

Should Traceability Systems in the Food Industry be Based on Blockchain Technology?

International Conference: Global commodity chains from a risk assessment perspective, Berlin, May 27th 2024



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About Nofima

Nofima is a private, non-profit research institute owned by the Norwegian government with head office in Tromsø, around 400 employees in six different locations around Norway, and turnover in 2022 of 700 MNOK.

Nofima was founded in 2008 when four former public food research institutes merged: **Norconserv**, **Matforsk**, **Akvaforsk**, and **Fiskeriforskning**. Our research is organised into divisions for **Aquaculture**, **Agri-food**, and **Seafood**.

Research areas:

- Raw materials, primary production, breeding, feed
- Processing, packaging, quality, food safety
- Sustainability, governance, societal impact
- Socio-economics, market research, consumer research, information logistics, traceability, blockchain technology



What is traceability?

Traceability:

The ability to trace the history, application or location of an entity by means of recorded identifications.

For products this includes:

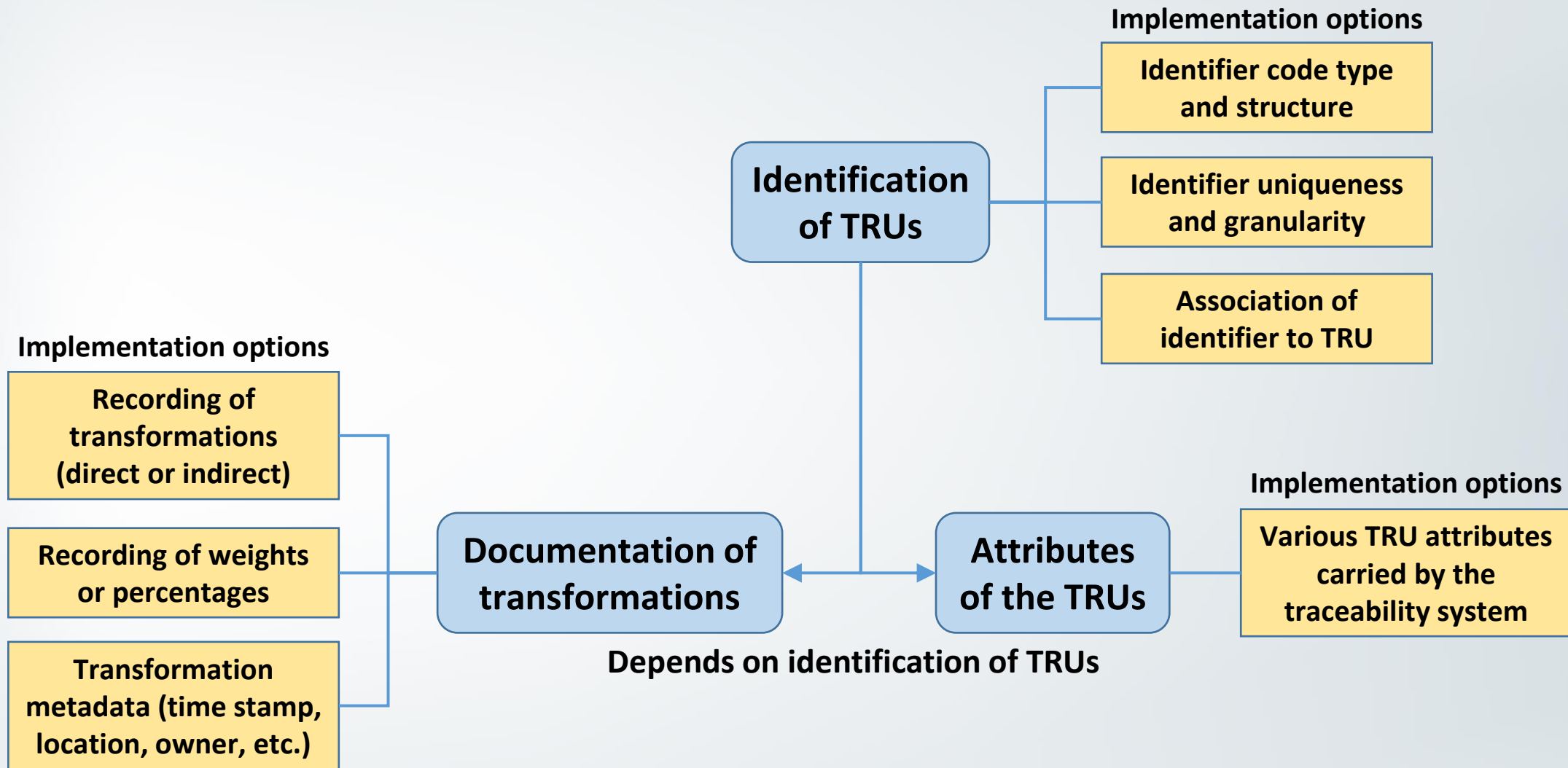
- Origin and characteristics of all materials, ingredients, and parts
- Process history, Location at any given time

