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

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INRA SCIENCE & IMPACT

Oniris École Nationale Vétérinaire, Agroalimentaire et de l'Alimentation Nantes Atlantique

Santé et alimentation au cœur de la vie

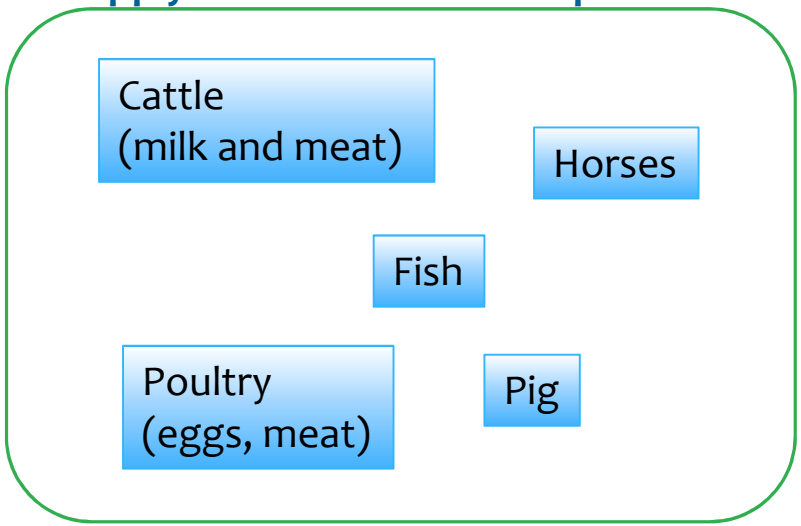
Context of high political attention

* 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)

