%**)	Malaria
Malnutrition	Malnutrition
Neonatal pre-term complications	HIV

## Almost no change over 23 years:

Lower reparatory infections and infectious diseases the major cause

**Diarrheal disease** and malnutrition **unchanged but still highly ranked**

\*Percentage of total DALYs

\*\*< 5 years



# Leading causes of DALY in Vietnam & Laos

Vietnam 1990	2013
War	Stroke
Pre-term birth complication	Road accidents (6.1%*)
Stroke	Back and neck
Measles	Sense organ diseases
Drowning	Lower respiratory infections

Laos 1990	2013
Diarrhoeal diseases	Lower respiratory infections
Lower respiratory infections	Preterm birth complication
Pre-term birth complication	IHD
Measles	Stroke
Tetanus	Diarrhoeal diseases

\*Percentage of total DALYs

## Considerable changes over 23 years:

- Cardiovascular and/or stroke but also road injuries (Vietnam) jumped up
- **Diarrhoeal disease**, depends on country

# Health constraints and causes in developing and developed countries

- Clear differences between developed and developing countries
- Cardiovascular related diseases main cause in developed countries
- Infectious diseases **including diarrhoeal diseases still a major problem in developing countries** with regional and country differences

# Food safety – global perspective

## WHO report: Global estimates of foodborne diseases

- First ever estimates of the global burden of foodborne diseases
- For the global estimates, 31 foodborne hazards causing 32 diseases were included, being diarrhoeal disease agents, invasive infectious disease agents, helminths and chemicals
- Estimated global burden of foodborne disease by these 31 hazards was 33 million DALYs in 2010

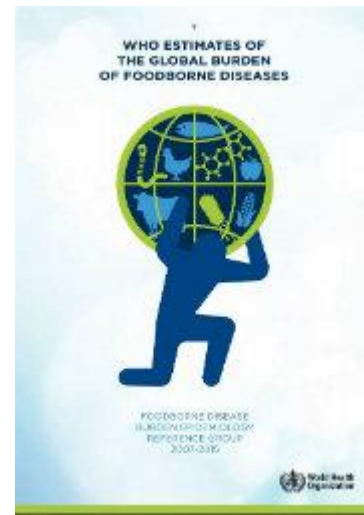
# Food safety – global perspective

- Demonstrated that **almost 1 in 10 people fall ill every year from eating contaminated food** and **420,000 die** as a result
- **Children under 5 years** of age from low-income countries are at particularly high risk
- **Highest burden** observed for **Africa** (East and Central) followed by Southeast Asian region

# Food safety – global perspective

- **Diarrhoeal diseases** responsible for more than **half of the global burden of foodborne diseases**, with 230,000 deaths every year.
- **Major causes** of diarrhoea: norovirus, *Campylobacter*, non-typhoidal *Salmonella* and pathogenic *E. coli*.
- **Others causes of foodborne disease** related to *Salmonella typhi*, *Taenia solium*, hepatitis A virus and aflatoxins.

[http://www.who.int/foodsafety/publications/foodborne\\_disease/fergreport/en/](http://www.who.int/foodsafety/publications/foodborne_disease/fergreport/en/)