What traceability is not:

- A traceability system is a system of claims, not (necessarily) facts
- Laboratory / analytical methods are means of verification, not traceability
- Chain of Custody systems protect given characteristics, not traceability

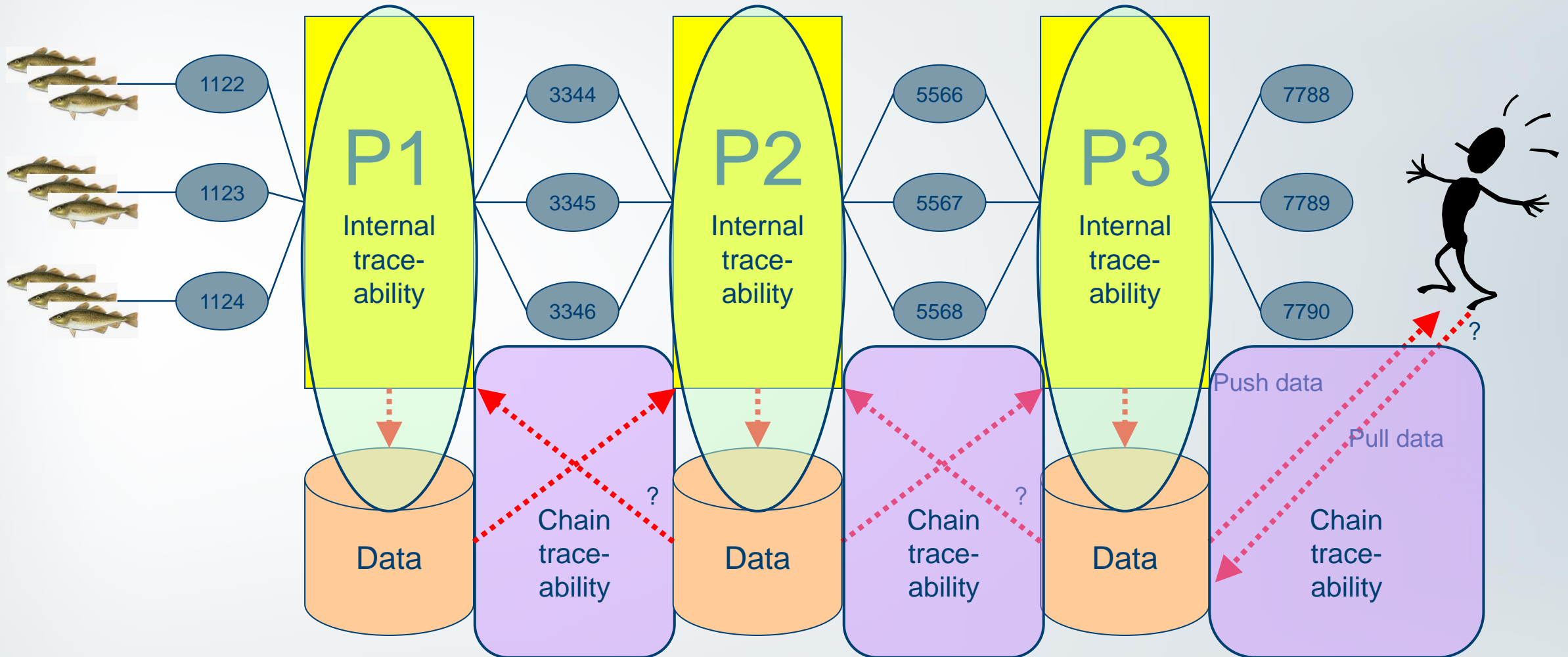
Olsen, Borit (2013): "How to define traceability". doi:10.1016/j.tifs.2012.10.003

