

# **Innovations in Food Traceability**

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# This presentation

- How traceability is defined
- Matching claims to characteristics
- Why analytical methods for testing and authentication are not enough
- Mass-balance accounting and input-output analysis
- Blockchain technology



# Food product supply chain - Example

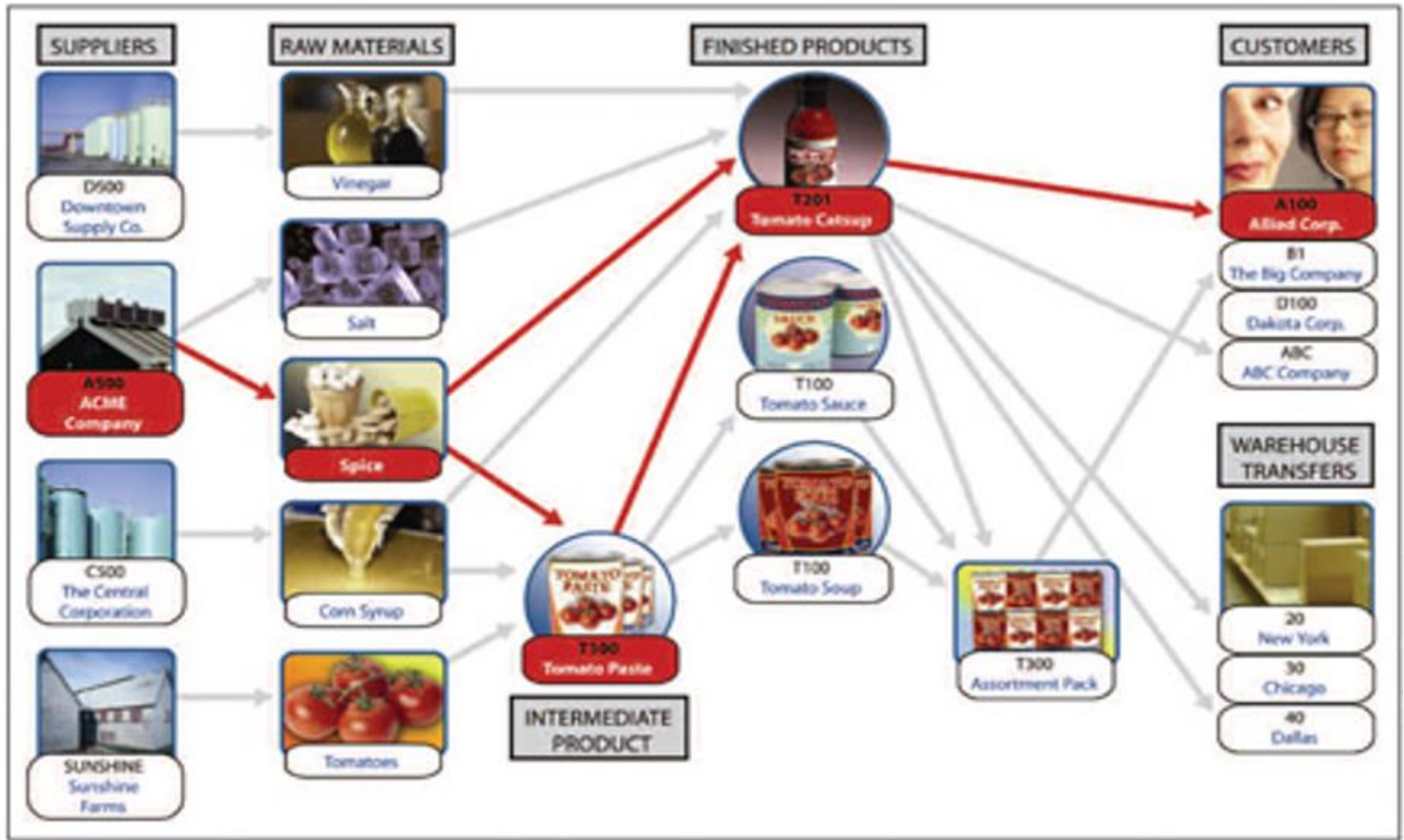
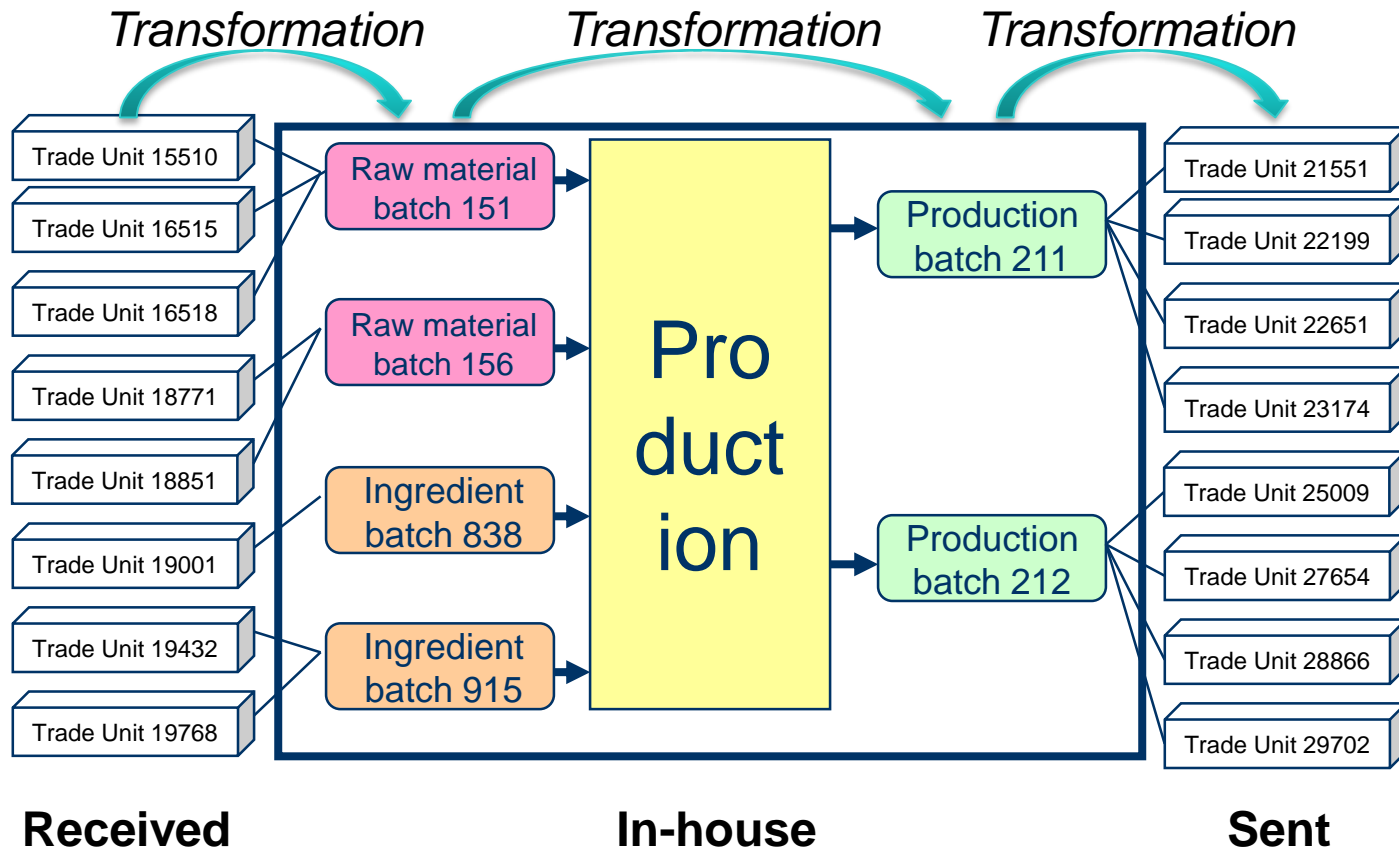


