



The challenge to trace the source of contamination in the international food and feed supply chain



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- Complexity of Tracing
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PERSPECTIVES

Tracing is in all interest

Industry

- Optimization
- Ensure supply
- Ensure quality

Consumer

- Guarantee origin
- Ensure quality
- Ensure sustainability

Administration

- Ensure food safety
- Prohibit food fraud
- Ensure food security



PERSPECTIVES

but not one fits all

Industry

- Optimization
- Ensure supply
- **Tracking**
- Ensure quality

Consumer

- Guarantee origin
- Ensure quality
- **Certification**
- Ensure sustainability

Administration

- Ensure food safety
- Prohibit food fraud
- **Recall**
- **Tracing**
- Ensure food security



SEVERAL DEFINITIONS OF TRACEABILITY

But one important distinction¹:

“**Tracking** is the informative process by which a product is followed along the supply chain keeping records at each stage, (...).” (Prospective data collection)

“**Tracing** is defined as the ability of reconstructing the history of a product, identifying its origin (...).” (Retrospective data collection)



¹ Pizzuti & Mirabelli (2015): The global track&trace system for food



SEVERAL DEFINITIONS OF TRACEABILITY

- **Product traceability** is the reconstruction of the physical product flow, the location of a product at any stage of the food supply chain.
- **Process traceability** is the reconstruction of all transformations of the product, including interactions with physical/mechanical, chemical, and environmental factors.
- **Genetic traceability** is the reconstruction of the genetic constitution of ingredients of the product. This is used to identify ingredients, their origin, or if they are genetically modified.
- **Inputs traceability** is the reconstruction of types, source and supplier of all ingredients used during production and processing.
- **Disease and pest traceability** reconstructs the epidemiology of pests and biotic hazards that may contaminate food or feed.
- **Measurement traceability** is the reconstruction of data and quality of measurements.

Reference: Opara (2003)



SEVERAL DEFINITIONS OF TRACEABILITY

There exist no common definition of traceability, but several approaches¹

Working definition of (product) traceability

Traceability is defined as the ability to retrospectively follow the movement of food, feed, food-producing animal or substance intended to be, or expected to be incorporated into or in contact with food or feed, through all stages of production, processing and distribution by means of recorded data.

¹ Olsen & Borit (2012): How to define traceability



GENERAL FOOD LAW / EC REGULATION 178/2002

Article 18: 1-step back/ 1-step forward traceability

1. *The traceability of food, feed, food-producing animals, and any other substance intended to be, or expected to be, incorporated into a food or feed shall be established at all stages of production, processing and distribution.*

“Traceability of food should be established at all stages of production, processing and distribution”

2. *Food and feed business operators shall be able to identify any person from whom they have been supplied with a food, a feed, a food-producing animal, or any substance intended to be, or expected to be, incorporated into a food or feed. To this end, such operators shall have in place systems and procedures which allow for this information to be made available to the competent authorities on demand.*

“Food business operators shall be able to identify any supplier”

3. *Food and feed business operators shall have in place systems and procedures to identify the other businesses to which their products have been supplied. This information shall be made available to the competent authorities on demand.*

“Food business operators shall be able to identify any client”

4. *Food or feed which is placed on the market or is likely to be placed on the market in the Community shall be adequately labelled or identified to facilitate its traceability, through relevant documentation or information in accordance with the relevant requirements of more specific provisions.*

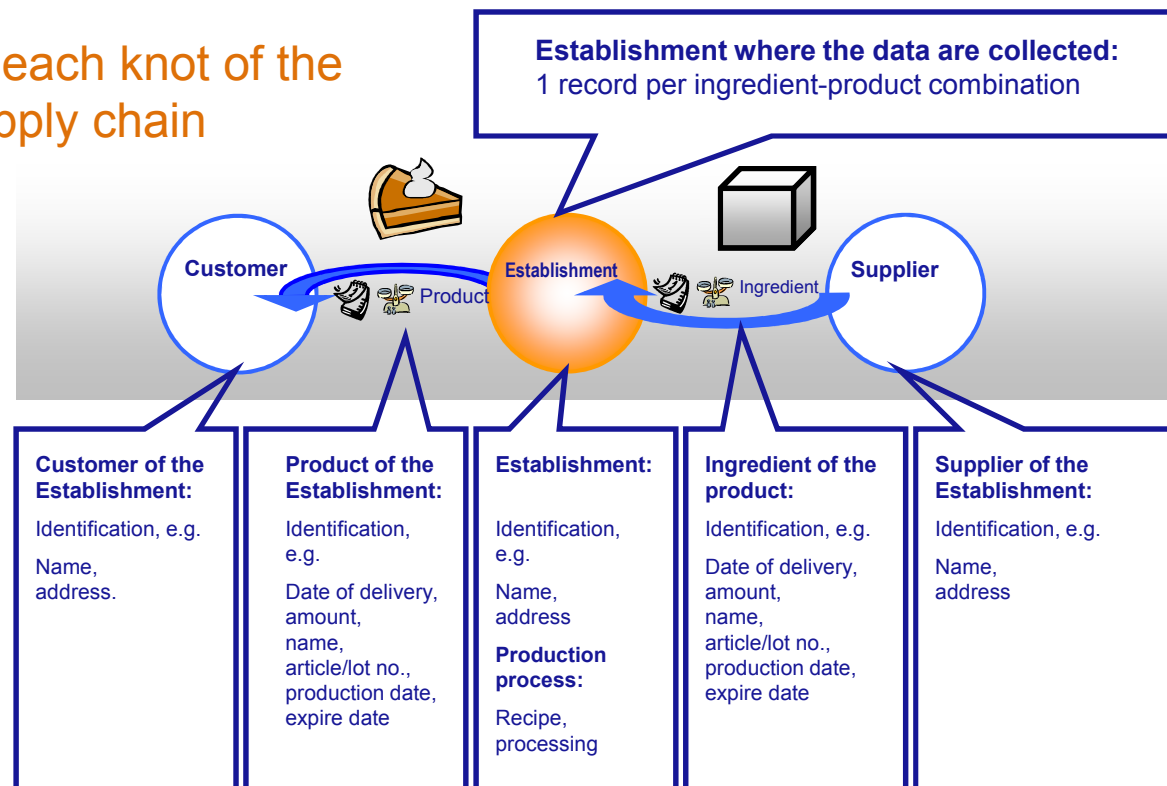
“Food shall be adequately labelled or identified to facilitate its traceability”