The components of a traceability system

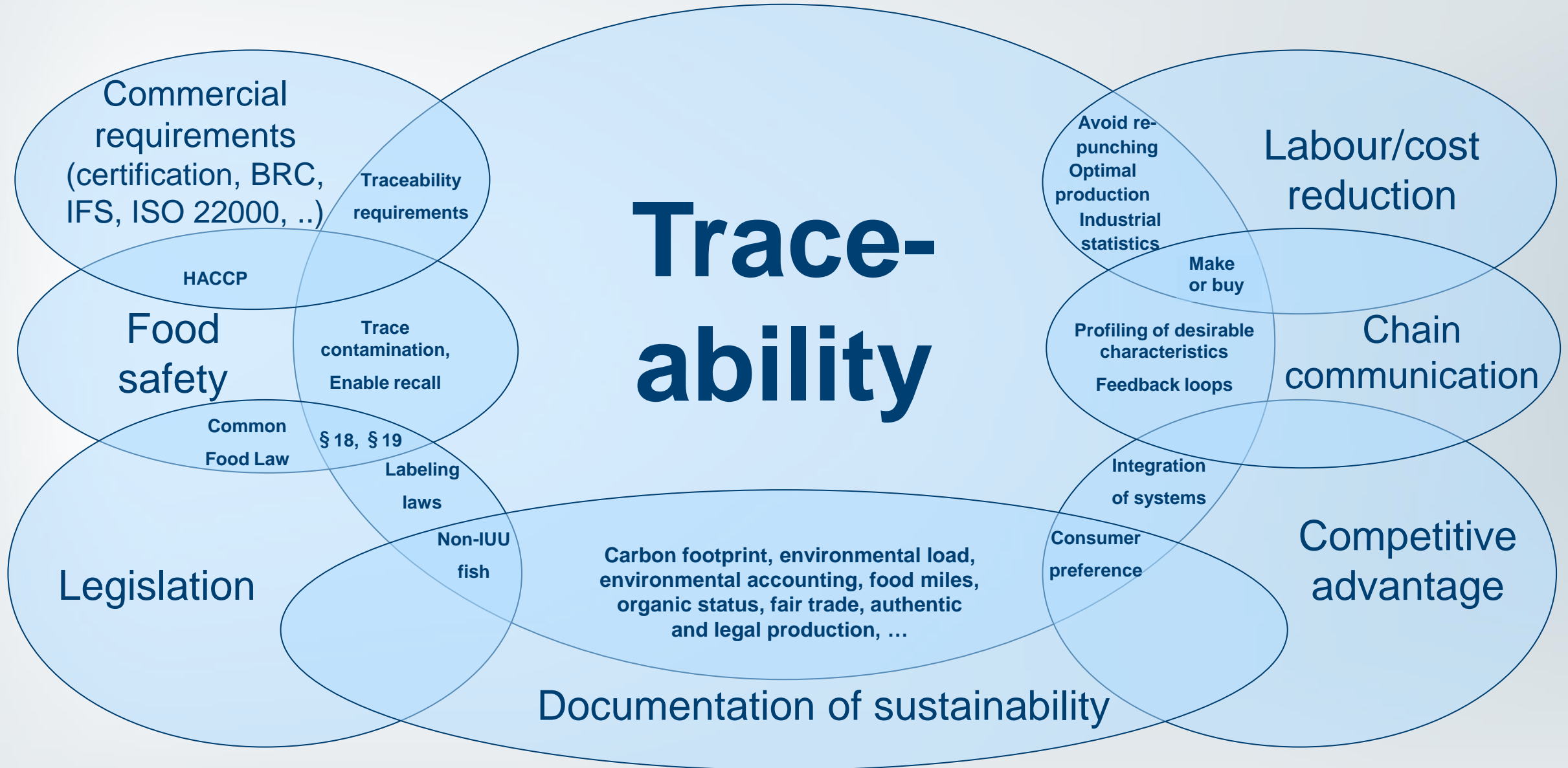


Olsen, Borit (2018): "The components of a food traceability system". doi:10.1016/j.tifs.2018.05.004

Internal traceability and chain traceability



Why traceability?