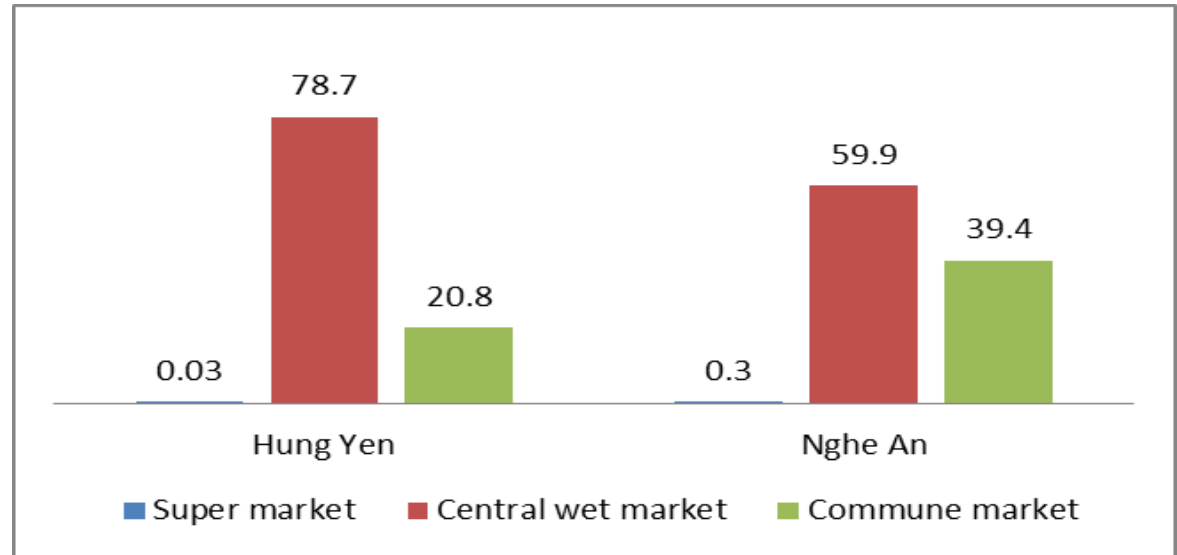
# Food safety – Vietnam

- Limited number of food safety studies
  - Focus on assessment of hazards and often focusing on slaughter process
- Lack of
  - Value chain approach
  - Investigating the related risk for consumers, impact and intervention studies
- Risky consumption habits are common
  - Raw pork sausage, blood pudding, common in slaughterhouse workers
- Increasing consumer concerns on animal diseases and food safety
  - Disease in pigs, hormones, antibiotics and grow promoters and slaughter hygiene

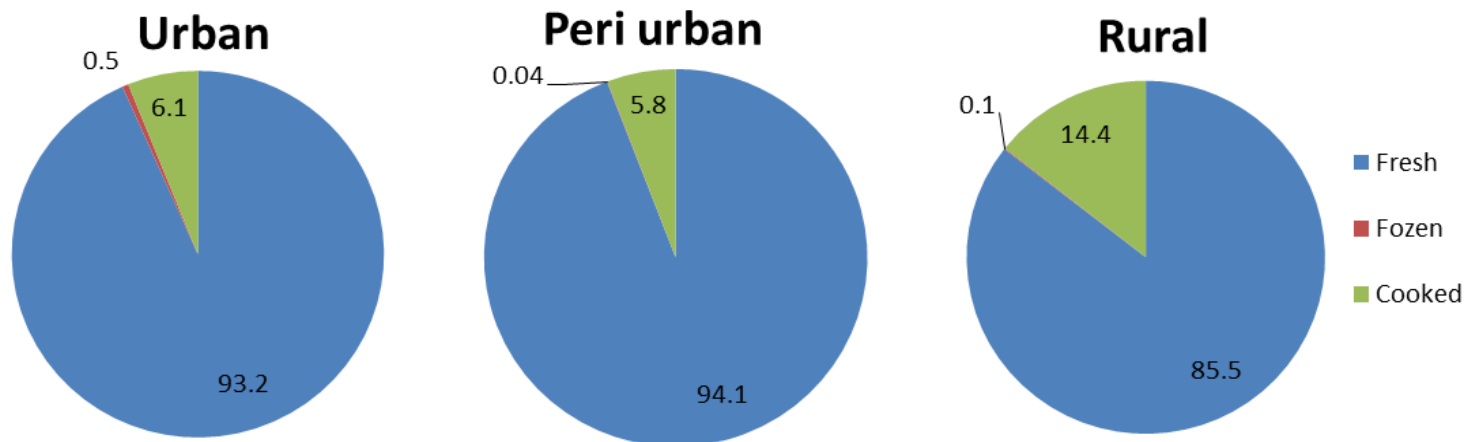
# Food safety Vietnam

## Consumer preferences for purchasing pork

*Pork purchasing sources*



*Proportion of purchased pork types by consumer groups*



# Food safety – Vietnam

## Legal framework

- Various ministries involved, MoH (VFA), MoA (Nafiqad)
  - New single institutional body needed?
- Food safety law from 2010, currently revised, 2016 amendment expected
- Enforcement limited
  - Mainly based on importer demands
  - Very limited or absence in small-scale sector



# Food safety Vietnam

- Majority of pork distributed through informal market chains
  - traditional processing, and retail practices (e.g. wet markets, temporally and/or permanent)
  - escape effective health and safety regulation (lack of regular inspection)
  - affordable, accessible, addressing local demands (e.g. fresh pork, meat pie, blood pudding)
- Approximately 30,000 small-scale pig slaughter units
  - Implementation of existing food safety law a challenge
  - Regular inspections (if any) focus on medium to large scale slaughterhouses

# Background - pigs in Vietnam

- Pork is an **important component** of the Vietnamese diet
  - More than 70% of consumed meat is pork
  - More than 80% supplied by small scale sector
  - Preference for chilled pork provided by traditional market chains (90%)
- **Strong dominance of smallholders in pig production**, significant contribution to household income

# Background - pigs in Vietnam

- Various challenges to increase production of smallholders from an animal health perspective
  - Limited biosecurity, poor on-farm hygiene
  - Poor reproductive management
  - Very limited resources of farmers to change
  - Pig diseases are common, wide range of notifiable diseases are endemic
  - Vaccines available but efficacy often not clear
  - Limited surveillance and response capacity
  - Pig vets rather used by large-scale sector

