

**Risk based meat inspection**

**and**

**Integrated meat safety assurance**

**at abattoir level**

**Dragan Antic**

Veterinary Public Health

Dragan.Antic@liverpool.ac.uk

# Content

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- Definitions
  - Integrated meat safety assurance
  - Risk-based meat inspection
  - Do we need them?
- Proposed generic system – concepts and unanswered questions
- What next in the EU?
  - Ongoing work in RIBMINS Project
- Abattoir related strategies – group work
  - Exchange of ideas and experience
  - Knowledge gaps?

# Questions?

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- Discuss
  - Integrated meat safety assurance
  - Risk-based meat inspection
  - Why and whether current meat inspection require changes

# Current meat inspection

- **Fundamentals:**
  - developed in second half of 19<sup>th</sup> century;
  - practically unchanged since;
  - was risk-based then; but not today!
- **Current meat inspection's main elements:**
  - pre-slaughter phase:
    - food chain information (FCI);
    - *ante-mortem* examination of animals;
  - *post-mortem* examination of meat (visual, palpation, incision).
- **Goals:**
  1. to **protect public health** from meat-borne hazards, and
  2. to control both **animal health** and 3. **welfare**
- **The current EU legislation** on meat inspection states *risk-* and *food chain-based* approach, but it is presently largely under-developed

# Current EU meat inspection: the status

## Good performance:

### •*Ante-mortem*

- Animal health, welfare, identification
- Food chain information (FCI; underdeveloped)

### •*Post-mortem*

- Animal health hazards
- Animal welfare hazards
- Meat quality
- Classical zoonotic hazards (nowadays absent/rare or less important)

## Under- or no-performance:

### •*Ante-mortem*

- No animal risk categorisation
- Non-uniform analysis of FCI
- Difficult to examine individual animals

### •*Post-mortem*

- Hazards not causing visible signs/lesions are not detected
- Those include the most currently relevant biological hazards causing the majority of foodborne diseases
- Palpation/incision mediates cross-contamination with the most relevant bacterial hazards
- Most agents present in detected lesions (e.g. pneumonia agents, abscesses agents; some parasites, etc.) are not a health threat *via* the foodborne route
- Judgement of meat fitness for human consumption does not differentiate foodborne risk from other reasons

## Hazard identification: Non-meatborne hazards in common conditions at post-mortem inspection (pigs) (Nordic Council of Ministers, 2006; Alban *et al.* 2008)

Condition	Microbial agents involved
Acute pneumonia	<i>A. pleuropneumoniae</i> , <i>Mycoplasma</i>
Chronic pneumonia	<i>A. pleuropneumoniae</i> , <i>Past. multocida</i>
Acute pleuritis	<i>A. pleuropneumoniae</i> , <i>H. parasuis</i>
Chronic pleuritis	<i>A. pleuropneumoniae</i>
Abscesses	<i>Arcanobacterium pyogenes</i> , <i>S. aureus</i> , <i>Streptococcus</i> spp.
Atrophic rhinitis	<i>Bordetella bronchiseptica</i> , <i>Past. multocida</i>
Arthritis	<i>H. parasuis</i> , <i>Erysipelothrix</i> , <i>Strept. suis</i> , <i>Strept. spp.</i> , <i>S. aureus</i>
Osteomyelitis	<i>A. pyogenes</i> , <i>S. aureus</i> , <i>Strept. spp.</i>
Tail bite and infection	<i>A. pyogenes</i> , <i>S. aureus</i> , <i>Strept. spp.</i> (pyogenic), <i>Pseudomonas aeruginosa</i>
Peritonitis	<i>A. suis</i> , <i>A. pyogenes</i>
Pericarditis, endocarditis	<i>A. suis</i> , <i>Pasteurella</i> spp., <i>Strep. spp.</i> , <i>E. rhusiopathiae</i>
Hepatitis	Several, often secondary
Infected wound	<i>A. pyogenes</i> , <i>S. aureus</i> , <i>Strept. spp.</i> , <i>Pseudomonas aeruginosa</i>
Nephritis	<i>Strept. spp.</i> , <i>Erysipelothrix</i> , <i>A. pyogenes</i> , <i>S. aureus</i> , <i>Proteus</i> spp.
Caseous lymphadenitis	<i>M. avium</i> , <i>M. bovis</i> , <i>R. equi</i> , <i>Nocardia farcinica</i>

# **Hazard identification:** Meatborne human health hazards at current *post-mortem* inspection

## Not detected (examples):

*Salmonella enterica*

*Yersinia enterocolitica*

*Campylobacter* spp.