How can we detect or prevent food fraud?

① Determine the chemical, physical, or sensory characteristics of samples and check if they match the description provided

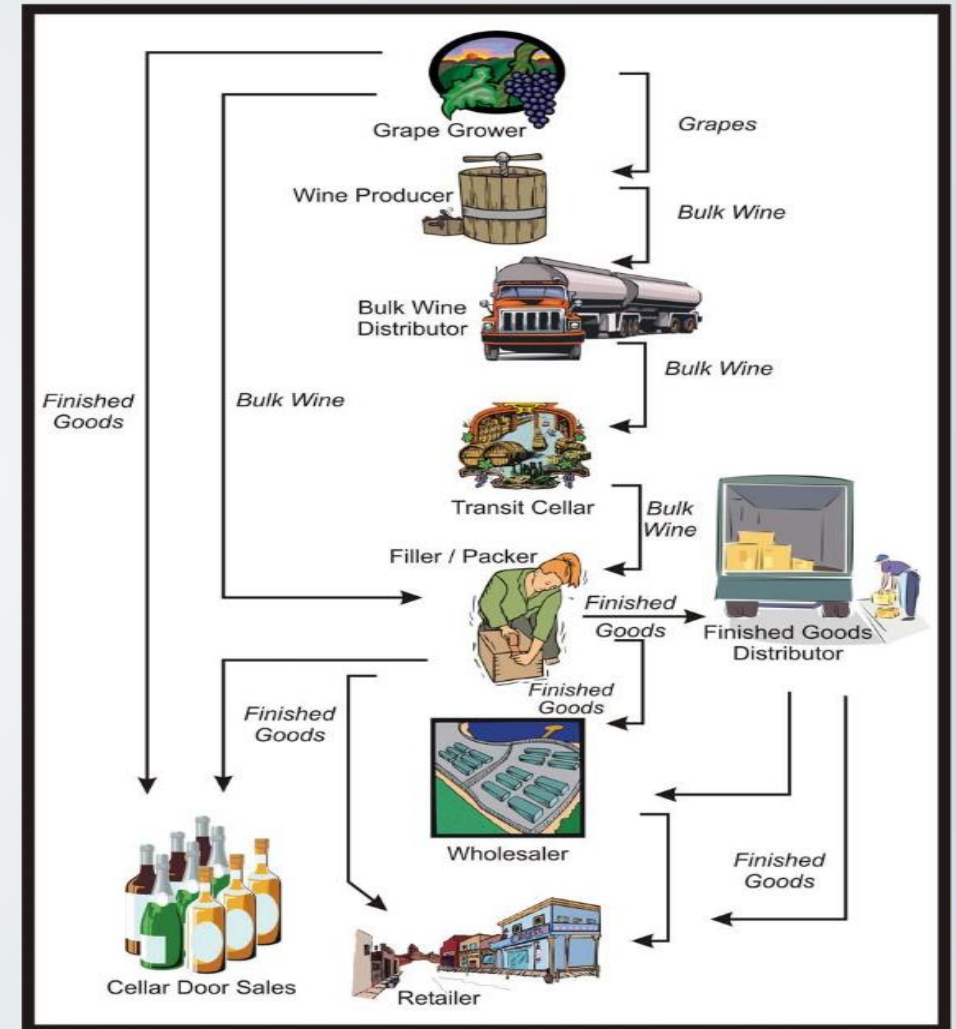


DNA-based analyses, Stable isotope and trace element analyses, Liquid / Gas Chromatography (LC/GC). Nuclear magnetic resonance (NMR) spectroscopy, Vibrational spectroscopy, including near-infrared (NIR) or Raman spectroscopy, Mass spectrometry, Microscopy, General food chemistry analysis, Sensory analysis, ...

How can we detect or prevent food fraud?