# Food safety issues along the pork value chain

## Pork-related foodborne hazards

### Parasitic

- Cysticercosis
- Trichinellosis
- Toxoplasmosis

### Bacterial e.g.

- *Bacillus cereus*
- *Brucella suis*
- *Campylobacter* spp.
- *Salmonella* spp.
- *Streptococcus suis*
- *Shiga toxin producing E. coli*
- *Yersinia enterocolitica*

### Chemical

- Antibiotic residues
- Aflatoxins
- Steroids/growth promoters
- Heavy metals



- Trichinellosis
- Cysticercosis

- *Salmonella* spp.
- *Streptococcus suis*
- Antibiotic residues
- Growth promoters



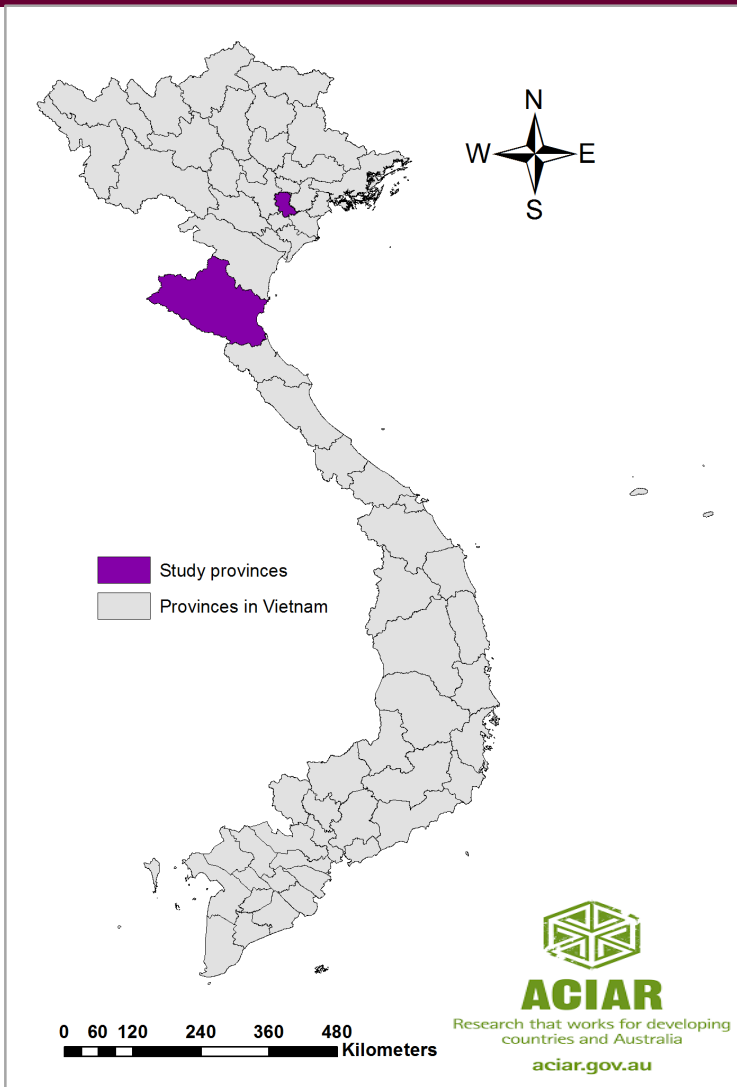
Source: PigRISK Project proposal

# *ILRI food safety research related pig systems in Vietnam*

## - an overview

- **Pig risk project (2012–17)**
  - ACIAR-funded
- Cross-CGIAR Research Program (2014–15)
  - Scoping study to evaluate the potential of indigenous pig systems**
- Lab diagnostic review (related to pork)
- Evaluation of large scale interventions related to food safety along the pork value chain (LIFSAP)

# PigRISK project (2012–17)



*To assess impacts of pork-borne diseases on human health and the livestock and identify control points for risk management.*