*Clostridium* spp.,

*Listeria monocytogenes*

VTEC

Antimicrobial resistance

HEV

*Sarcocystis suihominis*

*Toxoplasma gondii*

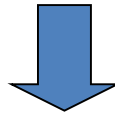
## Detected (examples):

*T. solium cysticercus* (low sensitivity)

*Trichinella* spp. (reliably)

# The need for modernization

- Inability of macroscopic meat inspection to detect and control “invisible” biological hazards most important for public health
- The impracticality of laboratory examination of those hazards in/on each carcass individually



- The need for a new effective overall control system:
  - risk-based, meat-chain orientated and comprehensive**
- Combine a range of preventative and control measures applied at both on farm and at the slaughterhouse levels in a integrated way
- It is more a “**meat safety assurance**” system than meat inspection



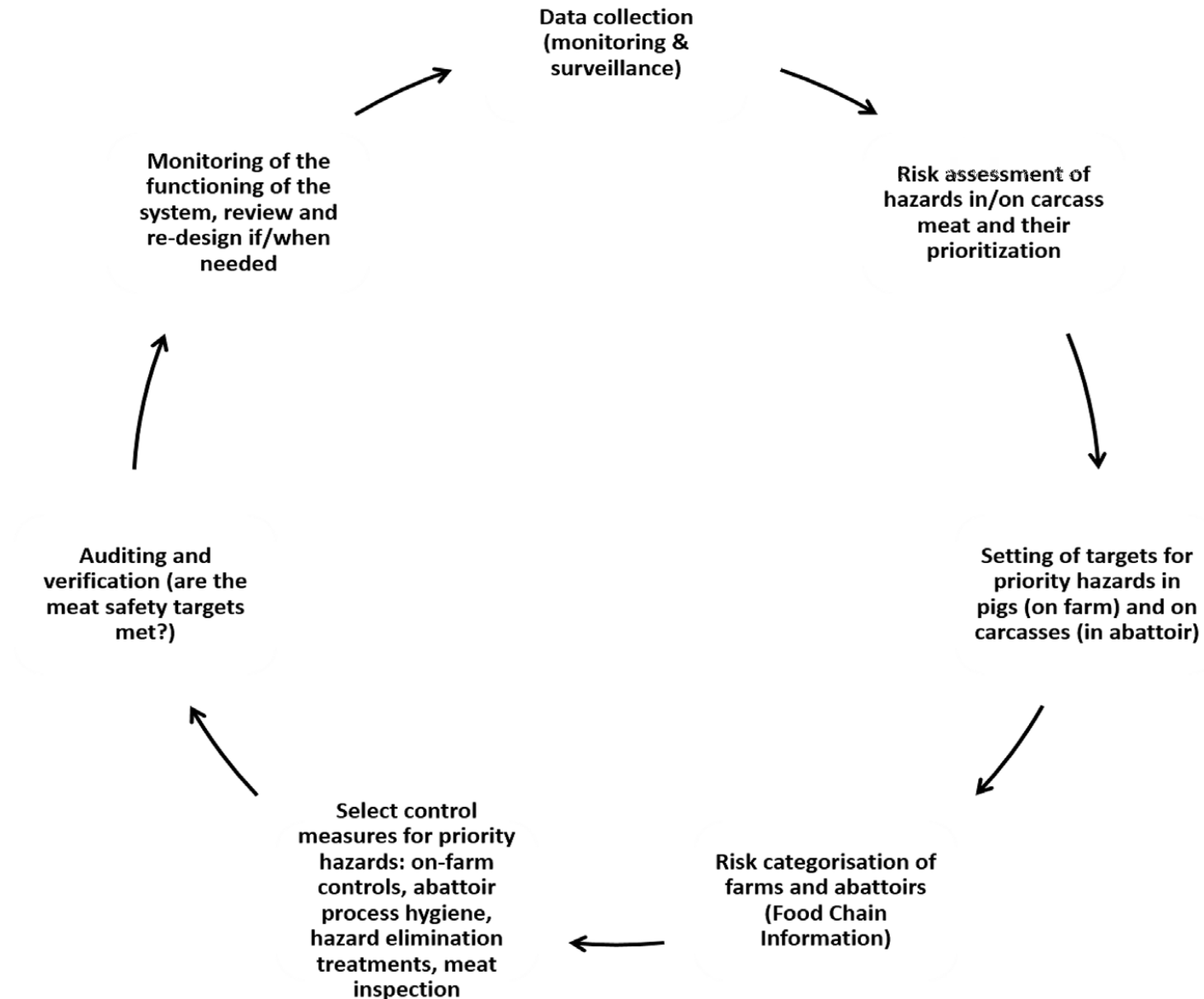
# EFSA's work on modernization of meat inspection