② Analyze the supply chain, and look for discrepancies in the recorded data

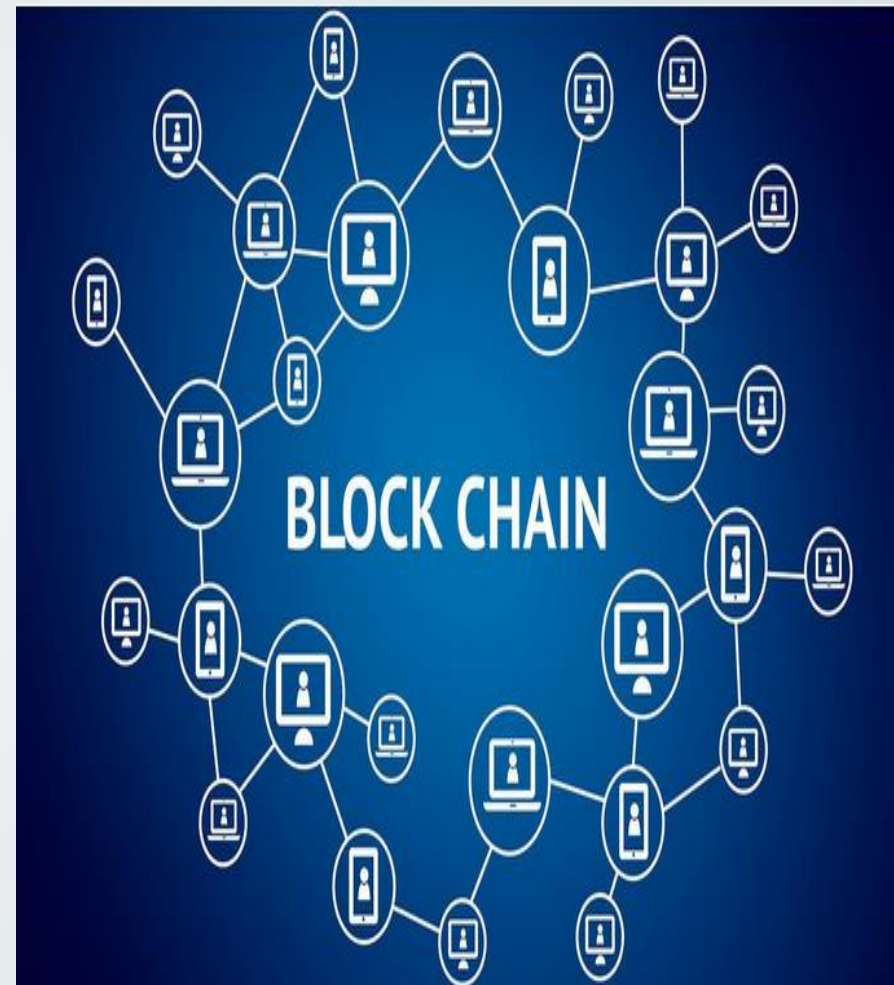
- Supply chain mapping and analysis
- Input-output analysis
- Mass-balance accounting



How can we detect or prevent food fraud?

③ Prevent data from being tampered with; document origin and ensure integrity of recorded data

- Digital Ledger Technologies (DLTs)
- Blockchain technology



What is 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)

Sample transaction: From account: 1234, To account: 5678, Amount: 1 BTC

Blockchain is a database of transactions



Online
(many users)

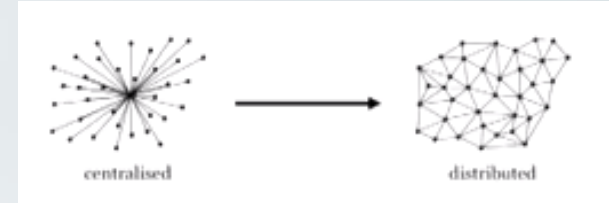


Synchronised
(every 10. minutes)



Database

Records transformations,
not state values



Distributed
(many copies)



**Encrypted,
Immutable**

Blockchain in the food industry



Blockchain In Retail Market Is Expected To Reach around USD 30,641.76 Million by 2030, Grow at a CAGR Of 91.67% during Forecast Period 2023 To 2030 | Data By Contrive Datum Insights Pvt Ltd.

BUSINESS 6 SEPTEMBER 2022

Eileen Brown



ID Food taps local tech firm to build blockchain-based fish exchange

China Dialogue Ocean

Aditya Hadi (The Jakarta Post)
and Agriculture



From farm to fork, using blockchain for transparency and traceability across the food industry

BUSINESS ASSURANCE

Tracing seafood with technology

Blockchain can revitalize industry by boosting trade



Is Blockchain Technology Optimizing the Supply Chain System in Food and Agriculture Industry?