Illustration from FoodSafety magazine December 2005/January 2006



# Batches, Trade Units, and Transformations



## Traceable Resource Unit (TRU)

– the unit that we want to trace; normally a batch or a trade unit



# Definition of the term “Traceability”

*Traceability (ISO 8402):*

*Ability to trace the history, application or location of an entity by means of recorded identifications*

In a product sense, it may relate to

- the origin of materials and parts
- the product processing history
- the distribution and location of the product after delivery

*See "Olsen, Borit (2013): How to define traceability" for more on definitions on traceability*



# What traceability is, and what it isn't

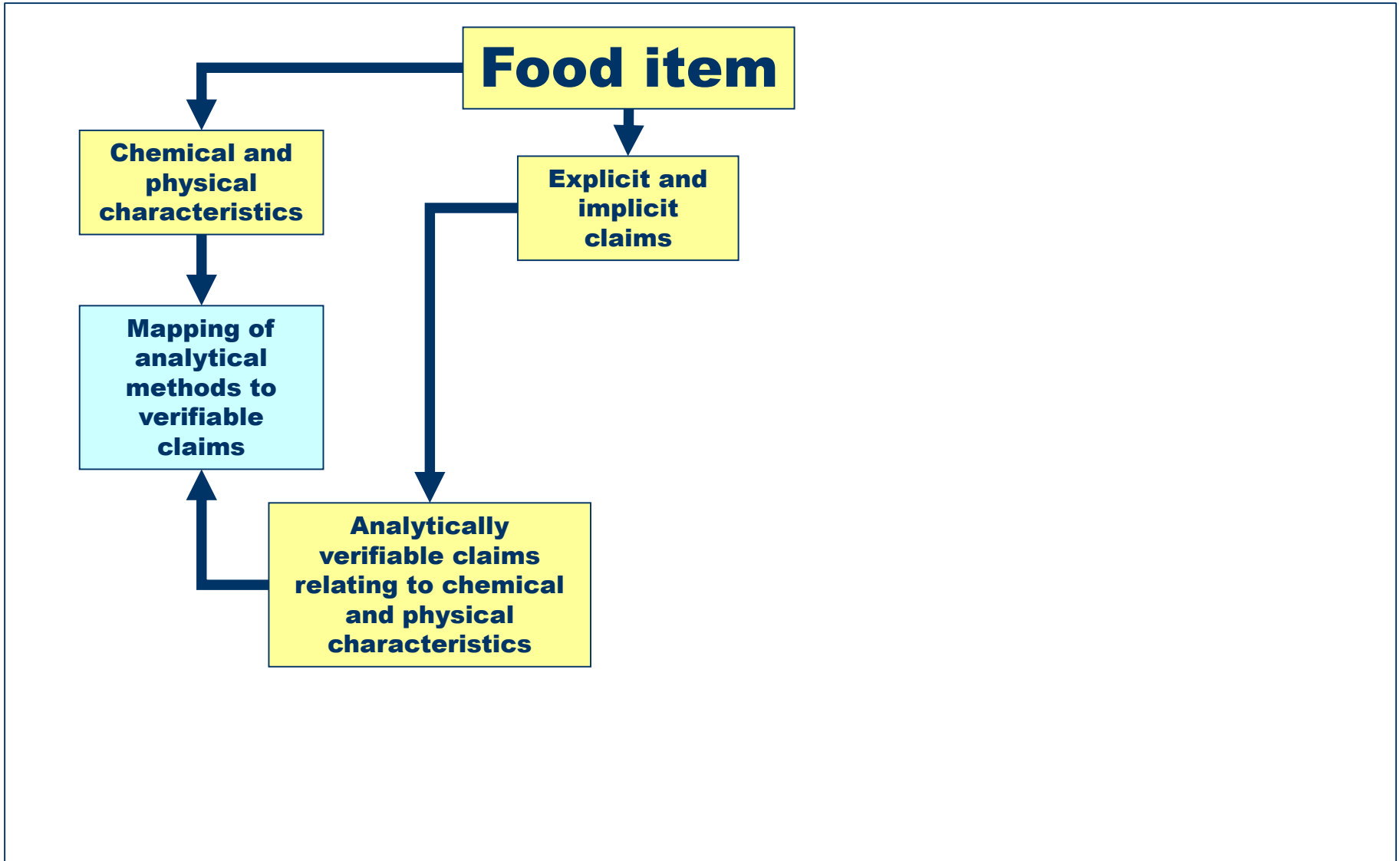
Traceability is not the name of a type of data. In some companies a lot of data is recorded, and traceability is bad; in other companies little data is recorded, and traceability is good.