5. *Provisions for the purpose of applying the requirements of this Article in respect of specific sectors may be adopted in accordance with the procedure laid down in Article 58(2).*



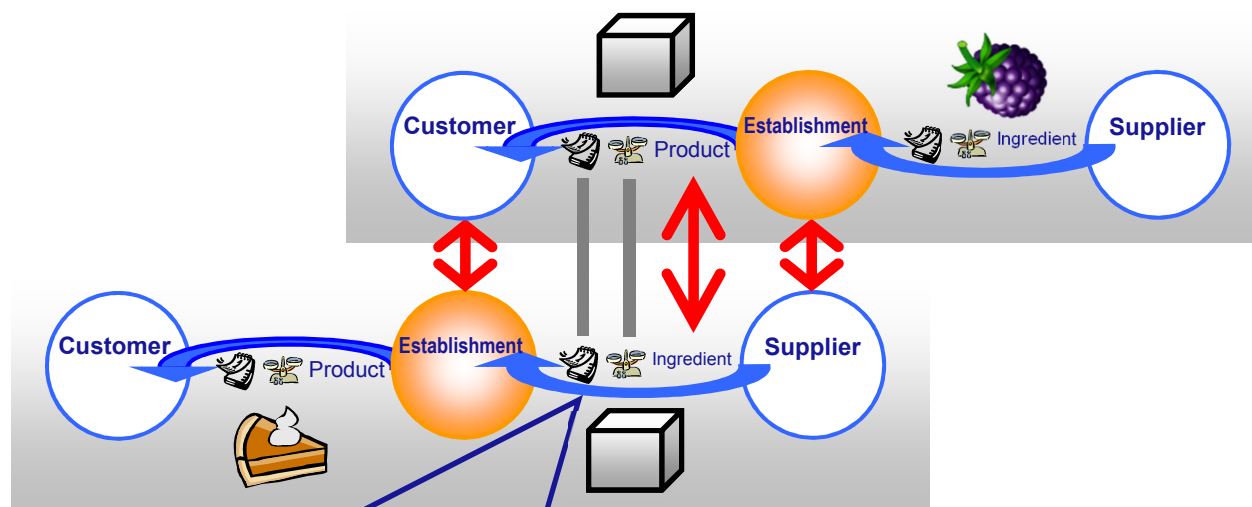
DATA COLLECTION FOR TRACING

Data at each knot of the food supply chain





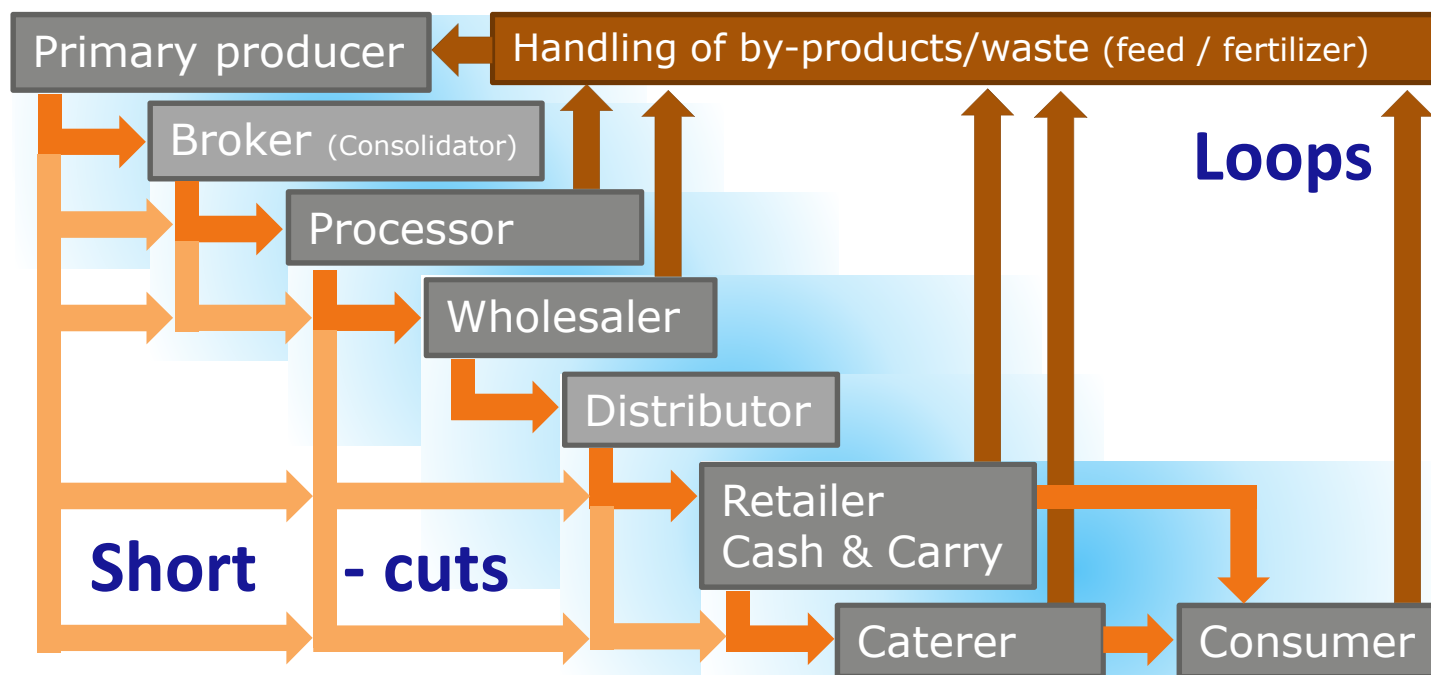
DATA ANALYSIS: BUILDING THE FOOD CHAIN



Identification of common links by Customer=EstablishmentA / EstablishmentB=Supplier / Product=Ingredient
Verification (proof of consistency) by correct date of delivery / correct amount of the product