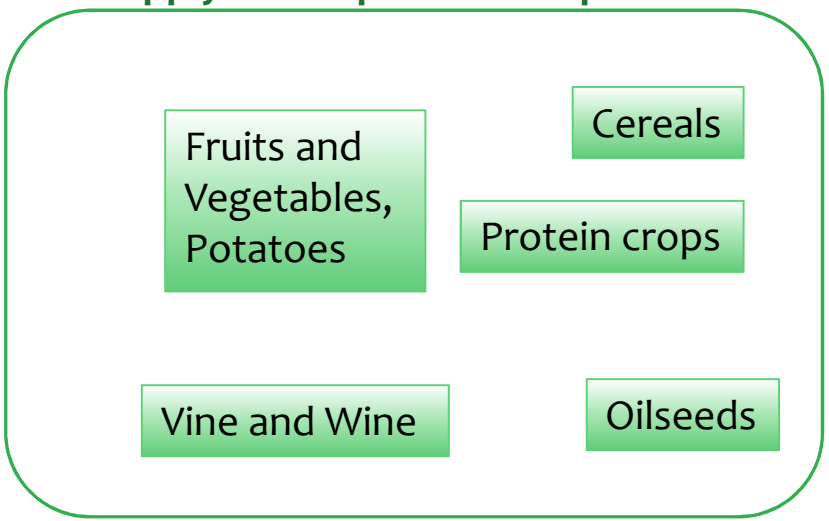
INRA study objectives

- 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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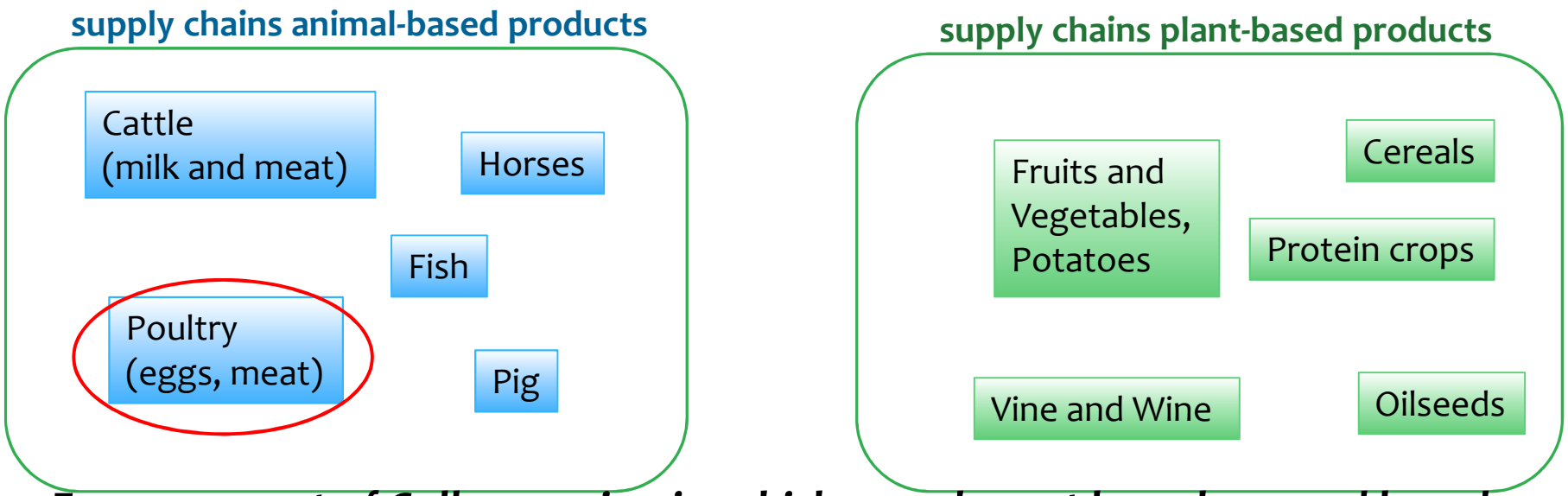


Focus on meat of Gallus species, i.e. chicken and spent layer hens and breeders

Volume of poultry productions in France

(SCEES – Agreste -2015)

	Number (x 1000 of individual)	Weight (1000 of tonnes of carcass equivalent)	Average weight of the carcass equivalent (kg)
Broiler[1]	745 972	1 000	1.35
Spent layers & 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 (including liver)	37 205	139	3.74

[1] 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.