Dronecharya Dave / 27 May 2022 / Blockchain / ReadWrite



Use of blockchain technologies in the seafood industry to reduce fish loss and IUU fishing



UNITED KINGDOM

Thursday, July 09, 2020, 01:00 (GMT + 9)

May 4, 2018

Blockchain in seafood discussion at Advania in Iceland

IMPORTANCE OF BLOCKCHAIN TECHNOLOGIES IN SEAFOOD INDUSTRY

Fish Focus



Food and Agriculture Organization of the United Nations

FIAM/C1207 (En)

FAO Fisheries and Aquaculture Circular

ISSN 2070-6065

TOPICS

BLOCKCHAIN APPLICATION IN SEAFOOD VALUE CHAINS



Scottish Government project explores use of blockchain and AI in fishing

Written by Liam Kirkaldy on 17 January 2020 in News
Highlands and Islands Enterprise to run scheme looking at

FORBES > INNOVATION

Using Blockchain Technology To Increase Transparency In Agriculture



Jeff Bradshaw Forbes Councils Member

Forbes Technology Council COUNCIL POST | Membership (Fee-based)

Norwegian seafood industry association partners with IBM on blockchain

The network can give Norway's seafood industry a premium edge compared to other markets.

<https://blockmatnet.com> has updated links to "blockchain in food industry" news stories

Blockchain and supply chain



Online
Virtual

Getting accurate data into the blockchain is the challenge



Physical

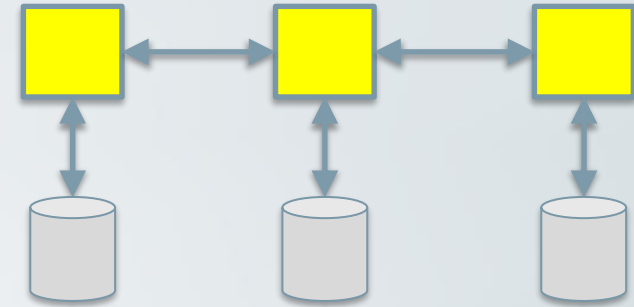
Development of traceability systems



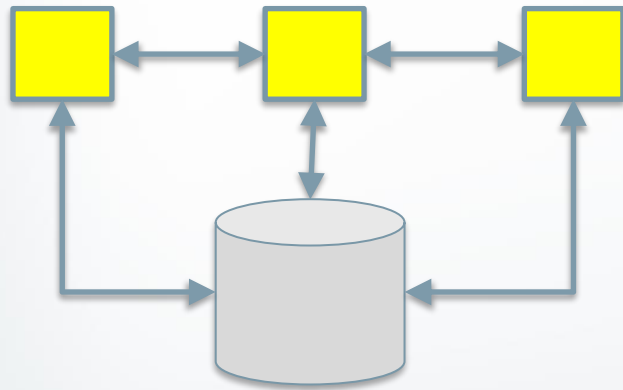
① Paper based local systems, physical ledgers