A FOOD CHAIN WITH ITS STAGES / ACTORS

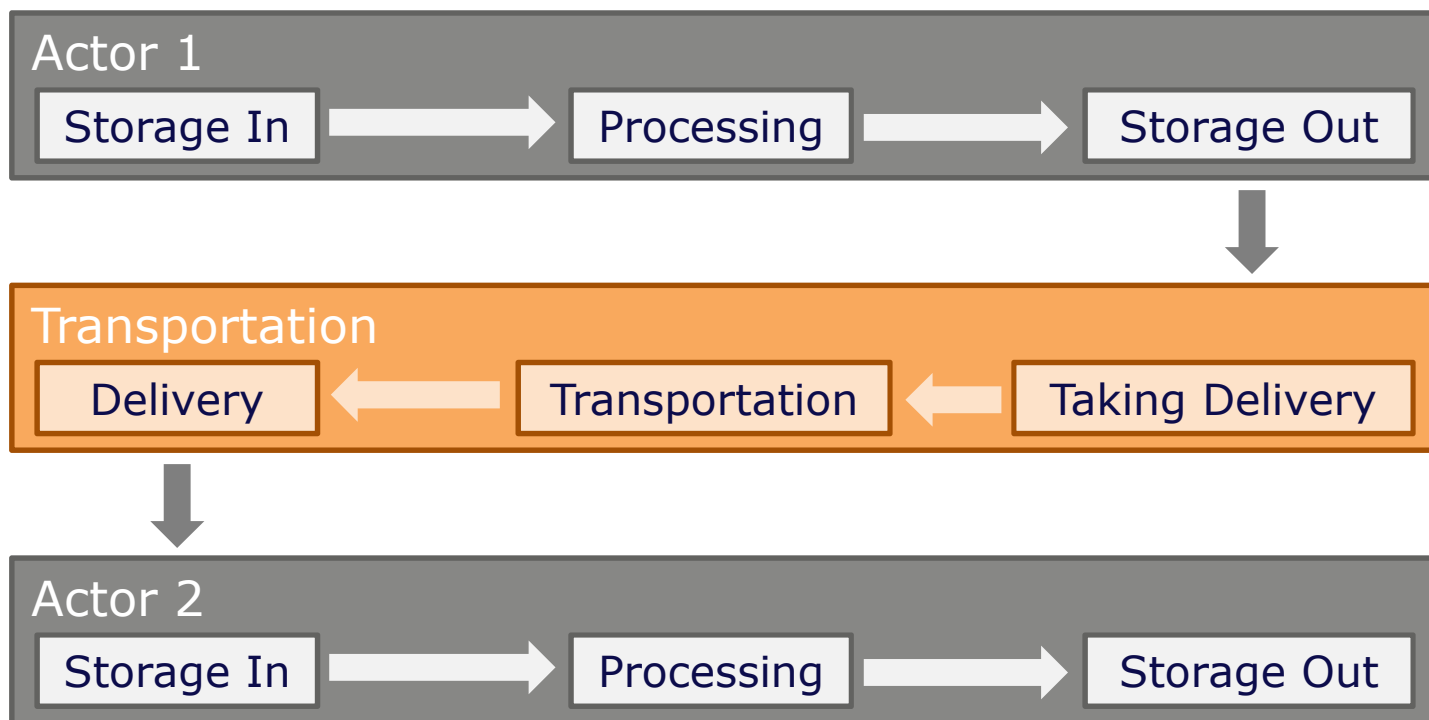




Which data do we need to reconstruct the history of a food item (suspected to be the cause of a disease) ?