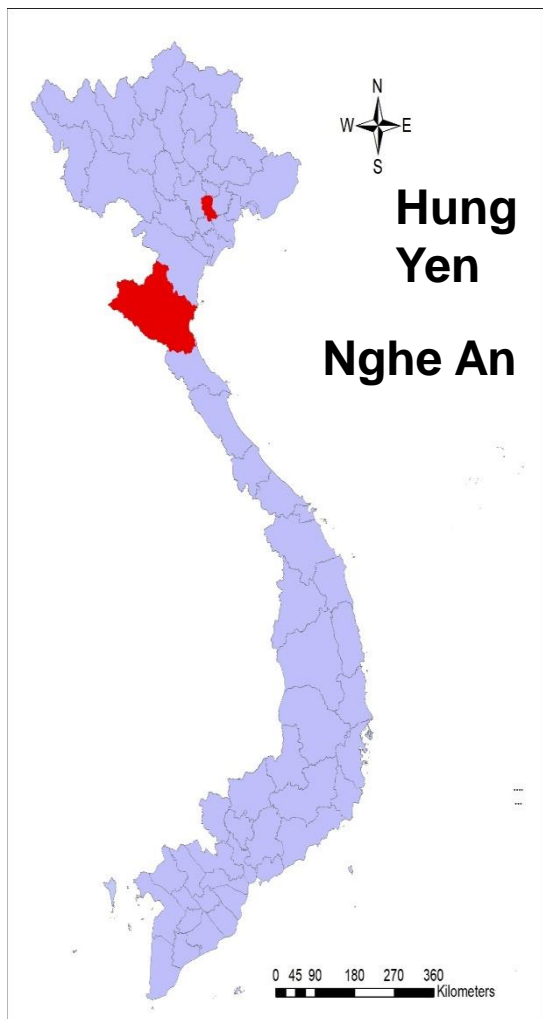
## **Key components:**

Assessment (qualitative/quantitative risk assessments) and intervention

## **Integrated approach**

- Interdisciplinary team: vets, public health, economics, animal science, modeller
- Data collected along entire pork value chain

