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# Food losses and waste in the poultry production chain: from farm to retail

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# Context of high political attention

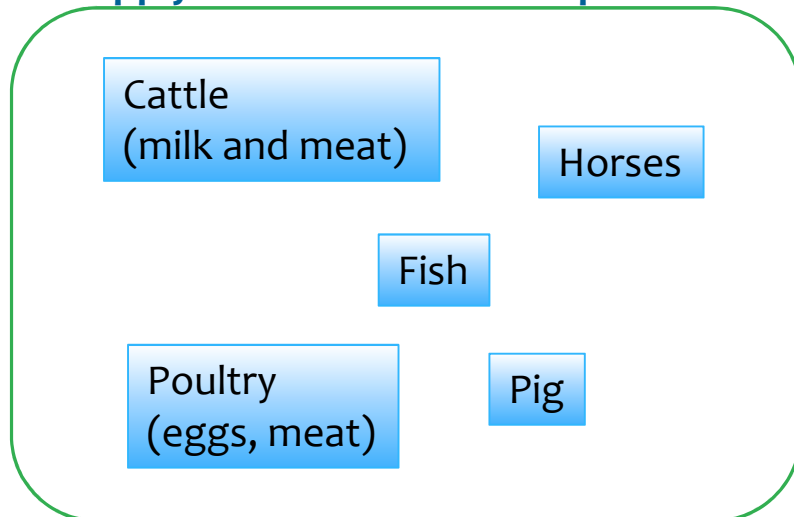
- \* **FAO report (2011): 1/3 of food produced is lost**
- \* **Joint initiatives FAO (Save Food), UNEP, ...**
- \* **WRI Food loss and waste protocol**
- \* **2014 “European Year against Food Waste”**
- \* **EU project FUSIONS as support to the Roadmap to a Resource efficient Europe (goal -50% by 2025)**



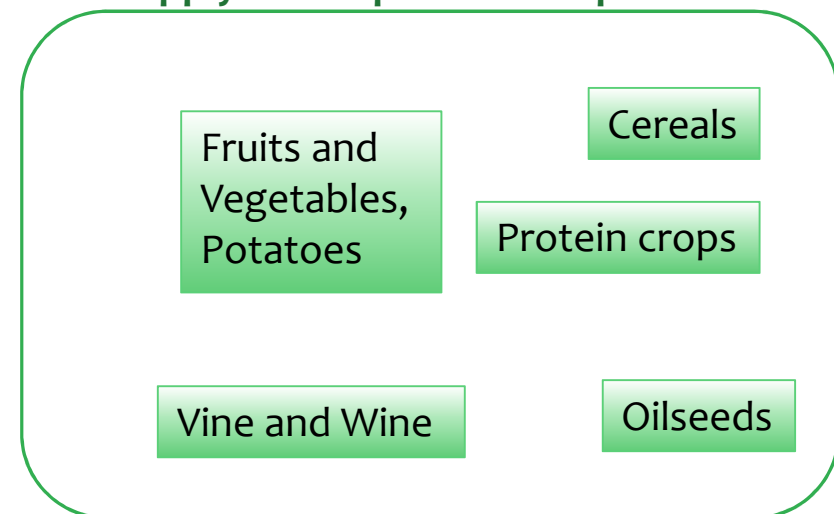
# INRA study objectives

- \* Indicate the incidence and determinants of food losses and waste from farm to retail; identify their fate (waste management, recycling).
- \* Assemble available data in order to calculate food losses and waste quantities,
- \* Identify issues for research, knowledge on which to support food loss and waste prevention and reduction.