MICRO STRUCTURE

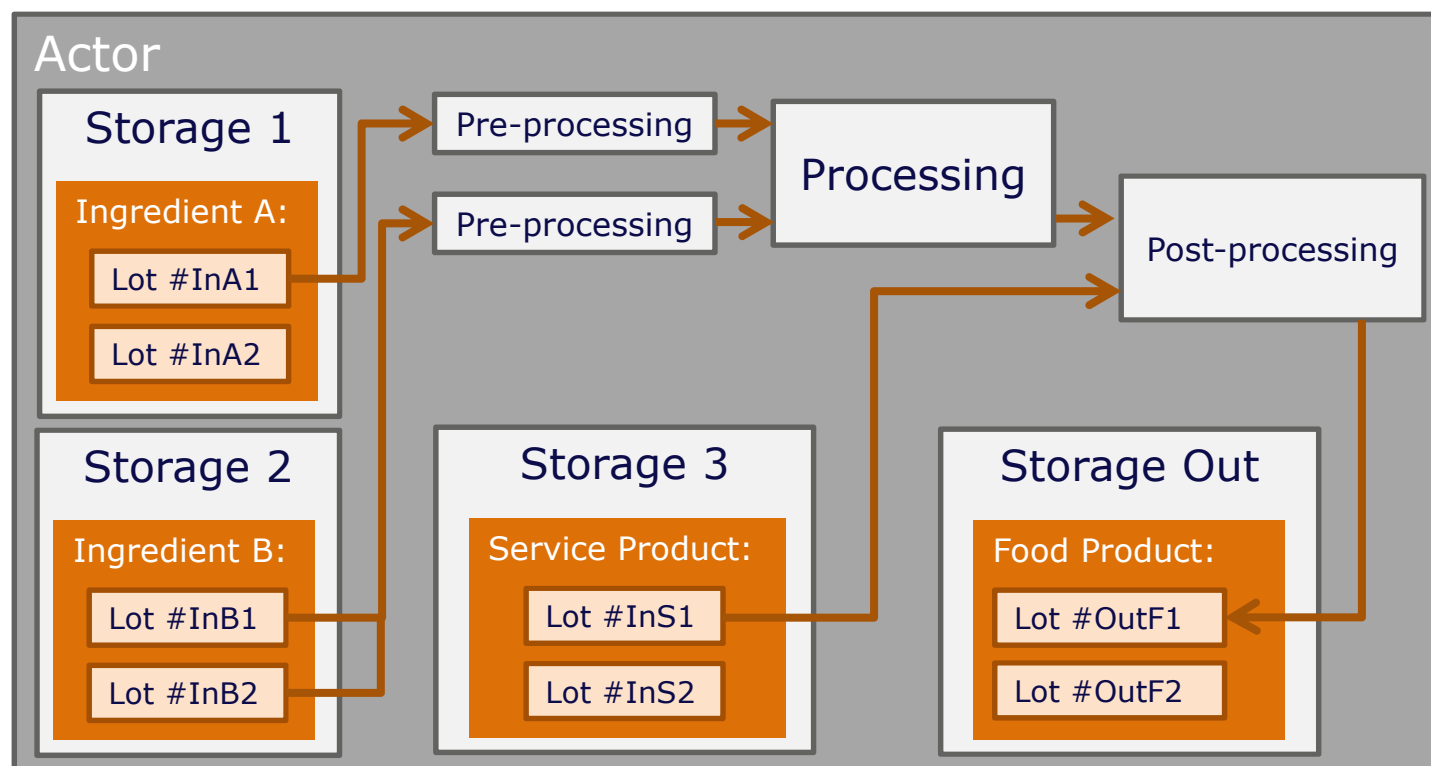




1st step: Processing



GRANULARITY OF PROCESSING





DEFINITIONS

'Product category' identifies the general type of a food item. Food items of the same product category have usually same food safety characteristics.

'Product' identifies the kind of the food item in the usual terminology in the food chain (e.g. product type, brand, package size etc.). Food items with the same product name are usually exchangeable in the food chain.

'Lot / batch' identifies the production process in which the food item was produced. This includes the producer, the location and the date of production. Food items with the same product name and lot number were produced under equal conditions, e.g. equal ingredients, equal production line, equal time slot of production.

'Consignment / trade unit' identifies the single unit of a product which is not divided during transportation. Food items of the same product and consignment had the same provider and recipient in the food chain.



PROCESSING

Processing is any change of the product:

Name	Change
Preparation	New product / new lot (time)
Storage	New product characteristics / time

Processing at distribution:

Trade	New contact (information owner)
Blending, repacking	Merged lots / new consignments
Dividing, splitting	Splitted locations / multiple consignments

Transport as processing:

Transport	New location (time)
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PRIMARY ACTIVITIES

Assemble/ load Join / merge
 Mix Blend
 Transport Distribute Unload
 Trade Import Export Store
 Repack Relabel
 Primarily produce Primarily process
 Produce / manufacture Process / transform
 Retail Catering
 Deplete (exit) Consume

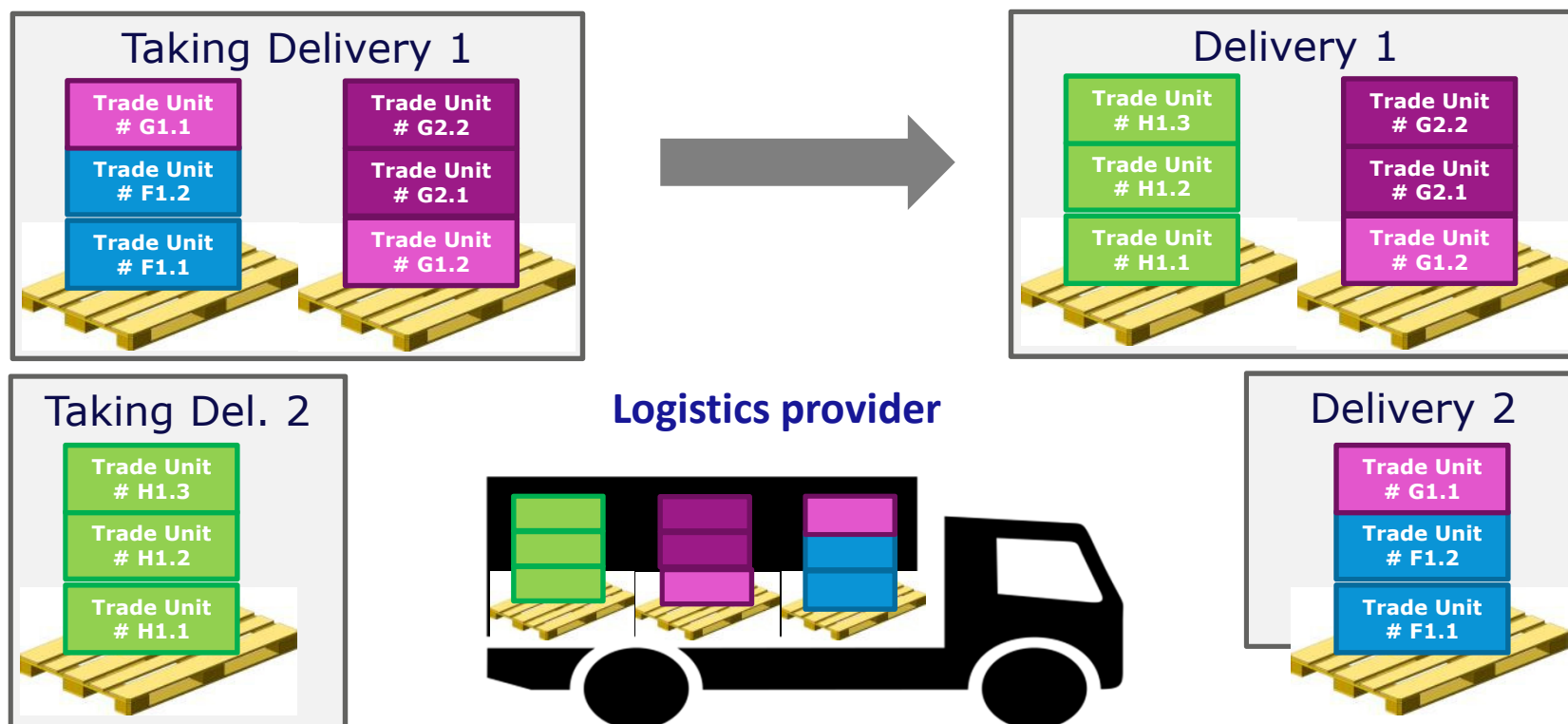


2nd step: Transporting



COMPLEXITY OF CONNECTIONS (I)

The units of transportations are Logistic Units, e.g. palettes, container etc.