Traceability is the ability to find the relevant data; both the data that you have generated, and the data that you receive. You get traceability by systematically identifying and organizing your recordings in such a way that you later can find them. In practice, traceability consists of assigning identifiers to the TRUs, to record TRU transformations, and to record TRU characteristics.

Good traceability will not give you safer food, healthier food, or higher quality food; it will only give you better documented food.



# Matching claims to characteristics



# Analytically verifiable characteristics

- **Species, Geographical origin**
- **Farmed or wild (for salmon, typically)**
- **Fresh or frozen, then thawed**
- **Presence of bioactive compounds, pathogens**
- **Presence of undeclared / unwanted additives**

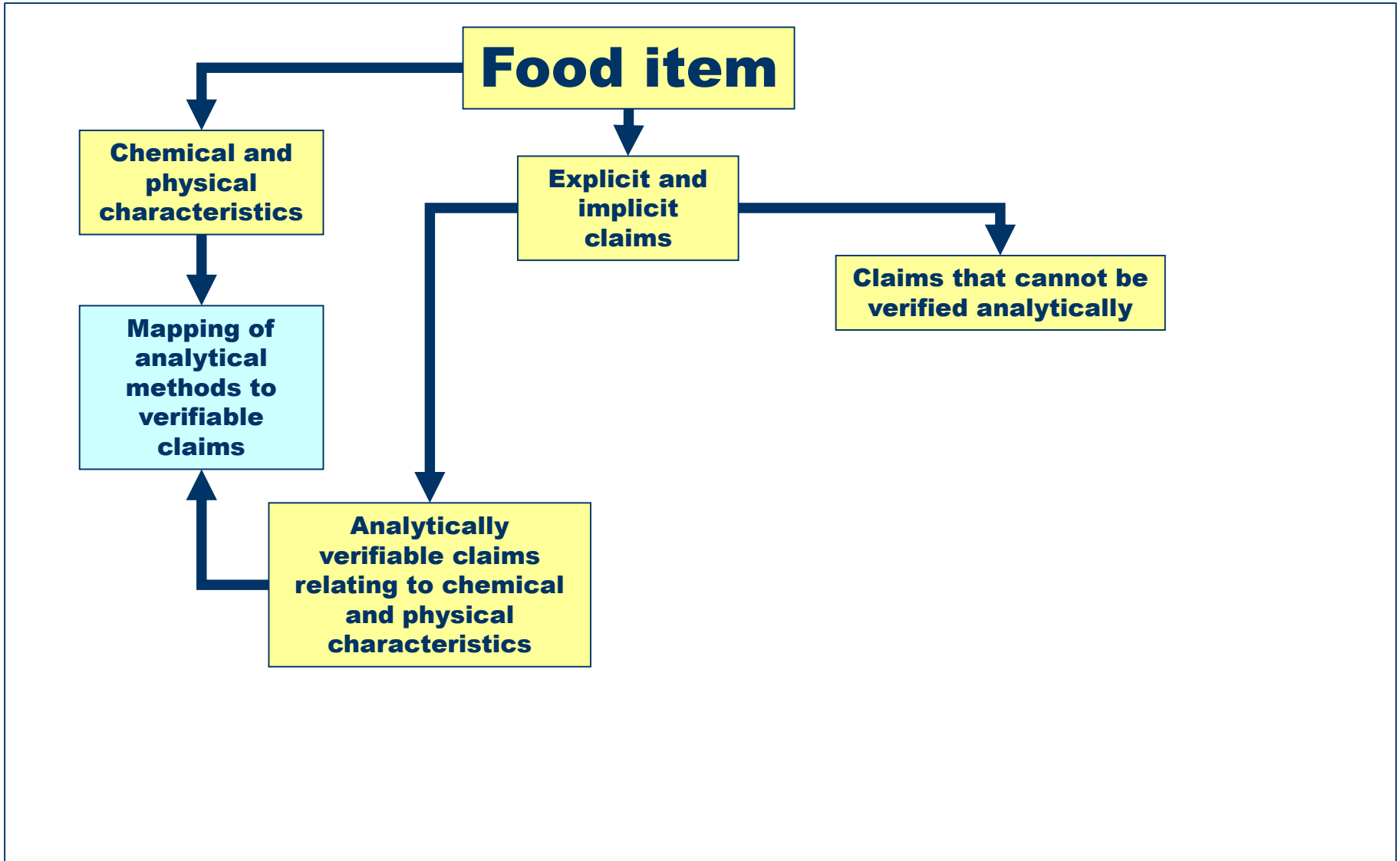
## Examples

- **Dioxin in Belgian chicken feed**
- **Cadmium in salmon feed**
- **Sudan Red**
- **Nitrite in smoked salmon**
- **Wrong species declaration for sushi fish**
- **Horsemeat sold as - / mixed with beef**