# Study sites – PigRisk



Provinces

Hung Yen

Nghe An

Districts

R-R

R-U

P-U

R-R

R-U

P-U

Khoai Chau

Van Giang

Tien Lu

Do Luong

Dien Chau

Hung Nguyen

Communes

Nhuê Dương  
Đại Hưng  
Bình Kiều

Nghĩa Trụ  
Tân Tiến  
Thắng Lợi

Đức Thắng  
Minh Phượng  
Thủ Sỹ

Thượng Sơn  
Đà Sơn  
Lam Sơn

Diễn Lâm  
Diễn Nguyên  
Diễn Kim

Hưng Đạo  
Hưng Phúc  
Hưng Thông

R: Rural

P: Peri – urban

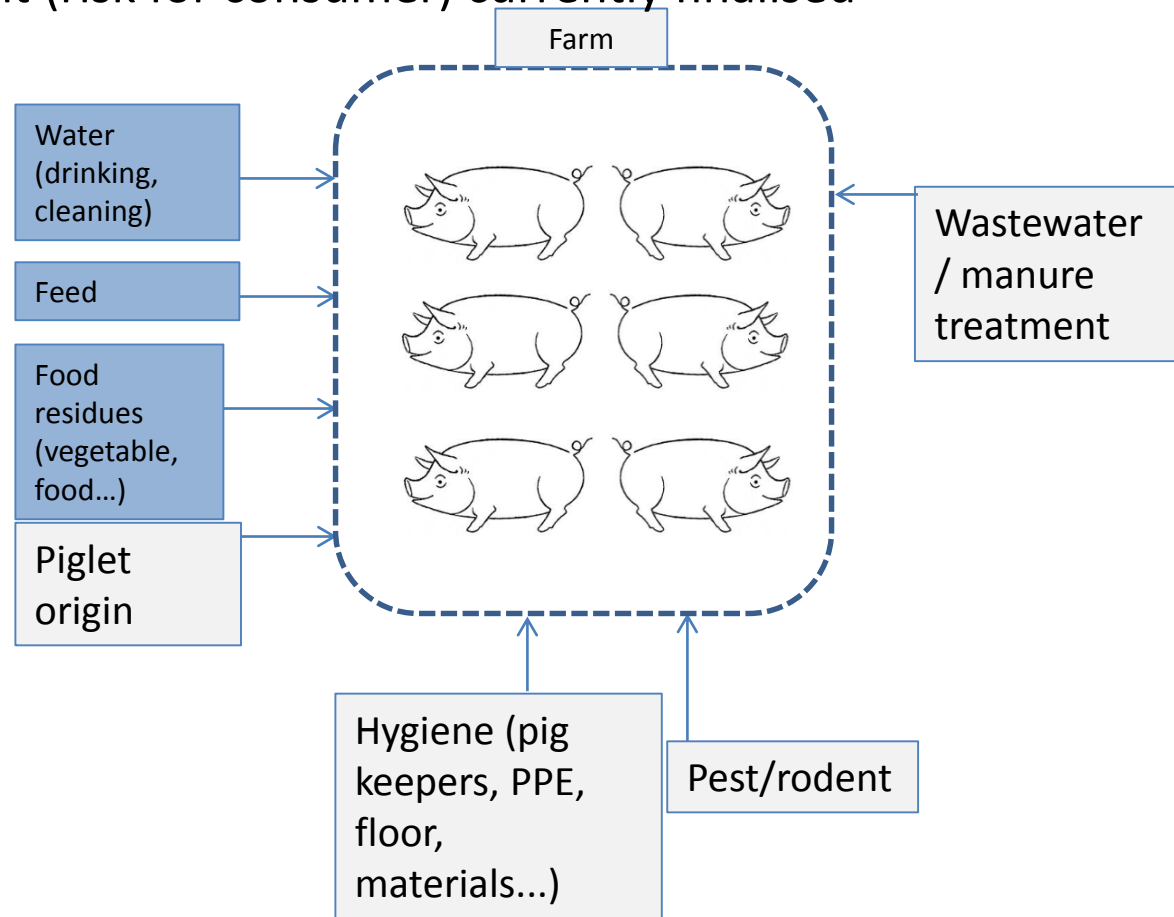
U: Urban

# PigRisk: Selected results

## Food safety

### Risk assessment (RA):

- *Salmonella* risk pathways developed for producers, slaughterhouse and consumers
- Quantitative risk assessment (risk for consumer) currently finalised





# PigRisk: Selected key results on food safety

## Sampling for biological hazards (*Salmonella* spp.)

- Overall **1275 samples** (farm, slaughterhouse, market) over 12 months
  - Increasing prevalence along chain – final product, **meat for sell: 45%**
- Quantitative risk assessment completed
- Systems dynamic model (potential interventions ex-ante evaluated) completed

## *Streptococcus suis* in slaughter pigs (N=147):

- Presence of *S. suis* type 2
- Potential risky behaviour 'Tiet canh'
- common in slaughterhouse workers (43%)

## Chemical hazards

- **Presence of banned substances** (e.g. chloramphenicol and the growth promoter salbutamol in pig feed and sold pork)