DEFINITIONS

'Consignment / trade unit' identifies the single unit of a product which is not divided during transportation. Food items of the same product and consignment have the same provider and recipient in the food chain.

'Logistic unit' is defined as an item of any composition established for transport and/or storage that needs to be identified and managed for logistics.

'Lot transaction' identifies the single transportation unit of a lot which is not divided during transportation. Food items of the same product, lot and consignment had the same provider and recipient in the food chain.

'Package unit' identifies the minimal trade unit, which could not be divided into smaller trade units.

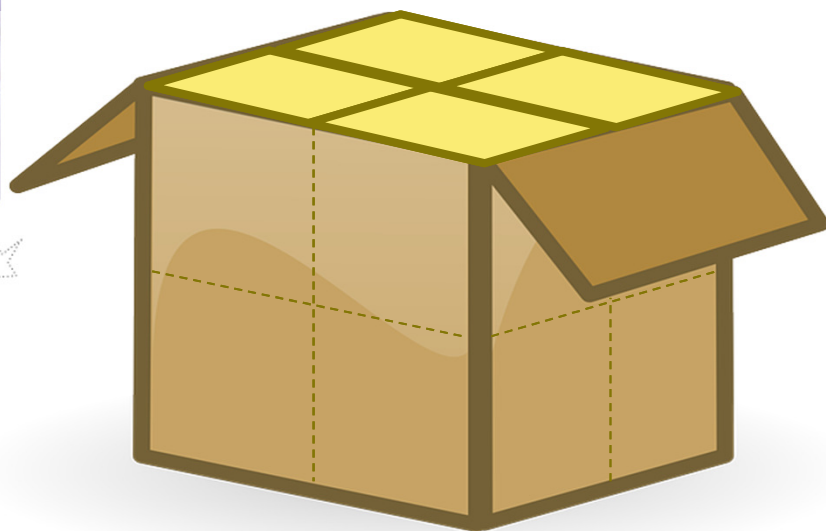


DIVISION OF PRODUCTS DURING DISTRIBUTION

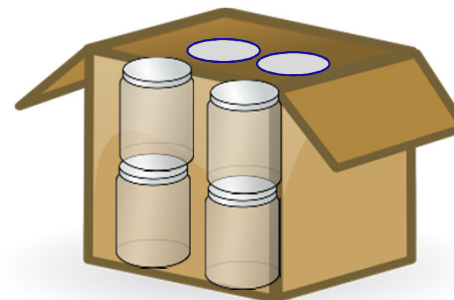
The trade units can change in the food chain, ...

... but they are usually defined in the
Product Information Sheet

Trade Unit of production,
e.g. = 8 boxes = 64 cans



Trade Unit
for distribution,
e.g. 1 box = 8 cans



Trade Unit
for the Consumers,
e.g. 1 can





3rd step: Information flow



DIFFERENT LAYERS OF TRACING

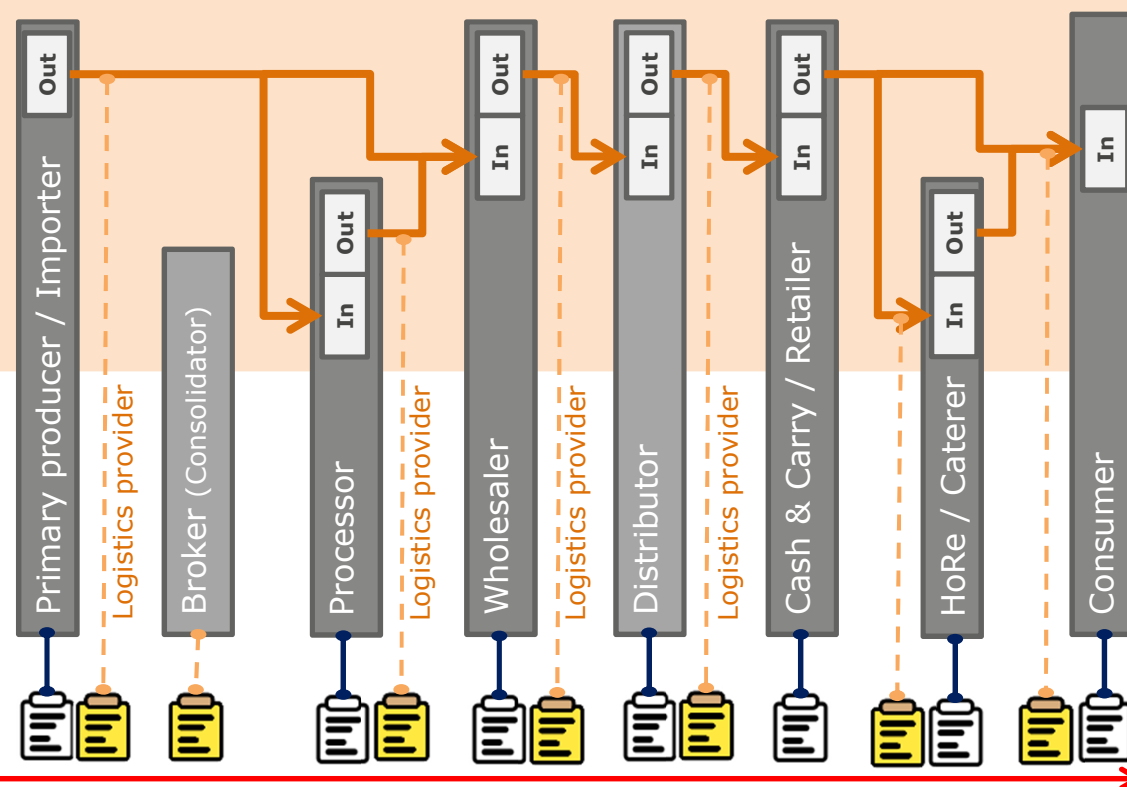
Physical material flow
in the food-supply-chain