## Completed:

- Pig meat inspection (2011)
- Poultry meat inspection (2012)
- Bovine meat inspection (2013)
- Small ruminants meat inspection (2013)
- Solipeds meat inspection (2013)
- Farmed game meat inspection (wild boar, deer, reindeer, ratites, rabbits/hares) (2013)

# The philosophy of carcass (pig) meat safety assurance framework

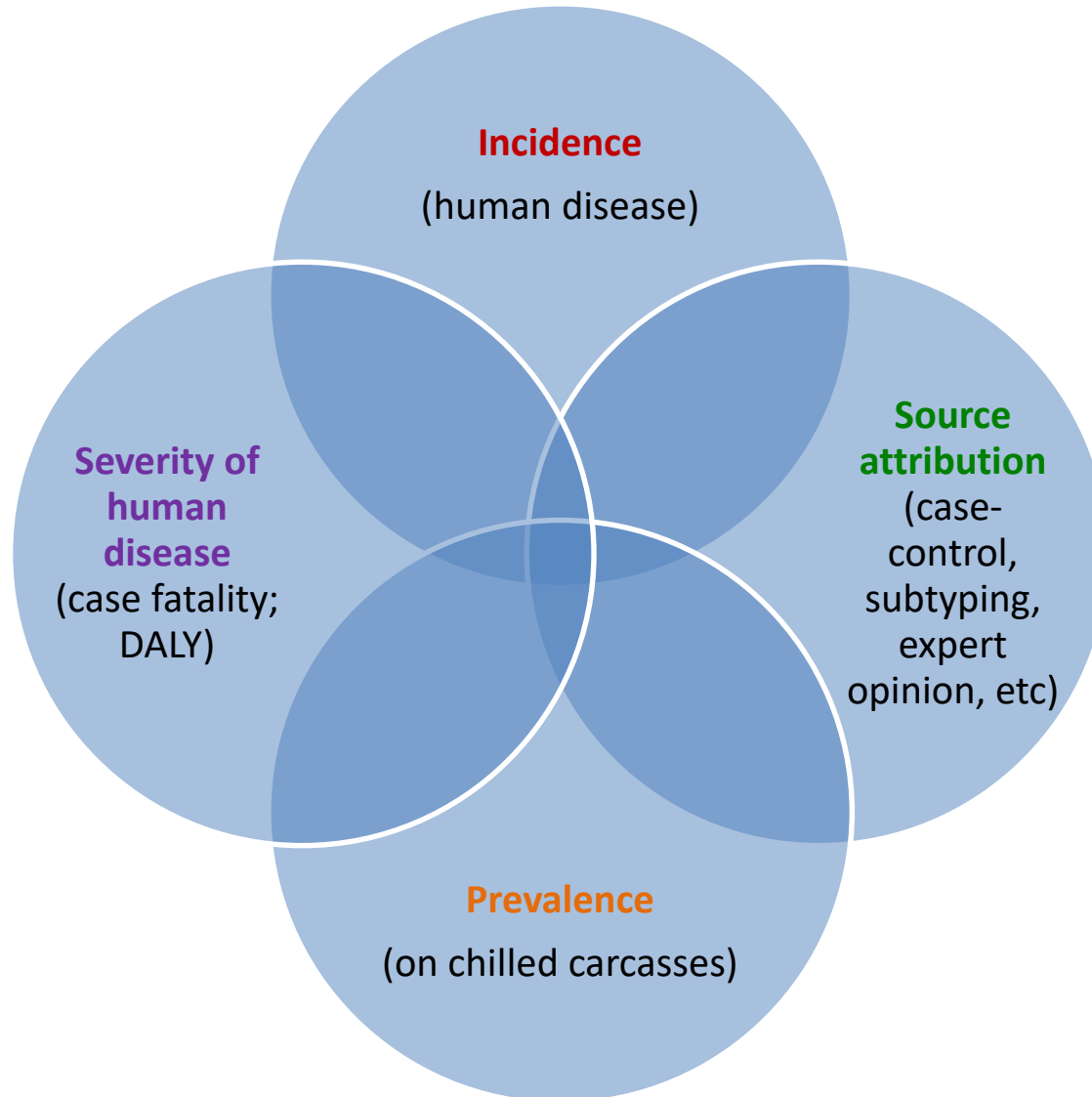
(Buncic, Alban, Blagojevic 2019)