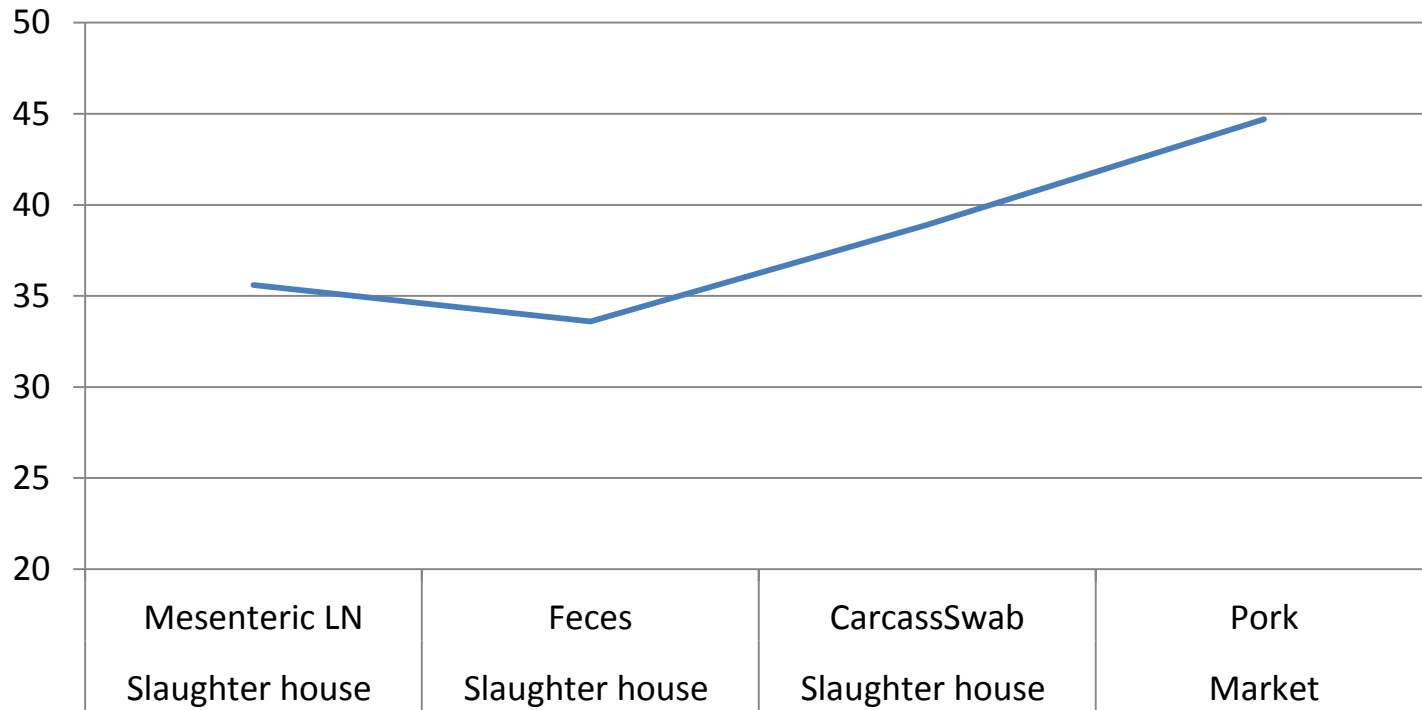


# PigRisk - Results of microbial analysis

Actor	Sample type	Pos/Total	Prev (%)
Producer	Drink-FA	14/72	19.4
Producer	FloSwab-FA	26/72	36.1
Producer	WasteW-FA	28/72	38.9
Slaughterhouse	CarcassSwab	58/149	38.9
Slaughterhouse	Feces	50/149	33.6
Slaughterhouse	Mesenteric LN	53/149	35.6
Slaughterhouse	SwabFlo-SH	11/49	22.4
Slaughterhouse	Water-SH	10/49	20.4
Market	Pork	97/217	44.7
Market	Pork-Gr	33/80	41.3
Market	CutSwab	55/217	25.3
Market	Overall	435/1275	34.1

# PigRisk - Results of microbial analysis

*Salmonella* prevalence



# Selected risk factors for *Salmonella* contamination

## Slaughterhouse

- Urban and peri-urban versus rural
- Hot season versus cold season
- Using of hot water kettle for scalding versus open hot water basin
- Not washing floor after each pig
- Hand, knife freely washed in open water tank
- Floor slaughter versus elevated

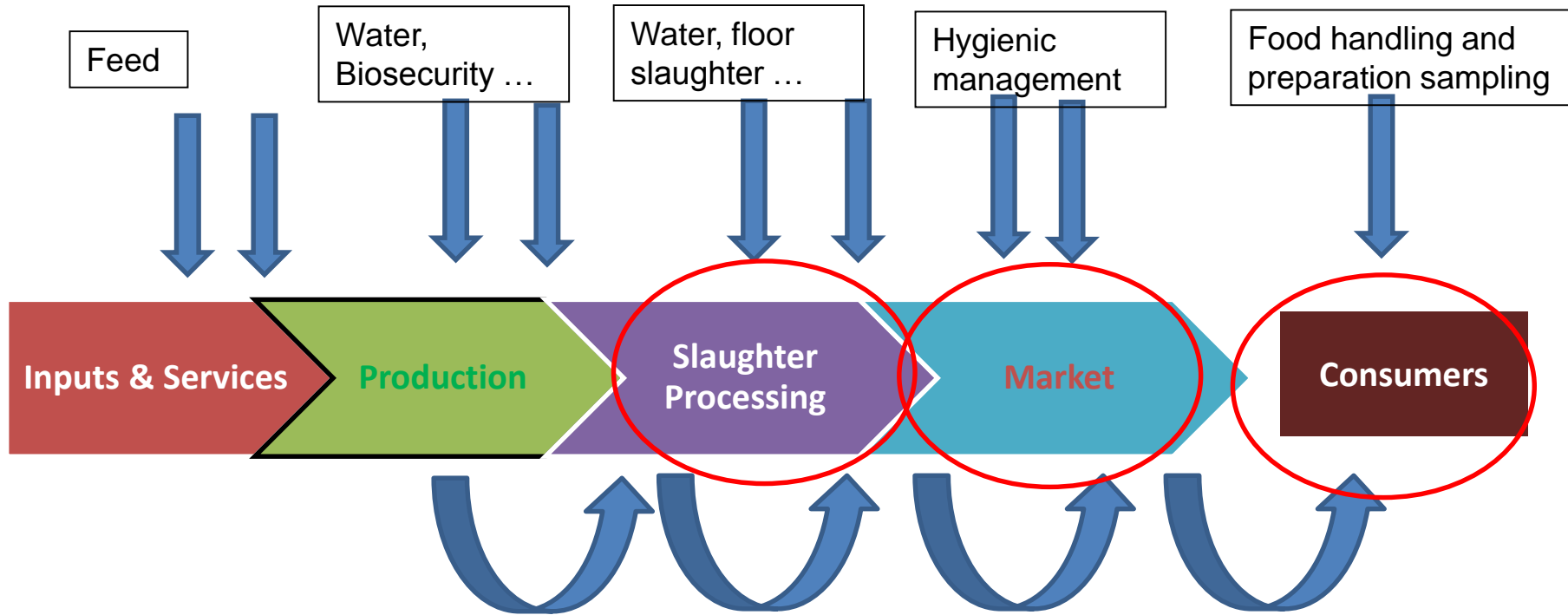


## Market

- Hot season versus cold season
- Wipe hand on cloth using for wipe pork/equipment
- Shop is next to the sewerage or presence of stagnant water