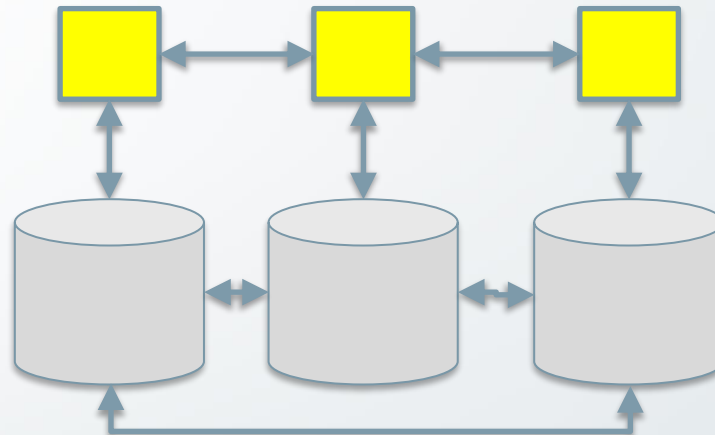
② Digital local systems, Excel, Access



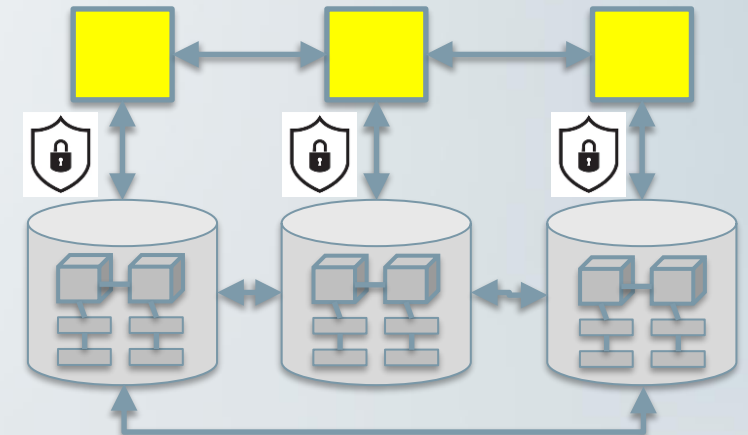
③ Electronic Data Interchange (EDI) systems, one-up, one down