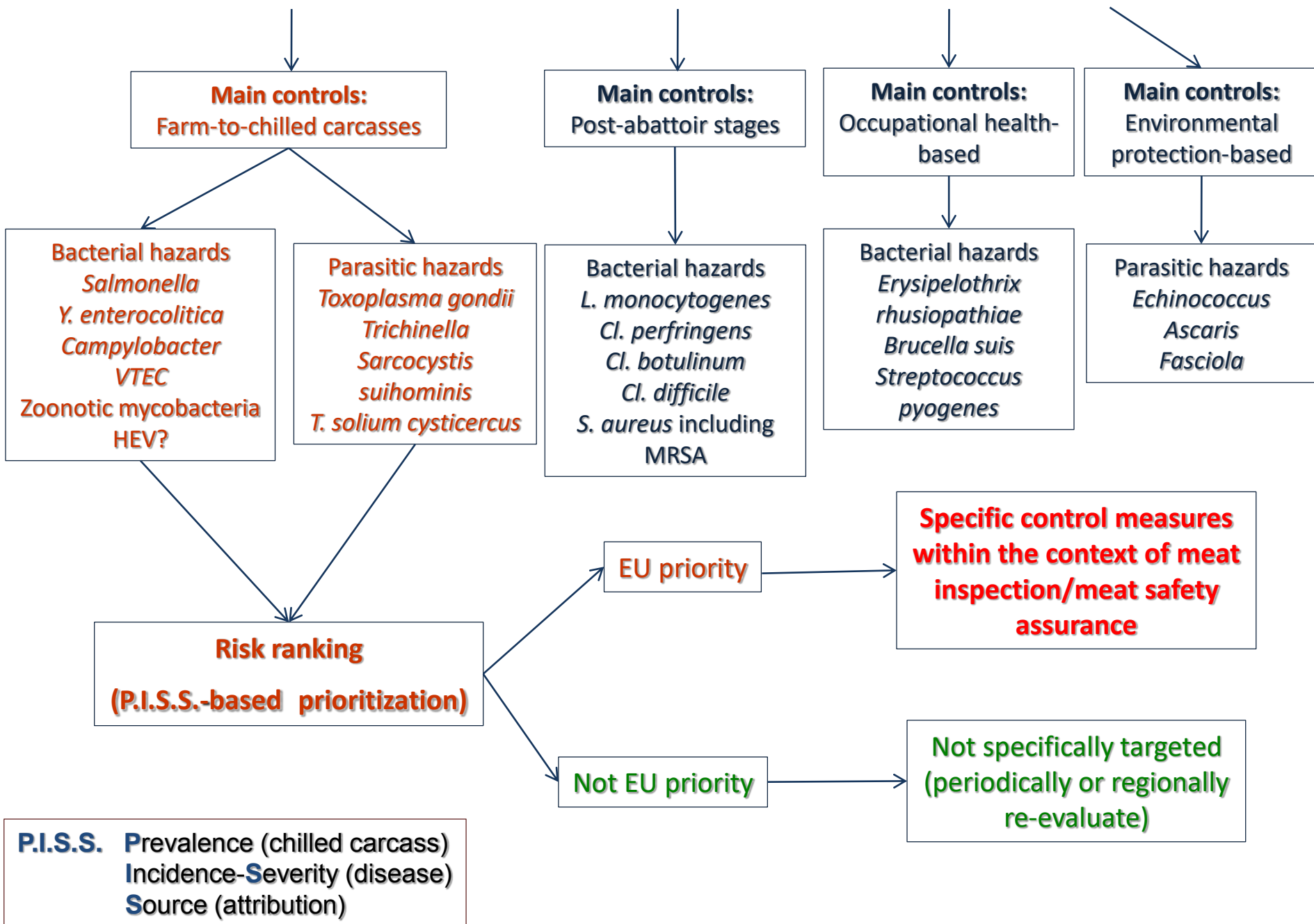
# Which hazards to target by risk-based meat inspection?