## supply chains animal-based products



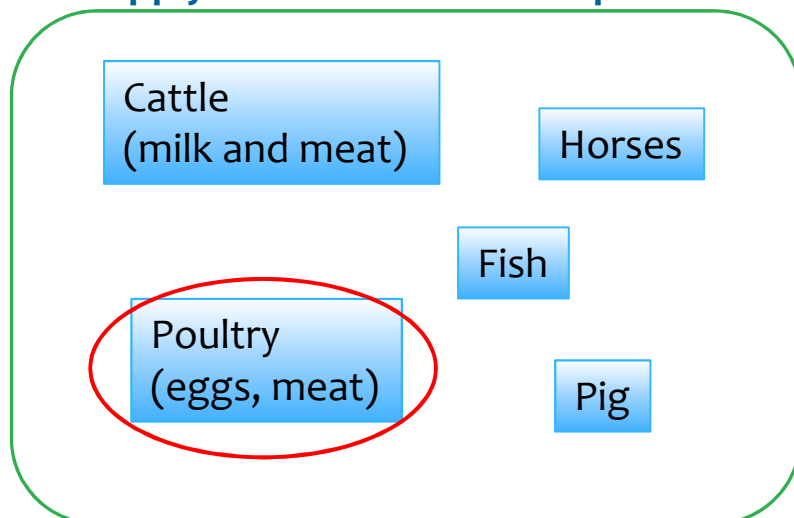
## supply chains plant-based products



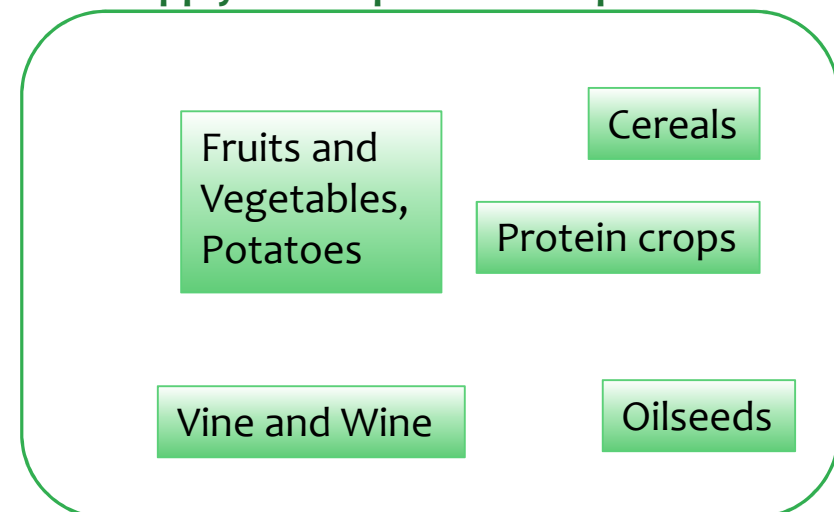
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## supply chains animal-based products



## supply chains plant-based products



***Focus on meat of Gallus species, i.e. chicken and spent layer hens and breeders***

# Volume of poultry productions in France

(SCEES – Agreste -2015)

|                                | Number<br>(x 1000 of<br>individual) | Weight<br>(1000 of tonnes of<br>carcass equivalent) | Average weight<br>of the carcass<br>equivalent (kg) |
|--------------------------------|-------------------------------------|---|---|
| Broiler <sup>1</sup>           | 745 972                             | 1 000   | 1.35  |
| Spent layers &<br>breeders     | 36 637                              | 47*   | 1.29  |
| Turkey                         | 45 986                              | 356   | 7.73  |
| Guinea fowl                    | 25 079                              | 32  | 1.26  |
| Meat duck                      | 38 836                              | 94  | 2.41  |
| Fat ducks<br>(including liver) | 37 205                              | 139   | 3.74  |

<sup>1</sup> including capons and cockerels

\*equivalent to 70% of production slaughtered in France

# Definitions

- \* **Food losses** : products meant for but discarded from human consumption which mainly end up as two categories of animal by-products (regulation EC 1069/2009) :
  - C2** (disposal, fertilizer) and **C3** (may be used in animal feeding)
- \* **Discarded because of:**
  - **public health issues** (dead broilers, condemned carcasses: C2)
  - **technical reasons** (carcass defects, damaged on line: C3)
  - **regulatory reasons** : tail must be removed (C3), when the chicken is cut

# Definitions

- \* **Food waste: discarding of any part of the animal which is edible or could, after processing, be eaten by humans**
  
- \* **Discarded because of:**
  - **technological reasons**, according to on-line process (e.g. giblets not separated from abdominal package)
  - **economic reasons**, such as lack of profitable demand from the market,
  - **regulatory or organizational reasons** (products expiry date management)
  - **culinary traditions** (ex: chicken feet considered as non edible in Europe in contrary to Asia)
  - **ethical reasons**: spent hens euthanized in the poultry farm in Sweden for welfare reason.