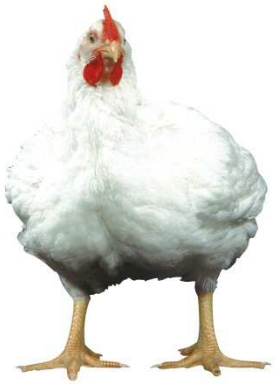
Definitions

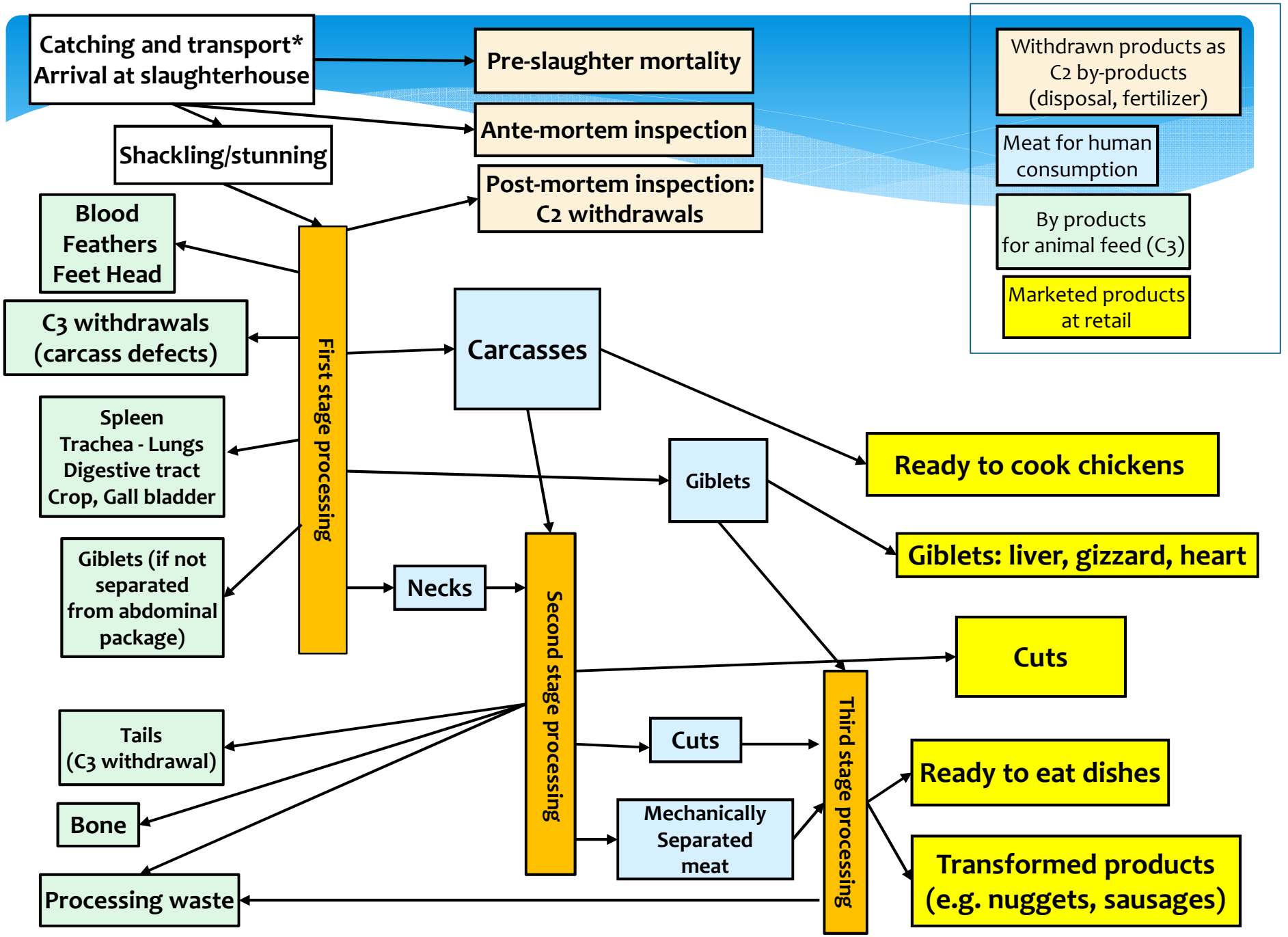
* **By-products :**

  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

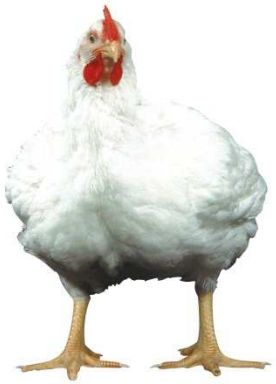
* **Description of processing steps resulting in marketable products:**
  * the 1st stage processing at the slaughterhouse : carcass and giblets,
  * the 2nd stage processing, where cuts are obtained,
  * the 3rd stage transformation, where poultry products are combined with other ingredients to elaborated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