- **Assumption 1:** **Public health** is a priority goal of meat inspection, **animal health/welfare** hazards are important but secondary to public health
- **Assumption 2:** **Chilled carcass** is the main issue for meat inspection
- **Assumption 3:** Focus is on **priority hazards** (**meatborne**, most relevant in EU)
- **Choosing the priority target(s):** differentiation of hazards posing primarily foodborne risk based on relevant information e.g.:
  - Prevalence on chilled carcasses
  - Incidence and severity of foodborne human disease
  - Source attribution (% cases associated with particular meat)

# Main parameters for ranking (prioritization) of meatborne hazards



# Control strategies for biological hazards that may be present **in/on chilled carcasses**



# Ranking of meat-borne hazards in the context of meat inspection in the EU (EFSA, 2011, 2012, 2013)

Biological hazard	Bovines	Ovines/ Caprines	Porcines	Solipeds	Poultry
	Ranking of the hazards				
<i>Bacillus anthracis</i>	Low	Low	Low	Low	N/A
<b><i>Campylobacter spp.</i></b> (thermoph.)	Low	Low	Low	Low	<b>High</b>
<b>Human pathogenic STEC</b>	<b>High</b>	<b>High</b>	Low	Low	Low
<b>ESBL/AmpC <i>E. coli</i></b>	Low	Low	Low	Low	<b>Medium</b>
<b><i>Salmonella enterica</i></b>	<b>High</b>	Low	<b>High</b>	Low	<b>High</b>
ESBL/AmpC <i>S. enterica</i>	Low	Low	Low	Low	Low
<i>Sarcocystis hominis</i>	Low	N/A	N/A	N/A	N/A
<i>Sarcocystis suihominis</i>	N/A	N/A	Low	N/A	N/A
<i>Taenia saginata</i>	Low	N/A	N/A	N/A	N/A
<i>Taenia solium</i>	N/A	N/A	Low	N/A	N/A
<b><i>Toxoplasma gondii</i></b>	Undetermined	<b>High</b>	<b>Medium</b>	Undetermined	Low
<b><i>Yersinia enterocolitica/pseudotuberculosis</i></b>	Low	Low	<b>Medium</b>	Low	Low
<b><i>Trichinella</i></b>	N/A	N/A	<b>Medium</b>	<b>High</b>	N/A

# Carcass meat safety assurance framework

- A comprehensive, coordinated and risk-based carcass meat safety assurance system must incorporate several control strategies **into a coherent whole**
- This is possible only if:
  - there is a **risk manager** who coordinates the whole system,
  - all participants in the system clearly know their responsibility, and
  - there is an efficient **flow of all relevant information** forward and backward along the farm-to-chilled carcass chain between the participants

# Carcass meat safety assurance framework

- The **operators** hold ultimate responsibility for achieving meat safety targets (slaughterhouses) and animal-related targets (farms)
- The **regulator** holds responsibility for:
  - setting clear meat safety targets (which have to be achieved by the slaughterhouse) and animal-related targets (which have to be achieved by farms)
  - auditing the operators' systems
  - meat inspection based controls



# Carcass meat safety assurance framework

- The first prerequisite:
  - The main participants in the meat chain are given clear and measurable **targets** and/or related criteria indicating what they should achieve in respect to specified hazards
- Targets are set by regulators as prevalence/levels of the hazards in the food in question (to be met by operators)
- At present, considering 7 most important hazards:
  - **Salmonella** occurrence above stated value - unsatisfactory process hygiene (process hygiene microbiological criterion)
  - **Trichinella** presence – carcass unfit for human consumption