# Pig Risk - Best bet selection – Value chain approach

Placed at specific actor along value chain based on RA results



From farm to fork



Randomized control trials: Pilot and RCT Feb 2016 onwards

# Intervention development

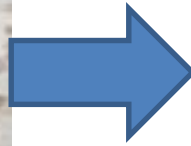
## **Consideration:**

- Based on evidence
- Investment cost
- Feasibility/compliance
- Effect on specific actor or entire chain
- Effect can be measured
- LIFSAP experience (USD 80 million World Bank)
- Adoption rate and time and after 6 months
- Systems dynamic model used to test effect of intervention
- Incentives (cash, social recognition)

## **Challenges:**

- Lack of enforcement of regulations
- Behaviour change required
- What are the incentives to change current practice
- No prime price for 'safer' pork

## Intervention development: Pig slaughterhouse



Investment USD 700 – 800

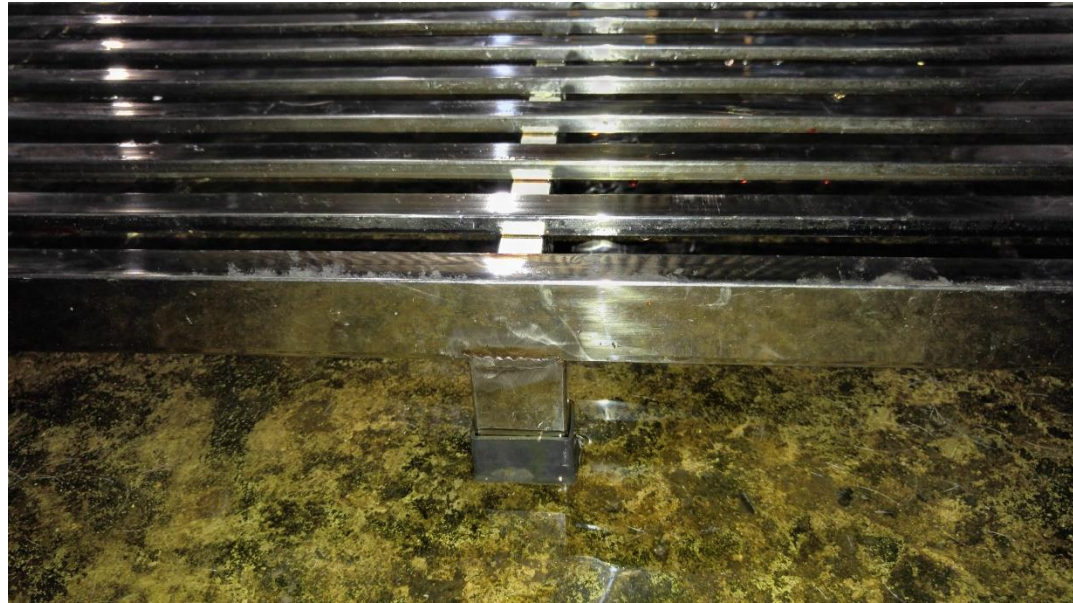
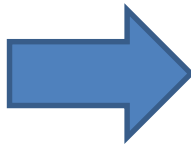
Source: Sinh, Handlos and Unger (2014)

## Intervention development: Pig slaughterhouse



Pilot trial to practical test:

- LIFSAP table not accepted by workers as too high to handle a pig alone





## Intervention development: Pig slaughterhouse



Grit has to have sufficient size to allow to handle 2 pigs and adapted to the existing slaughterhouse structure

Investment USD 400



Source: Unger (2015)

## Intervention development: Pig slaughterhouse



Source: Unger (2015)

**Pig slaughterhouse: challenges observed  
Behaviour/practice change is needed**



Source: Unger (2016)

## Market – challenges



Source: Unger (2016)

## Market – trader



# Interventions – final reflections

## **We aim for:**

- Feasible interventions towards ‘more hygienic’ pork with intervention at slaughterhouse, markets, and consumers
- Means not hazard free; possible develop a store brand

## Slaughterhouse:

- Avoid floor slaughter (implemented and scientific evidence)
- Water source (planned)
- Dirty versus clean zone (greatest challenge)

## Market:

- Avoid use of towel to dry pork (planned)
- Storage place for knife with cleaning/disinfection (planned)
- Reduce number of flies

## Consumer:

- Meat auction survey (what do they relate to safe pork)(planned)
- Test of dissemination options (poster, video, flyer, photos)(planned)