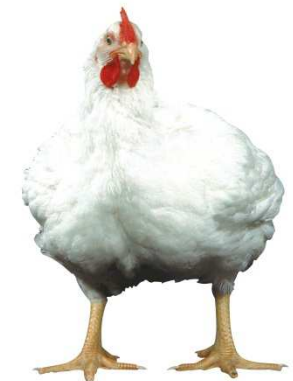
# Definitions

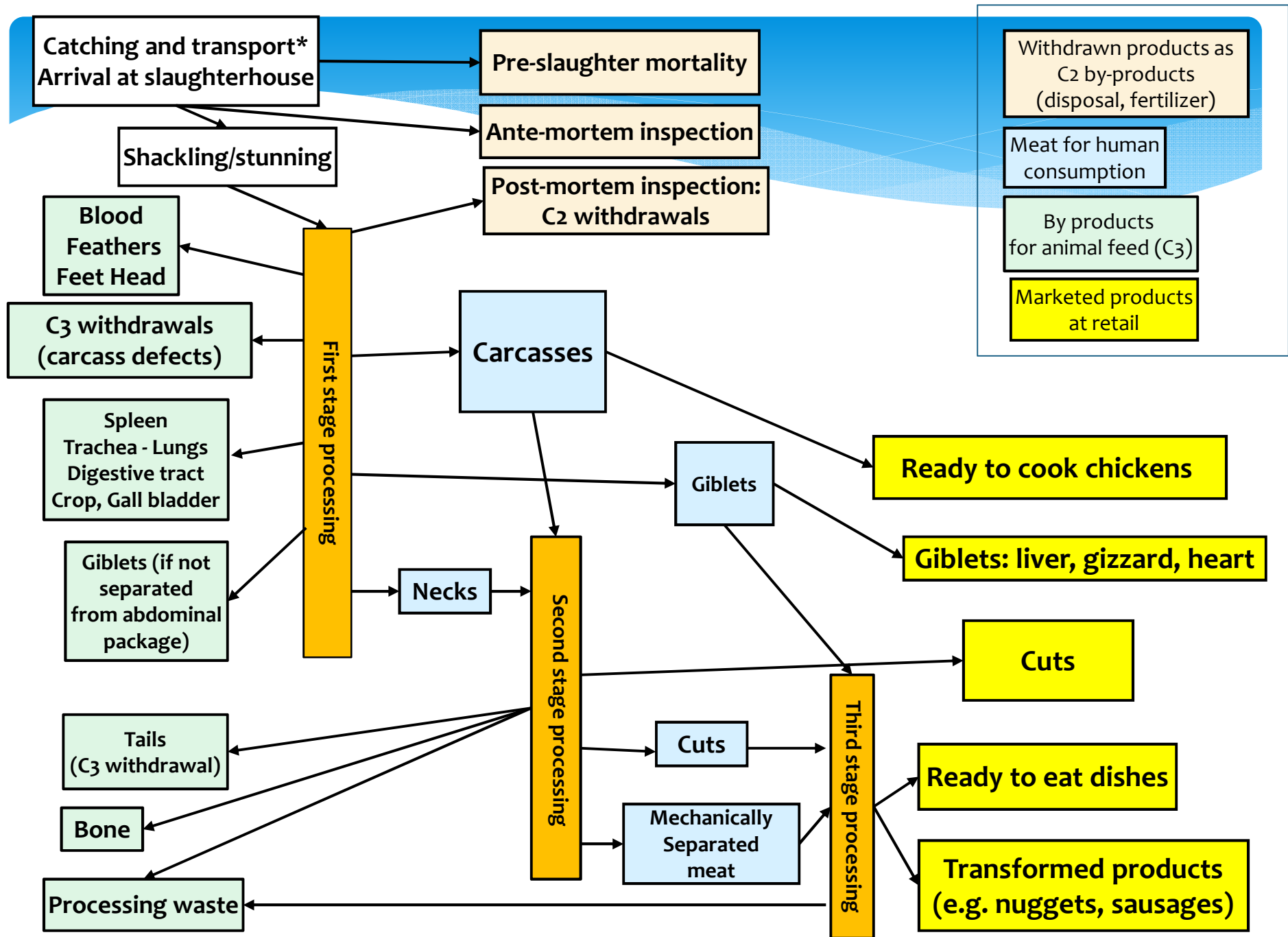
## \* **By-products :**

all parts that are excluded from human food: blood and non-edible parts of the animal (feathers, intestinal tract, feet, head, bones) separated at slaughtering or at processing + losses and waste

# Material and methods

- \* **Description of processing steps resulting in marketable products:**
  - \* the 1<sup>st</sup> stage processing at the slaughterhouse : carcass and giblets,
  - \* the 2<sup>nd</sup> stage processing, where cuts are obtained,
  - \* the 3<sup>rd</sup> stage transformation, where poultry products are combined with other ingredients to elaborated products or have to be processed to be edible