# Matching claims to characteristics

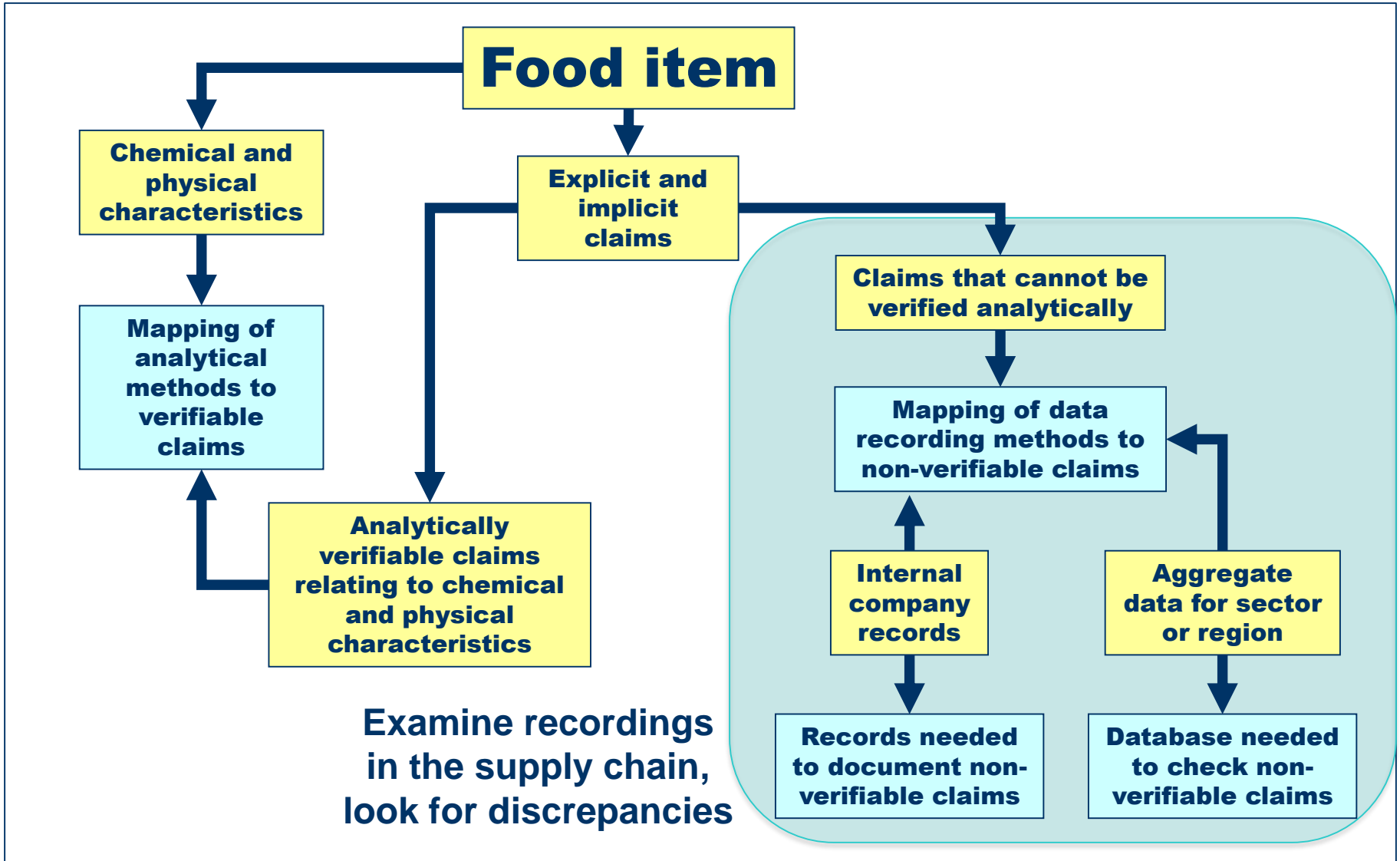


# Characteristics not verifiable by analytical methods

- Volume, Weight, Amount, Value
- Batch / lot number, Owner
- Origin, country of origin
- Eco-label, other value adding labels
- Organic production (also has some analytical components)
- Halal, Kosher (also has some analytical components)
- Most properties relating to sustainability or ethics



# Matching claims to characteristics



## Data recording based methods

Methods for identifying discrepancies in the data recorded in the supply chain that might indicate lack of authenticity or fraud:

- Input-Output analysis
- Mass-balance accounting

Method / technology that prevents tampering with data recorded in the supply chain:

- Blockchain technology

**In EU-China-Safe, we study the mass balance for the wine export from France to China, and we implement a blockchain-based traceability solution for pork exported from UK to China**



# Input-Output analysis

For companies, sectors or regions: Compare records and reports showing landing, production and export.

**Where does the product come from?**

	Reported amount fish / product landed into region:					
1000 tons	Landed	Finnmark	Troms	Nordland	Other	Sum
Finnmark	61254		1439	0	217	62910
Troms	70853	163		513	0	71529
Nordland	88188	0	128		85	88401
Andre	49005	0	0	212		49217
Sum	269300	163	1567	725	302	272057

Reported amount fish / product used or sold						
1000 tons	Processed	Norway	EU	Russia	Other	Sum
Finnmark	20131	11324	18244	10695	7549	67943
Troms	20028	10014	17167	12160	10014	69383
Nordland	26520	14144	25636	12376	9724	88401
Andre	15257	8367	14273	8859	4430	51186
Sum	81937	43849	75320	44090	31717	276913