Actors and their roles
in the food-supply chain
(Food Business Operators)

Information holder:

 = product,  = transport

Time →





INFORMATION

Typical documentation

						Invoice							
Seller (name, address, country, phone, email)							Date						
VAT no:							Invoice no.						
							Our reference						
							Your order						
Phone							Contract						
Email													
Consignee (name, address)							Delivery						
							Date						
							Transport by						
Buyer (name, address)													
Gnd. no	Description / code of goods	Quantity	Currency	Unit price	Price								
			Sum										
VAT 1				%									
VAT 2				%									
Total for payment													
Please pay to						Composed by							
Bank						Signature							
SWIFT / BIC													
Account / IBAN													
Payment terms / date													
The goods remain property of the supplier until full payment of the invoice has been made.													

Invoices

1 Sender (name, address, country)										INTERNATIONAL CONSIGNMENT NOTE (CMR)									
2 Consignee (name, address, country)																			
3 Place of delivery (address, country)										16 Carrier (name, address, country)									
										Tractor licence plate									
										17 Successive carrier (name, address, country)									
4 Place and date of taking (address, country, date)										18 Carrier's reservations and observations									
5 Annexed documents																			
6 Marks										7 No									
8 Units										9 Nature of goods									
10 Weight										11 Volume									
										kg									
										m ³									
										kg									
										m ³									
										kg									
										m ³									
Class										Number									
Letter										ADR									
Sum																			
13 Sender's instructions (Customs and other formalities)										19 Special agreements									
14 Directions as to freight payment										20 To be paid by									
										Sender									
										Consignee									
										Supplement charges									
										Total									
21 Established in (date, place)										15 Cash on delivery									
Dated: 19/05/2017																			
22 Signature/stamp of sender										23 Signature/stamp of carrier									
										24 Signature/stamp of consignee									
										Goods received on									

Consignment notes

Description	Product Specification
Storage	
Commence shelf life	
Best before	
Best before end	
Brand	
Product Name	
Legal product name	
Nutritional Information	Per 100g
Energy in kJ	
in kCal	
Protein	
Fat, total	
-saturated	
Carbohydrate	
-sugars	
Sodium	
Allergens	
Ingredients	
Additives	
Primary package	
Net weight	
Dimensions	
No of pieces	
Secondary packaging	
Type of package	
Net weight	
Gross weight	
Dimensions	
Units per box	
Text on Label	
Logistic Information	
Type of pallet	
Net weight	
Gross weight	

Product specification



DEFINITIONS

'Information owner' is a person or an entity, who generates or collates an information on a food item. This person is able to change or correct the information (and decides on confidentiality).

'Information holder' is a person or an entity, who has access to an information on a food item. This person is able to regularly retrieve the information.

'Contact person' is a person in a food business, who is contacted by food safety administrations in case of requests.

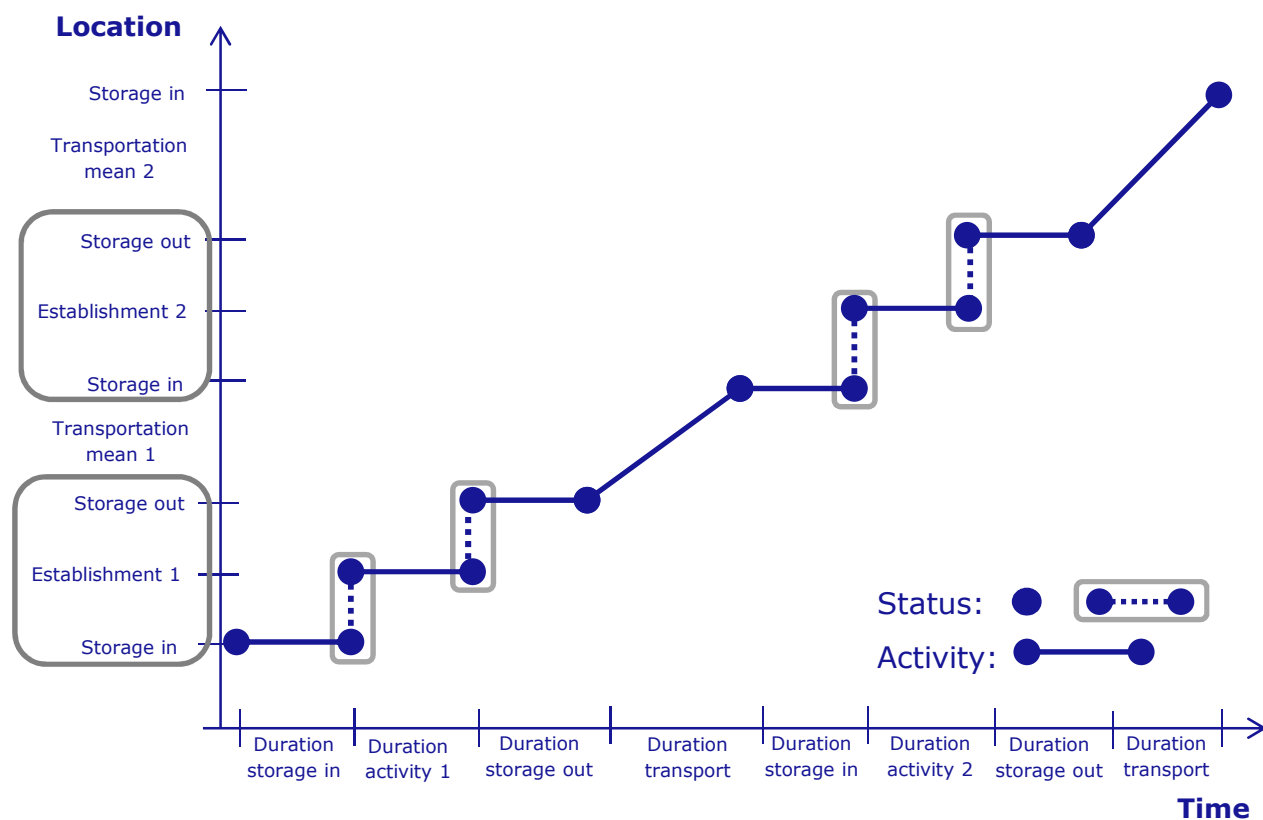
'Food business operator' means the natural or legal persons responsible for ensuring that the requirements of food law are met within the food business under their control (EC 178/2002).