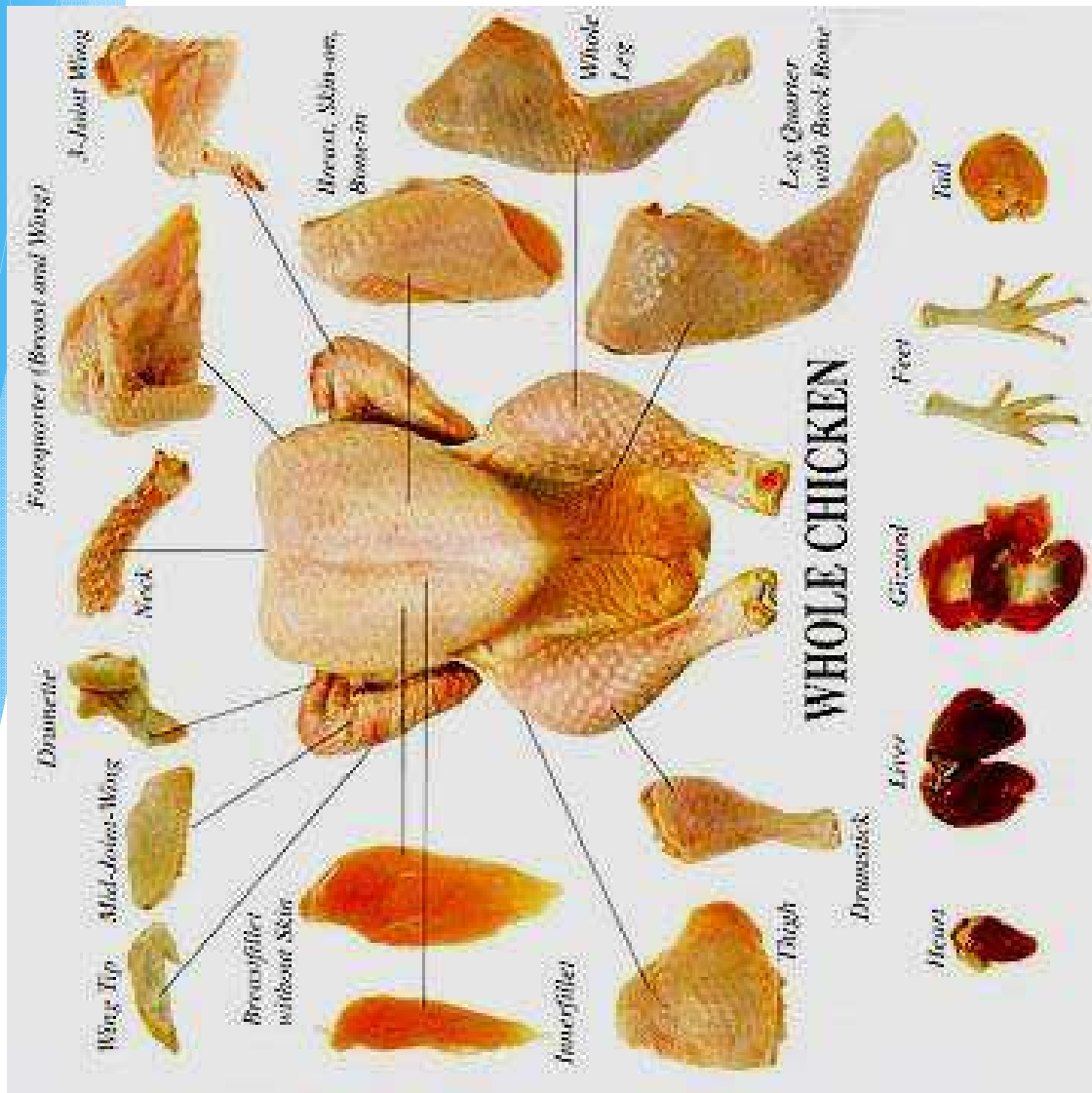




# Material and methods

- \* Simulations based on a representation diagram and a calculation sheet allowing calculations under various hypotheses