# Microbiological targets

- Meeting microbiological targets earlier in the food chain may be more effective in controlling such hazards
- The use of targets at different stages of production could lead to a decrease in the prevalence of certain pathogens along the food chain
- Specific requirements for certain pathogens (e.g. Salmonella) based on targets for the reduction of the prevalence of these agents in the food chain:
  - the targets consist of a numerical expression of the maximum percentage of epidemiological units remaining positive and (or) the minimum percentage of reduction in the number of epidemiological units remaining positive

# Microbiological targets

Setting and using such priority hazards' targets for chilled carcasses:

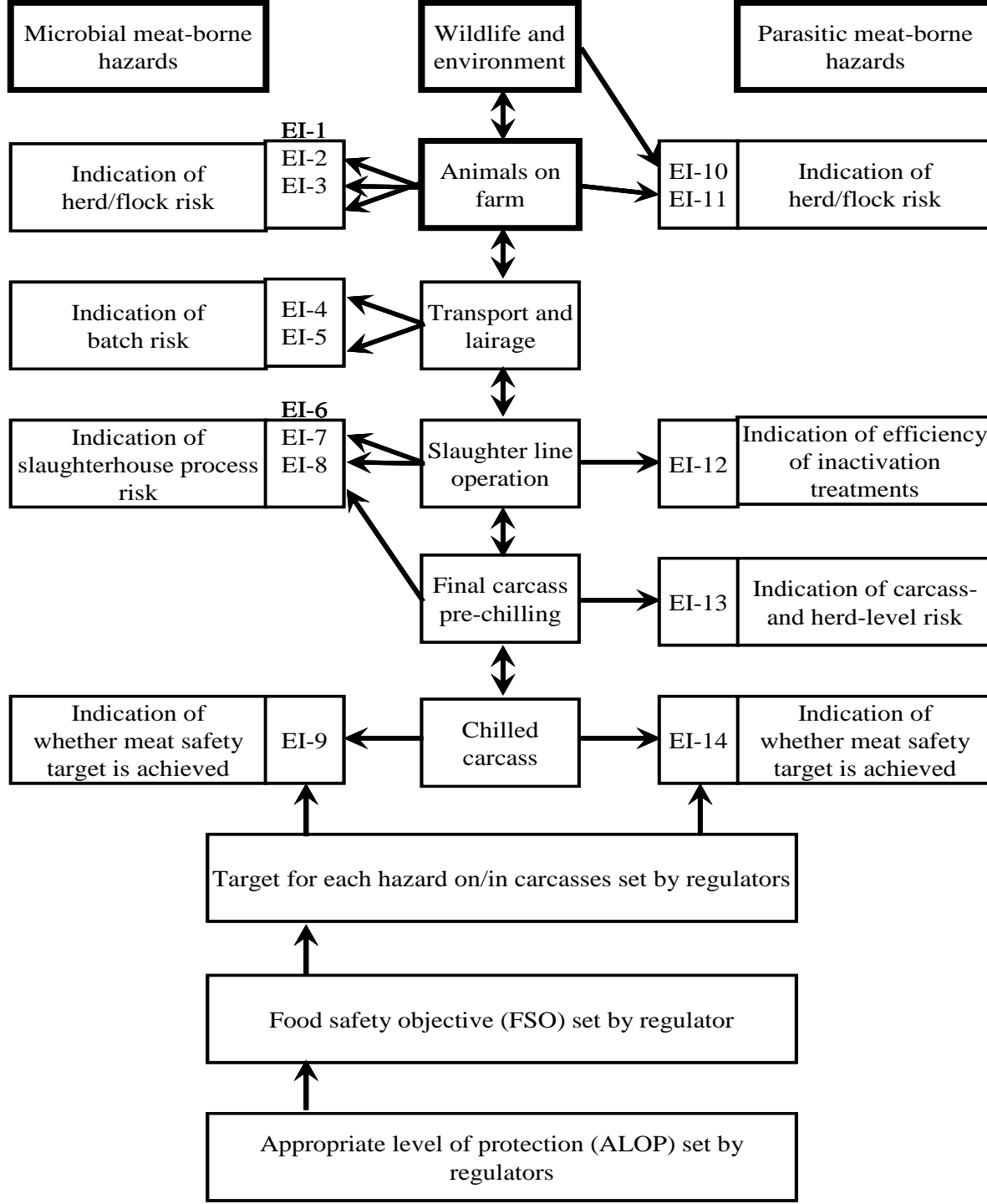
- provide a measurable and transparent focus for slaughterhouse's meat safety assurance system;
- information for human exposure assessment for those hazards
- differentiation between slaughterhouses producing end-product (carcasses) of “acceptable” and “unacceptable” status - **risk-categorisation** of **slaughterhouses**;
- basis for “backward”-generating of appropriate targets for farms delivering animals,
- differentiation between “acceptably” and “unacceptably” performing farms - **risk-categorisation** of **animals** for slaughter