# Scoping study on indigenous pig systems (2014–15) Central Highlands of Vietnam



Source: Unger, 2015

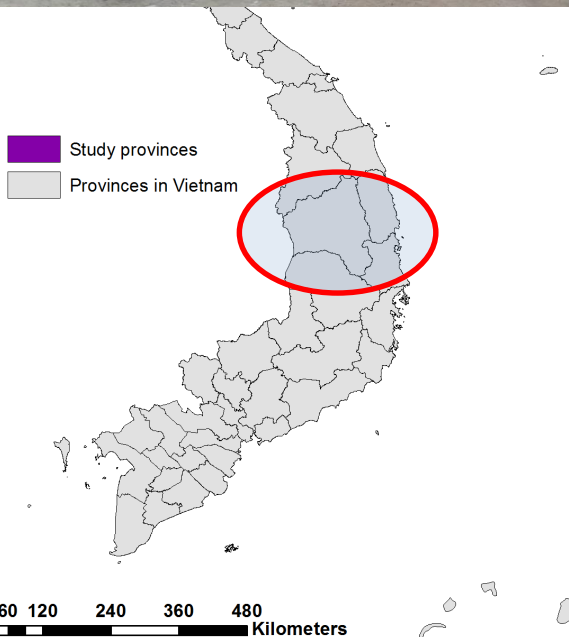
# Scoping study on indigenous pig systems (2014–15)



Scoping study to evaluate the **potential of integrated indigenous pig systems** to improve livelihoods and safe pork consumption for **poor ethnic minority** smallholders in the **Central Highlands** of Vietnam.

## Integrated focus

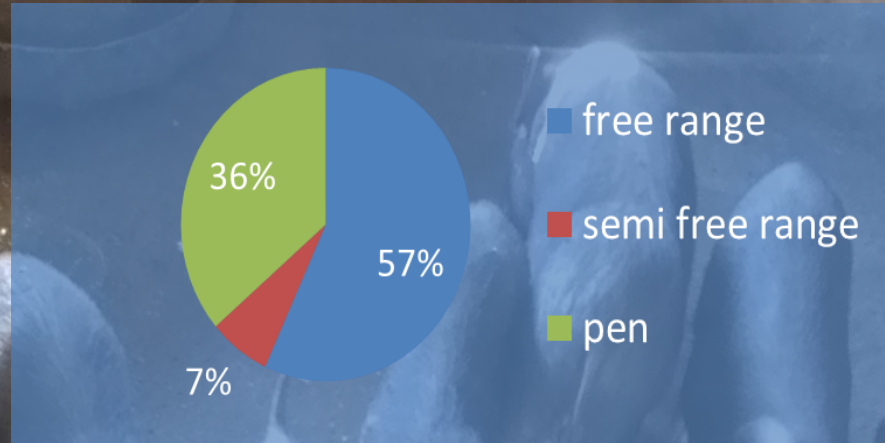
- Components:
  - Market access/opportunity study
  - Value chain study
  - Breeding component
  - Gender study
  - Food safety
- Economist, vets, public health, breeding, crop/livestock system experts



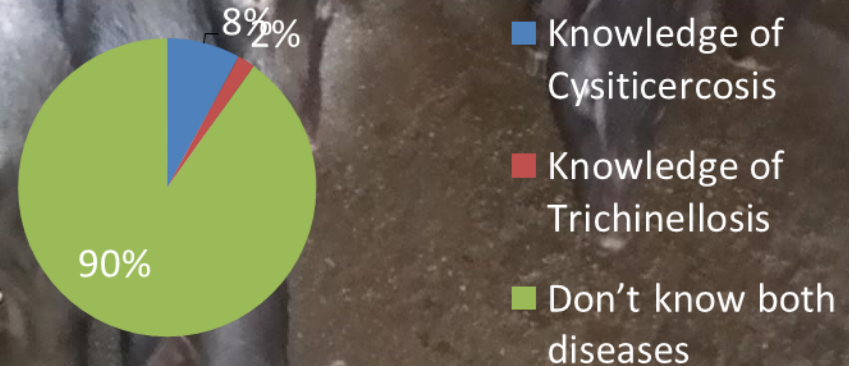


# Central Highlands native pig study

## Free range versus pen use, among HH with indigenous pigs (N=262)



## Knowledge of targeted zoonotic parasitoses (N=262)



Among those 10% none of them aware about mode of transmission from pig to human

# Conclusions

- Food safety an important concern, in particular in developing countries (and highest in children under 5 years) but also for Vietnamese consumers
- Presence of various hazards along the pork chain shown in Vietnam but related risk and impact unclear
- Various challenges found in Vietnam (all levels including policy)
- Intervention development must consider feasibility questions but also requires a behaviour change of all involved actors
- Suitable incentives: greatest challenge is how to find in a resource-poor context

# Special thanks to:

Hanoi School of Public Health  
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MARD, DARD  
VC actors and groups

Scientific evidence (2015): 8 journal articles, 27 presentations at international fora

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