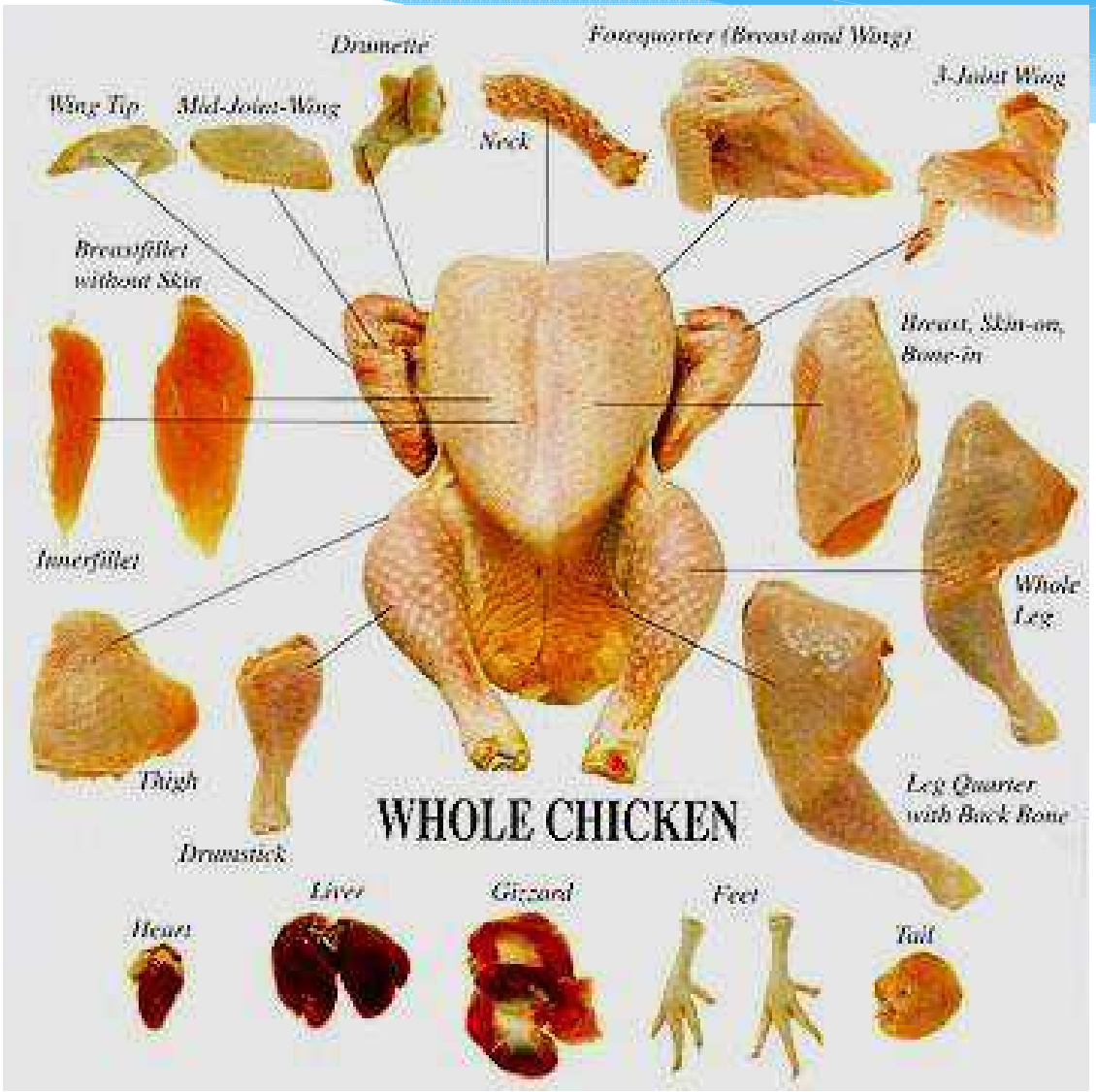


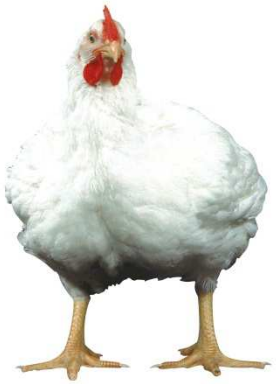

Catching and transport*
Arrival at slaughterhouse
Pre-slaughter mortality
Ante-mortem inspection
Shackling/stunning
Post-mortem inspection:
C2 withdrawals
Blood
Feathers
Feet Head
C3 withdrawals
(carcass defects)
First stage processing
Carcasses
Spleen
Trachea - Lungs
Digestive tract
Crop, Gall bladder
Giblets
Ready to cook chickens
Giblets (if not
separated
from abdominal
package)
Necks
Second stage processing
Giblets: liver, gizzard, heart
Cuts
Tails
(C3 withdrawal)
Cuts
Third stage processing
Ready to eat dishes
Bone
Mechanically
Separated
meat
Transformed products
(e.g. nuggets, sausages)
Processing waste
Withdrawn products as
C2 by-products
(disposal, fertilizer)
Meat for human
consumption
By products
for animal feed (C3)
Marketed products
at retail

Material and methods

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




Drumette
Forequarter (Breast and Wing)
Wing Tip
Mid-Joint-Wing
Neck
3-Joint Wing
Breastfillet
without Skin
Breast, Skin-on,
Bone-in
Innerfillet
Whole
Leg
Thigh
Leg Quarter
with Back Bone
WHOLE CHICKEN
Drumstick
Liver
Gizzard
Feet
Heart
Tail