Granularity of tracing information

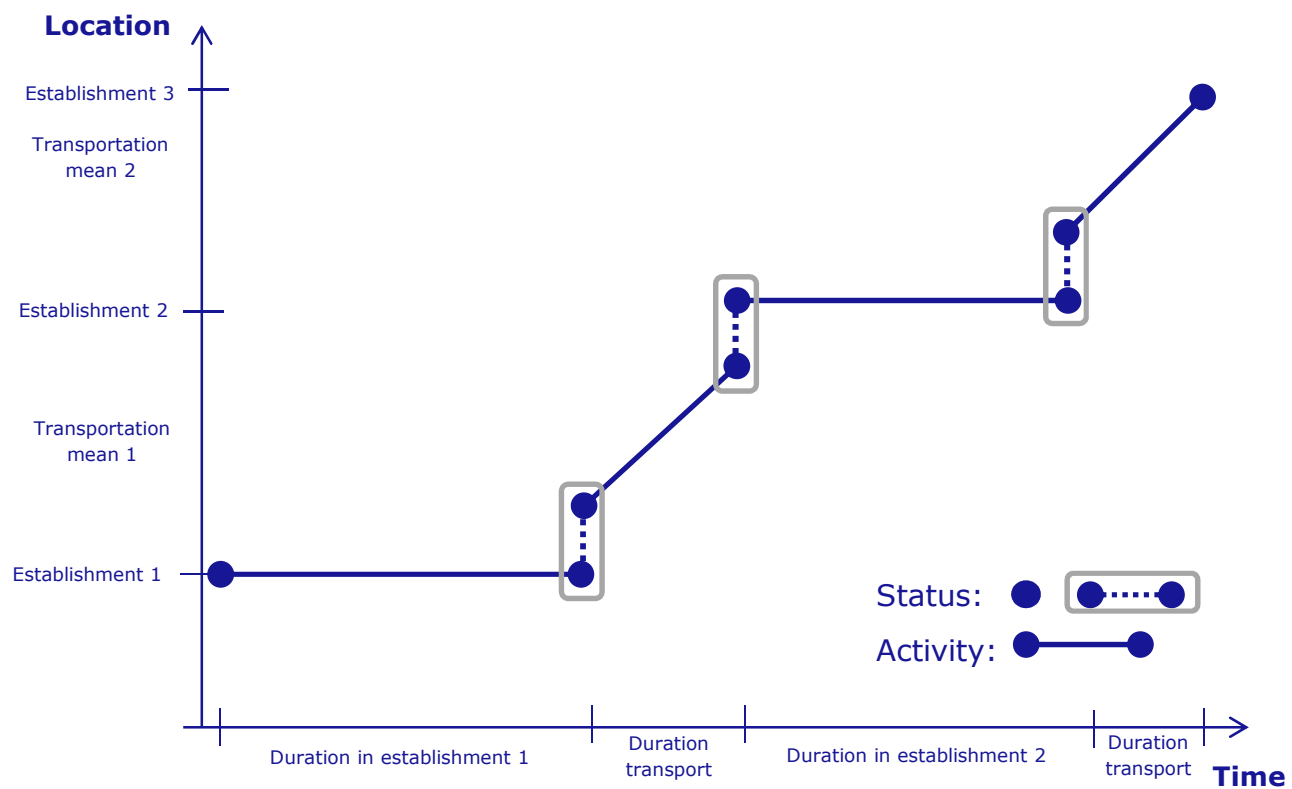


STATUS AND ACTIVITY RECORDS (DETAILED)