④ Centralised databases, chain traceability

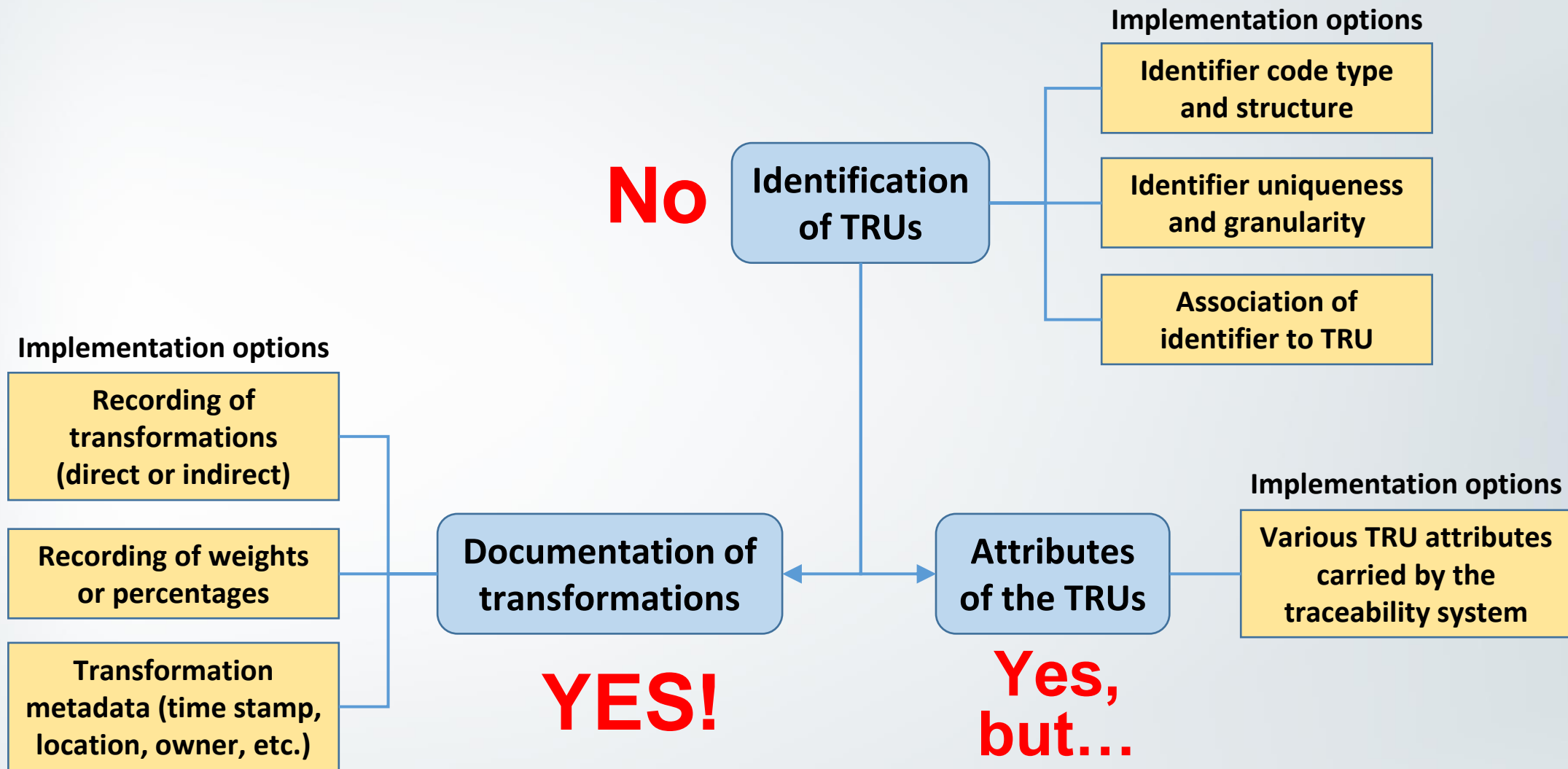


⑤ Distributed databases, chain traceability



⑥ Blockchain-based encrypted systems, immutability

Can blockchain improve the traceability system?



Desired quality of the system	Does blockchain offer an advantage?
Data quality and veracity	
Trust and transparency	
Data confidentiality, ability to provide tiered data access	
Performance and efficiency	
Robustness, fault tolerance	
Interoperability	

Olsen, Syed, Borit, Boechat (2022): "Application, limitations, costs and benefits related to the use of blockchain technology in the seafood industry". Nofima report 05/2022 available at <https://nofima.com>

Blockchain trade press articles ...

“It is estimated that 10% of adulterated and tampered products are isolated, preventing product recalls.”



“Blockchain products are identified and product recalls.”

“In [a Walmart] seconds to blockchain, it took hours and 26

it took 2.2 farm. Without er six days, 18 original farm.”

Blockchain summary

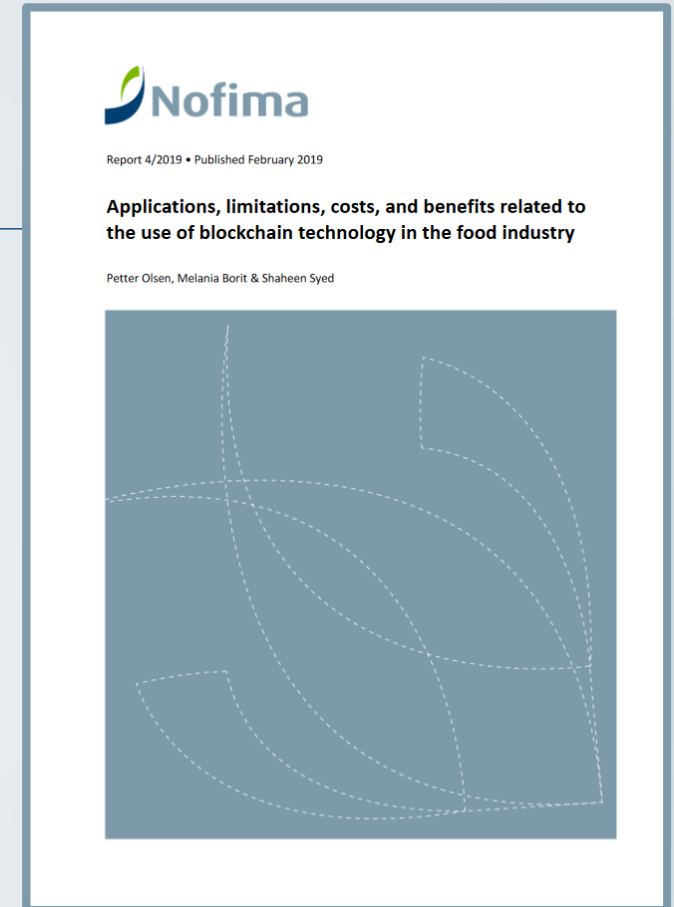
- Duplication of data takes a lot of space and time
- Synchronization can take a lot of time and energy
- Designed for anonymous systems with no / low trust
- Designed for equal rights wrt. adding data, not designed for asymmetric use
- Duplication means robustness
- Immutable data increases transparency and trustworthiness, makes it easier to identify fraud
- Well suited for documenting transactions rather than state values; important in a traceability system
- Easier to integrate data from different sources

Thanks for your attention

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