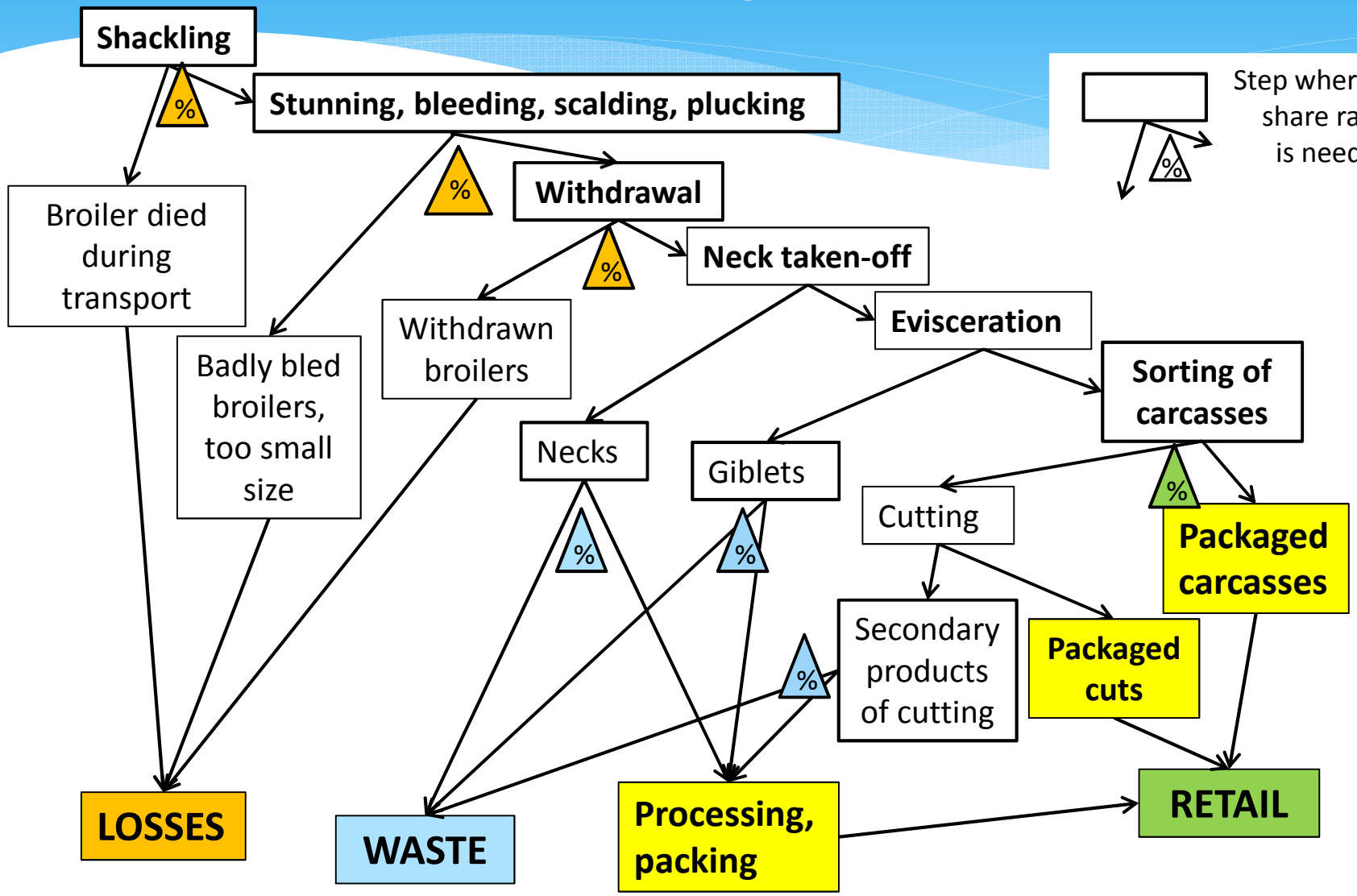
Data set for a cutting type

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 of the breast	4.64

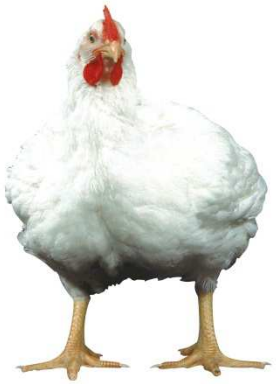
(adapted from Domsen et al., 2004)

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



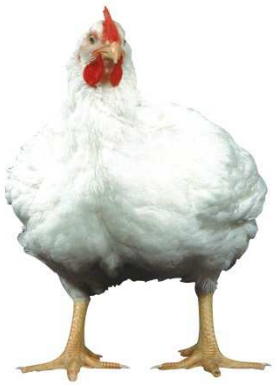
Food losses and waste in chicken production

* **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

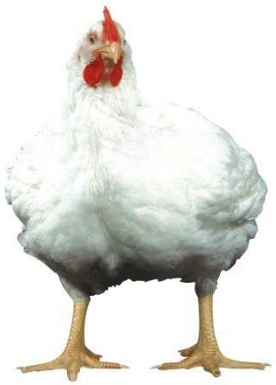
* **FOOD LOSSES**
  * **Withdrawal / condemnation rates:** different methods of calculation and differents withdrawal decision makers
  * More severe sorting when made by slaughterhouse staff than by veterinary administration
  * Average withdrawal rate in the technical reporting of standard broiler 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

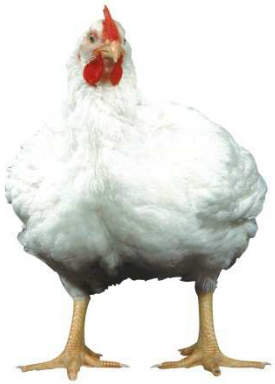
* **Food waste**
  * No statistics on the subjects
  * Largely depending on the markets opportunities, the technical conception of the transformation chain and the diversity of co-products (innovative products and technologies)
  * Depending on the % of carcasses devoted to cutting
  * If chicken feet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

    more losses (high rate of foodpad dermatitis)



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

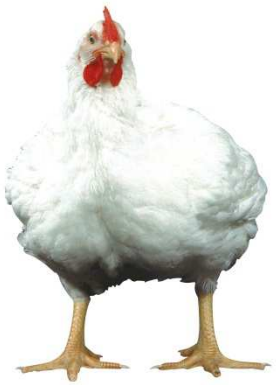
Hypotheses used in the simulation	
Overall withdrawal rate	1.4 %
Percentage of carcasses for cutting	60 %
Waste rate of secondary products from cutting (giblets, necks, shred meat)	30 %



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.