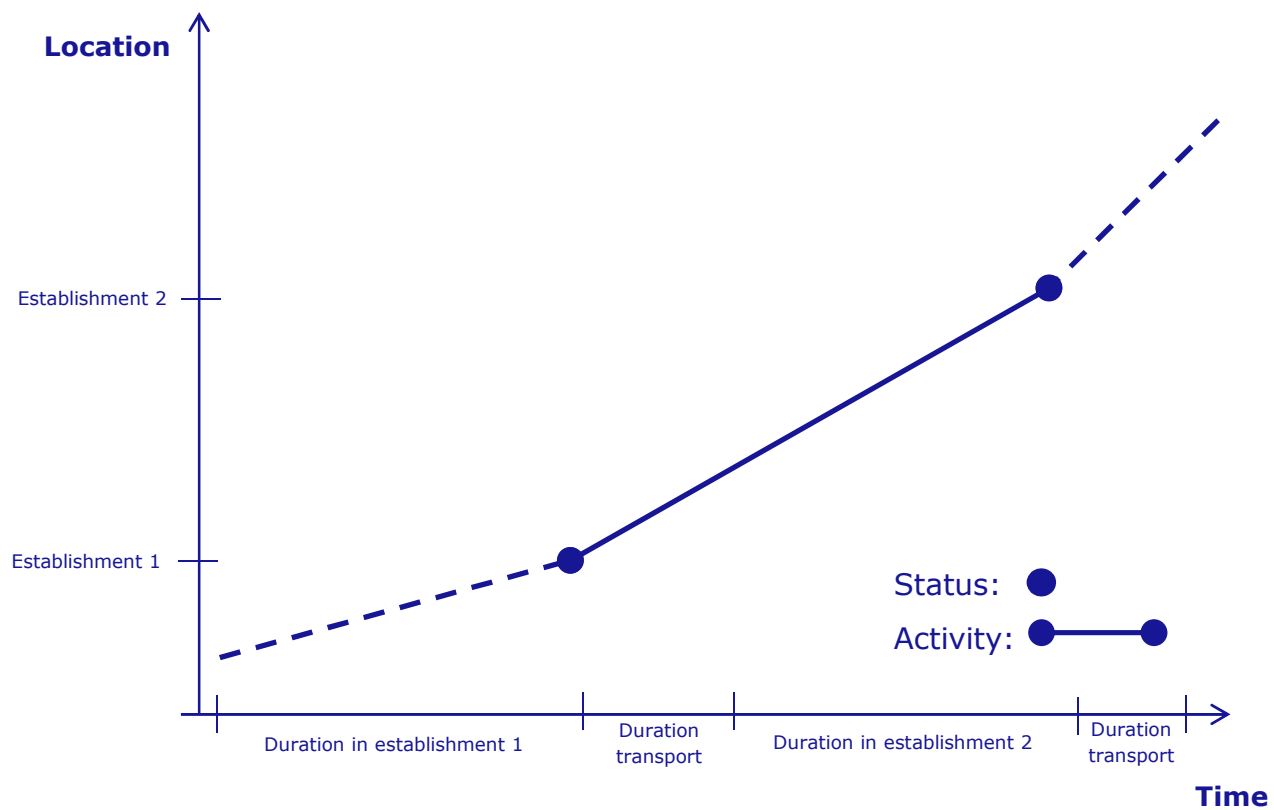


STATUS AND ACTIVITY RECORDS (MEDIUM)





STATUS AND ACTIVITY RECORDS (ROUGH)





QUALITY OF TRACEABILITY SYSTEMS

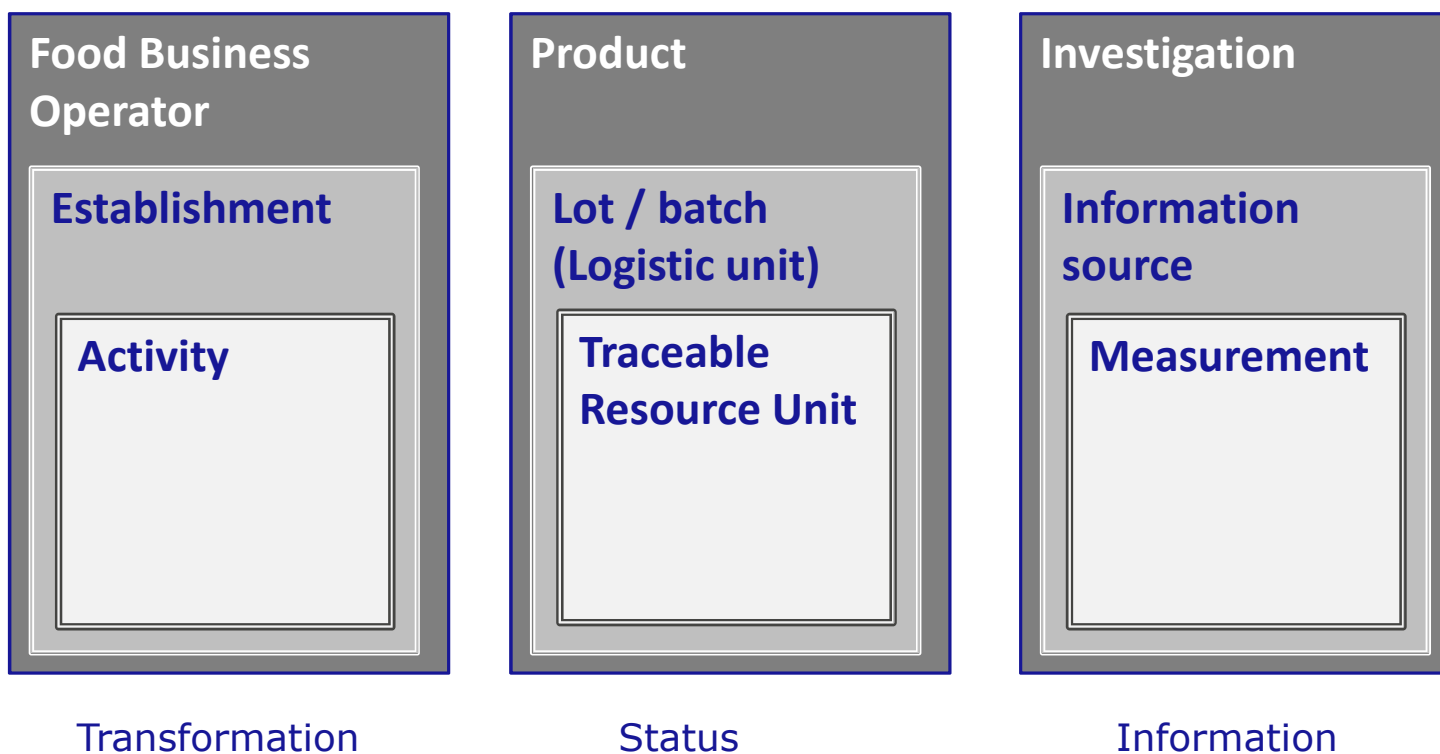
- **The precision** is mainly described by the granularity of the differentiation of the traceable resource units and activities.
- **The completeness** is mainly described by the percentage of necessary information, which it is possible to retrieve retrospectively.
- **The reliability** is mainly described by the accuracy of the stored information.



The revised data model



REVISED DATA STRUCTURE: 9 TABLES





REVISED DATA STRUCTURE

Main concepts

- Comprehensive structure for tracing
- Flexible for inputs:
 - Fine to rough traceability systems
 - Low data quality / incomplete data
 - Covers different perspectives
- Master plan for coming solutions



THANKS FOR YOUR ATTENTION



(Thanks to an unknown lady who permitted this photograph of her tattoo, 2016, photograph by Olaf Mosbach-Schulz)

European Food Safety Authority (EFSA)
Assessment and Methodological Support Unit (AMU)

Olaf Mosbach-Schulz

olaf.mosbach-schulz@efsa.europa.eu