# Data set for a cutting type

## Composition of live broiler % of live weight

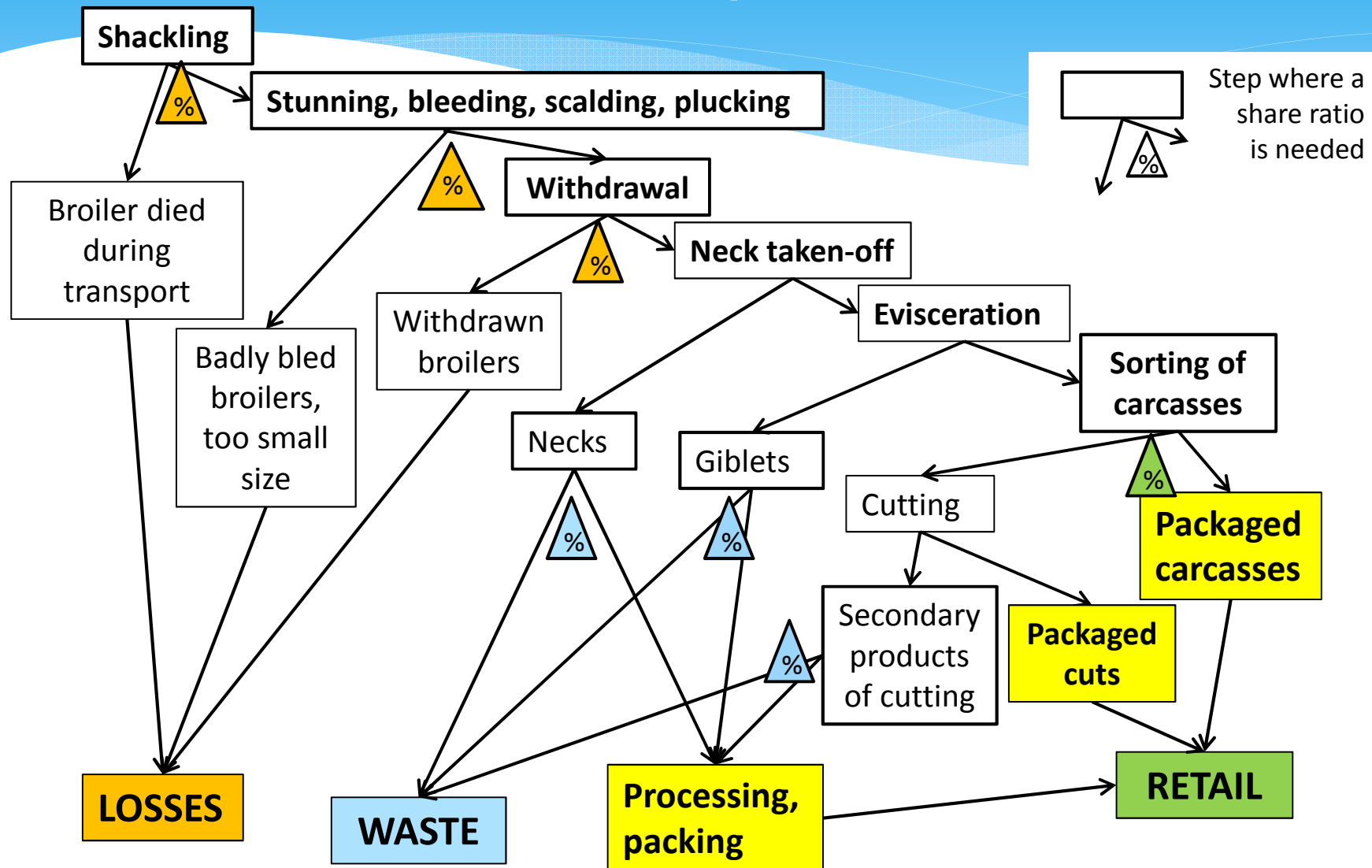
|                   |       |
|-------------------|-------|
| Feather and blood | 7.38  |
| Head              | 2.55  |
| Feet              | 4.23  |
| Internal package  | 6.15  |
| Abdominal fat     | 1.59  |
| Giblets *         | 4.36  |
| Neck without skin | 1.67  |
| Neck skin         | 0.87  |
| Miscellaneous     | 1.64  |
| Carcass           | 69.56 |

## Composition of broiler carcass % of carcass weight

|                                 |       |
|---------------------------------|-------|
| Wings                           | 12.48 |
| Breast skin                     | 3.98  |
| Shred meat                      | 0.83  |
| Fillet                          | 27.42 |
| Upper back                      | 6.61  |
| Legs                            | 36.59 |
| Lower back                      | 6.54  |
| Tail                            | 0.91  |
| Skeleton frame<br>of the breast | 4.64  |