# Principles of use of food chain information (FCI) including **Harmonised epidemiological indicators (HEI) for biological hazards**

- HEI - the **prevalence, concentration or incidence** of the hazard at a certain stage of the food chain that correlates to a human health risk caused by the hazard.
- Also, indirect HEIs of the hazards - **audits** of farms or **evaluation** of process hygiene
- Three types of data provided by these generic HEIs:
  - (1) data from structured and standardized **auditing** of farming and transport-lairage practices
  - (2) data from **microbiological/parasitological testing** of animals and carcasses (i.e. actual presence/absence of the hazards), and
  - (3) technical data from **validation/verification of regimes** used for antimicrobial and parasite-inactivation treatment of carcasses

# Descriptors of harmonized epidemiological indicators (HEI) in the risk-based carcass meat safety assurance

HEI of <b>microbial</b> meat-borne risks		HEI of <b>parasitic</b> meat-borne risks	
Descriptor	Purpose of EI	Descriptor	Purpose of EI
<b>EI-1:</b> Audit of animal purchase procedures	<b>Indication of herd/flock-related risk</b>	<b>EI-10:</b> Hazard monitoring in wildlife	<b>Indication of herd/flock-related risk</b>
<b>EI-2:</b> Audit of farming practices		<b>EI-11:</b> Audit of farming practices (e.g. housing)	
<b>EI-3:</b> Presence of hazard in faeces of animals on-farm		<b>EI-12:</b> Verification/audit of parasite-inactivation treatment parameters (e.g. temperature)	<b>Indication of slaughterhouse process hygiene-related risk</b>
<b>EI-4:</b> Audit of transport and lairage conditions	<b>Indication of batch-related risk</b>	<b>EI-13:</b> Parasite testing of carcasses	<b>Indication of both carcass- and herd/flock-related risk</b>
<b>EI-5:</b> Visual animal cleanliness scoring		<b>EI-14:</b> Parasitological status of carcasses post-chilling	<b>Indication whether parasitic hazard-related target for chilled carcasses is achieved</b>
<b>EI-6:</b> Microbiological status of animal coats post-slaughter but pre-skinning	<b>Indication of slaughterhouse process hygiene-related risk</b>		
<b>EI-7:</b> Microbiological status of incoming animals (evisceration)			
<b>EI-8:</b> Microbiological status of final carcasses before chilling			
<b>EI-9:</b> Microbiological status of carcasses post-chilling	<b>Indication whether microbial hazard-related target for chilled carcasses is achieved</b>		