**Significant discrepancy!**

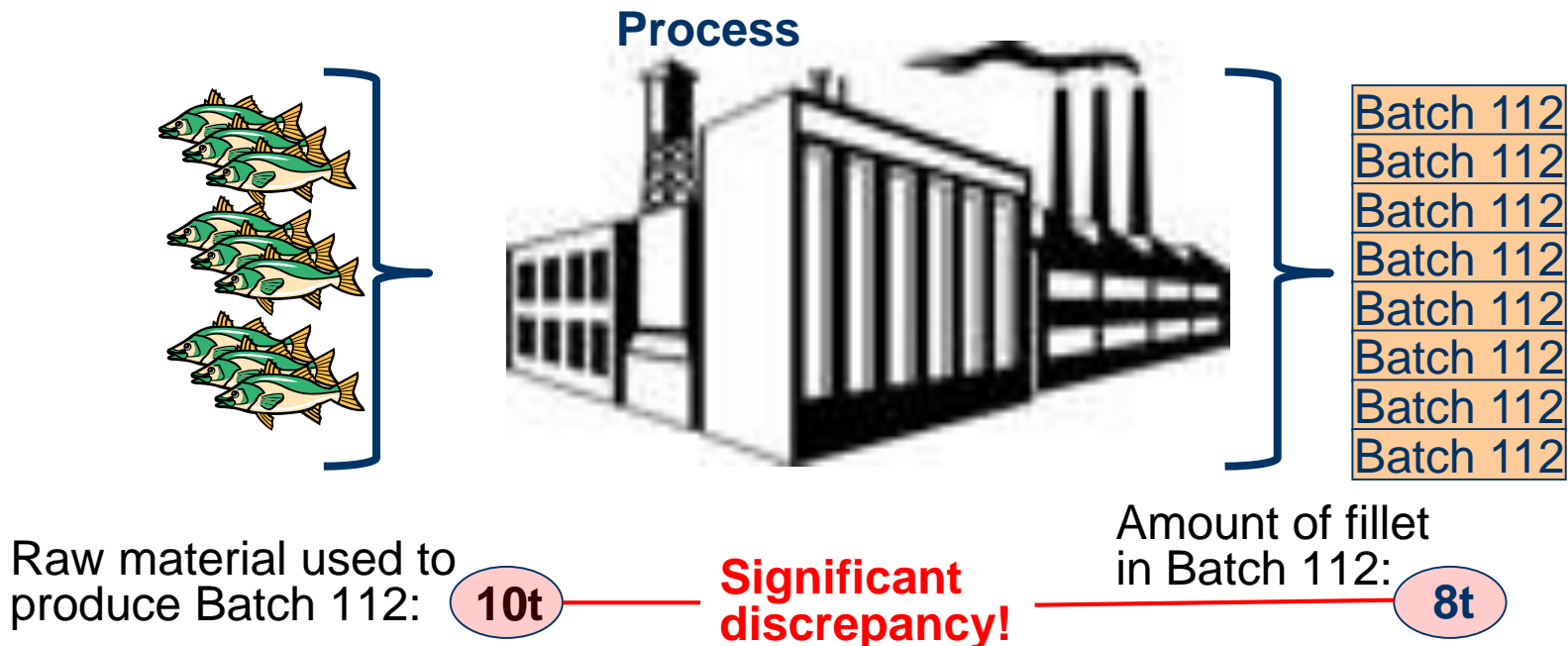
**Where does it go?**





# Mass-balance accounting

For processes: Using our knowledge of the raw material and the process type to establish typical or optimum conversion / yield factors, and then comparing process input with process output.



# What is a blockchain?

*The blockchain is an incorruptible digital ledger of (economic) transactions that can be programmed to record not just financial transactions, but virtually everything (of value)*

*Don & Alex Tapscott, Blockchain Revolution (2016)*

**A blockchain is just a database, with some particular properties**





# Blockchain properties



**Online**  
(many users)



**Distributed**  
(many copies)



**Database**



**Synchronised**  
(every 10 minutes)



**Encrypted,  
Immutable,  
Tamper-proof**



# Blockchain and food traceability

- It will forever be clear who recorded claims relating to transformations or unit attributes
- Some unit attributes will be inherited from the predecessors in the supply chain (e.g. species)
- Data on transformations will have to refer to units already in the blockchain
- The recordings in the blockchain will make it easier to do input-output analysis
- Integrating data from different traceability systems will be easier if they are all blockchain-based



# Summary and conclusions

- Analytical methods are essential, but cannot alone solve the problem of ensuring food authenticity
- Some food authenticity challenges involve claims of a type that cannot be verified analytically
- Input-Output analysis and Mass-balance accounting can identify discrepancies in the data
- Data recording methods can make analytical sampling more efficient by indicating where, when and who to sample
- Blockchain technology can make data recording permanent and transparent, and tampering more difficult, but there is an efficiency cost
- Blockchain technology can make traceability system integration easier



# Thanks for your attention

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