(adapted from Domsen et al., 2004)

# Processing steps where a quantification of proportions is needed for estimation of food losses and waste from harvest to marketable products



# Food losses and waste in chicken production

## \* FOOD LOSSES

### \* Mortality rate during the transport :

- \* 0.18% (CI 95%: 0.14-0.21) in 403 batches from 17 slaughterhouses (France, Le Bouquin *et al.*, 2010)
- \* 0.12% in Great-Britain (Haslam *et al.*, 2008)
- \* 0.25% in Czech Republic (Verecek *et al.*, 2006)
- \* 0.35% in Italy (Pettracci *et al.*, 2006)
- \* 0.46% in the Netherlands (Nijdam *et al.*, 2004).





# Food losses and waste in chicken production

## \* **FOOD LOSSES**

- \* **Withdrawal / condemnation rates:** different methods of calculation and different withdrawal decision makers
- \* More severe sorting when made by slaughterhouse staff than by veterinary administration
- \* Average withdrawal rate in the technical reporting of standard broiler batches in Western France (live weight equivalent):
  - \* **0.68% in 2010, 0.89% in 2011, 1.06% in 2012, 1.16% in 2013.**



# Food losses and waste in chicken production

## \* Food waste

- \* No statistics on the subjects
- \* Largely depending on the markets opportunities, the technical conception of the transformation chain and the diversity of co-products (innovative products and technologies)
- \* Depending on the % of carcasses devoted to cutting
- \* If chicken feet are considered as edible :  
more losses (high rate of foodpad dermatitis)



# Food losses and waste in chicken production (catching to secondary processing)

## Hypotheses used in the simulation

Overall withdrawal rate 1.4 %

Percentage of carcasses for cutting 60 %

Waste rate of secondary products from cutting (giblets, necks, shred meat) 30 %

## Distribution of initial live body weight

Total losses 1.4 %

Other by-products 25.5 %

Food waste 4.26 %

Food products 68.85%



# Food losses and waste in chicken production

## \* USES OF BY-PRODUCTS

- \* **By-products from C3** are transformed in PAP (Processed Animal Protein : poultry meat meal, feather meal and blood meal) and in Fat
- \* **Poultry meat meal, feather meals and blood meal** are used massively in pet-food, but also in aquaculture and to a small extent as fertiliser.
- \* **Fat** out of poultry by-products are used in pet-food or farm animal feed.



# Food losses and waste in spent layers and breeders



- \* Secondary product of the production of table and hatching eggs.
- \* Only 5.5% of Gallus meat in France in 2013
- \* Paid 0.19 to 0.33 €/kg to the producer (France, 2012)
- \* Costs of collection and transport 0.07 - 0.08 €/kg (2013).
- \* France : 1/3 exported alive to neighbouring countries, 2/3 slaughtered and processed in France (50% cuttings, 50 % carcasses) : 70 % frozen, 30 % fresh meat

# Food losses and waste in spent layers and breeders

- \* Vulnerable to bone fracture: 4.6 % up to 24 % according to surveys and catching methods (Christensen et al., 2004)
- \* Mortality rate in transport : 0.27% in Great-Britain (Weeks et al., 2012), 1.22% in Italy (Petracci et al., 2006). Much higher in some cases (distance, weather, density)



# Food losses and waste in spent layers and breeders

- \* Sweden : 50% directed to human consumption, 50% euthanized (30% for mink feed and 20% are incinerated)
- \* Switzerland : in 2008, only 22% of the hens went to human consumption (soup hen), whereas in 2012, 30% went to soup hen production and 45% to shredded meat (Gallo Circle)



# Perspectives

- \* 1- Food losses are mainly consecutive to animal health and welfare problems but conditioned by food safety and quality control measures.
- \* 2- Depending on the cultural background, some parts qualified as by-products by the European regulation might be considered as edible products in other cultures, therefore could be considered as food waste when not consumed.
- \* 3- Technology innovation in cutting plants might reduce technical food waste by finding new uses or products.



# Perspectives

- \* 4- Euthanizing spent hens induces waste of animal protein for human consumption.
- \* 5- The proportion of products which do not find a market at the end of the chain is very difficult to investigate.
- \* 6 - New technologies can contribute to a significant extension of products' shelf life, and innovation in the agro-industry can help finding new outlets for co-products.