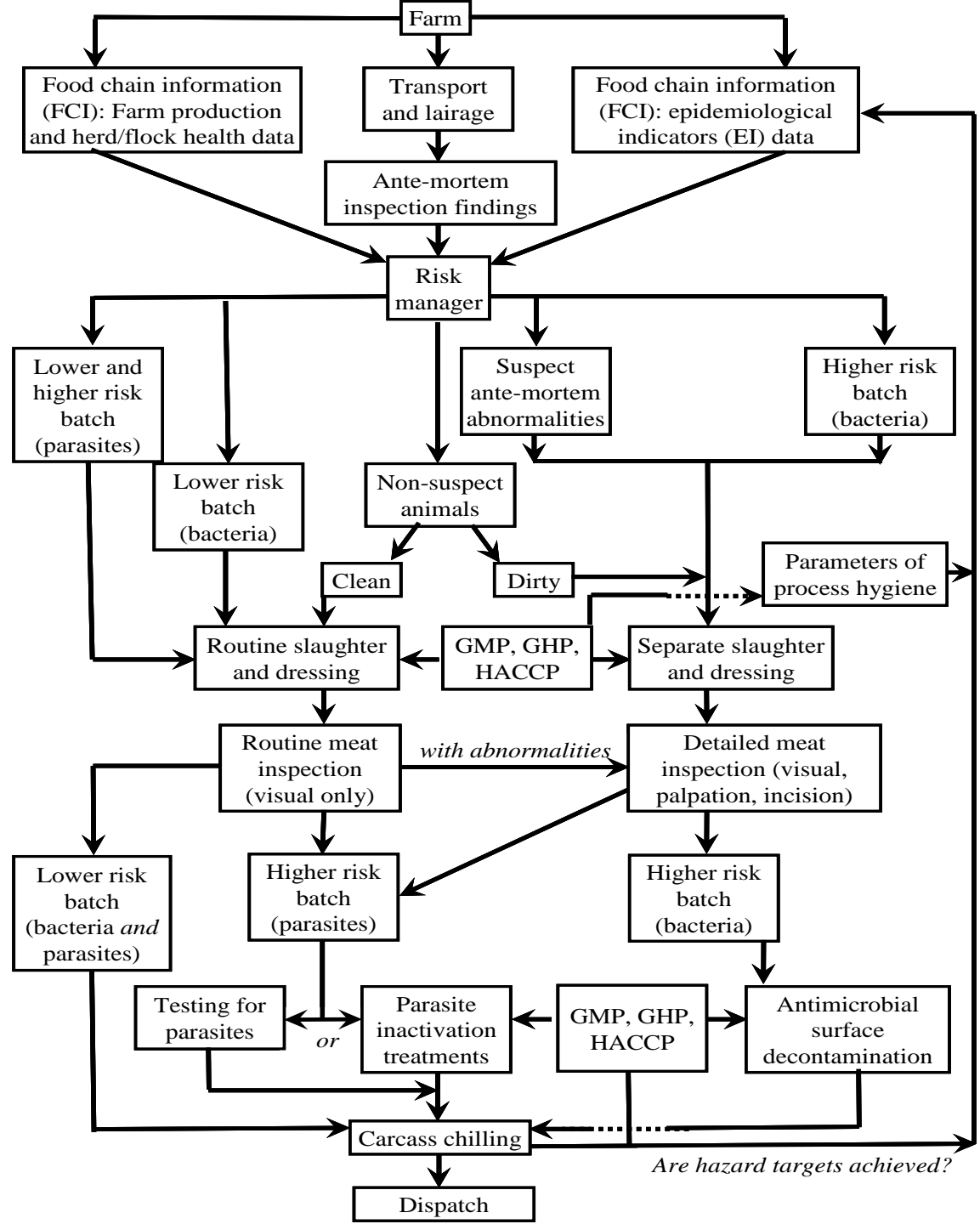
**Epidemiological indicators (EI) used in risk-based carcass meat safety assurance**

## Tools for the risk managers to risk-categorize: a) animal batches; and b) abattoirs

- **For each priority hazard:**
  - Harmonized Epidemiological Indicators (HEIs) to be used in risk-categorization within the proposed carcass safety assurance framework;
  - numerical values of HEIs to be defined by the regulators.
- **Using HEIs by risk managers:**
  - depending on the purpose and the epidemiological situation;
  - either alone or in combinations;
  - at national, regional, slaughterhouse or farm/herd level;
  - harmonised requirements for the controlled housing conditions on farms.

# Chilled carcass meat safety assurance framework in slaughterhouses

(Buncic, 2014)





# Use of FCI in the carcass meat safety assurance framework

- FCI is essential for the control of meat-borne hazards of high priority and it should include:
  1. hazard- and animal/meat species-specific **epidemiological indicators** (EIs) for both **farms** and **slaughterhouses**,
  2. historical **testing data** conducted at both farms and slaughterhouses,
  3. production **practices** and technology used at both farms and slaughterhouses,
  4. risk-reduction **interventions** applied (e.g. antimicrobial and anti-parasitic treatments),
  5. data from **HACCP verification**, and
  6. data whether the animal- and chilled carcasses-related **targets** are met

# What next (in the EU)?

- EFSA Scientific Opinions with recommended changes are being considered by the EU Commission (including consultations with stakeholders)
- If adopted by the EU Commission, new related EU legislation will be generated
  - **The first one: COMMISSION REGULATION (EU) No 218/2014 – “visual meat inspection of pig carcasses”.**
- The risk managers and all others involved in the proposed framework will need to be appropriately educated/trained in “new” skills