Methods and technologies for verifying data recorded in a traceability system

Market Advisory Council, WG2 presentation, 20. September 2021

Petter Olsen, Nofima, Senior scientist

About Nofima

Nofima is a private, non-profit research institute owned by the Norwegian government with head office in Tromsø and over 390 employees in six different locations around Norway.

Nofima was founded in 2008 when four former public food research institutes merged:

o   Norconserv – canned and preserved foods, Stavanger

o   Matforsk – food from agriculture, Ås

o   Akvaforsk – aquaculture related research, Sunndalsøra

o   Fiskeriforskning – seafood and processing, Tromsø

Main areas of work:

o   Aquaculture and fisheries – raw materials

o   Food from agriculture and aquaculture – processes and products

o   Consumer and market research, which includes:

  −   Consumer research, buying behaviour, food and context

  −   Innovation and product development

  −   Traceability, sustainability, environmental accounting

Turnover in 2020 was around 65 Million Euros

The components of a traceability system
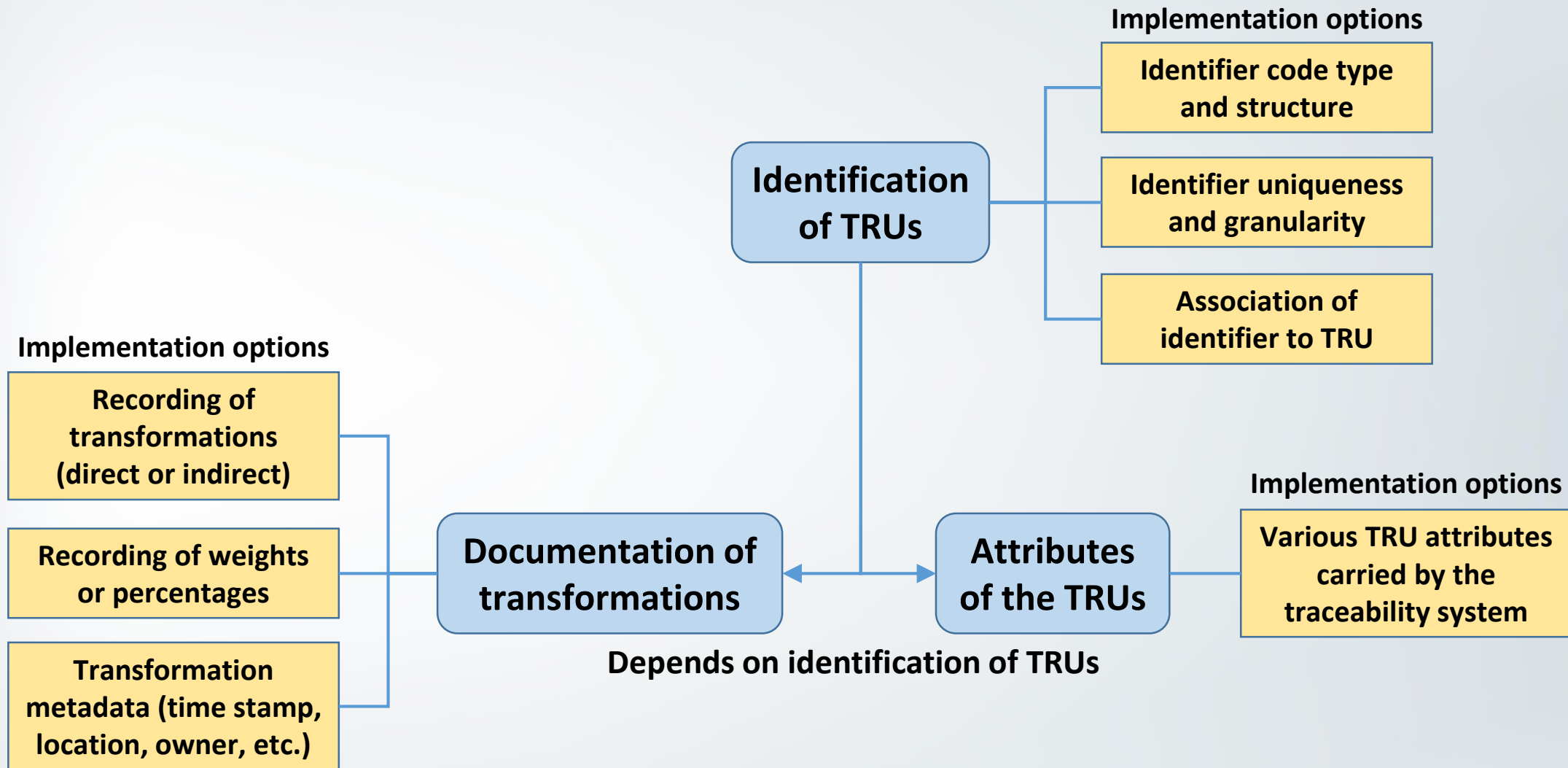
Verifying claims in a traceability system

A traceability system contains claims about product (TRU) characteristics / attributes. How can we check if these claims are true (or at least ensure that the original claims remain unaltered)?

1. For claims / characteristics with a biochemical component – Analytical methods

2. Matching recordings in one place with recordings in another place – Input-Output analysis

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Input-Output analysis

For companies, sectors or regions: Compare outputs from previous link in the supply chain with inputs to next link in the chain; identify discrepancies.

Where does the fish come from?

1000 tons	Landed	Finn-mark	Troms	Nord-land	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 landet into region:

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

Where does it go?

Significant discrepancy!

Verifying claims in a traceability system

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3. Using our knowledge of processes to identify discrepancies / unrealistic yields – Mass-balance accounting

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.

Process

| Batch 112 |
| Batch 112 |
| Batch 112 |
| Batch 112 |
| Batch 112 |
| Batch 112 |
| Batch 112 |
| Batch 112 |

Raw material used to produce Batch 112: **10t**

Significant discrepancy!

Amount of fillet in Batch 112: **8t**

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4. Using blockchain-based technologies to record the data to ensure that we know who recorded, and that data is unchanged

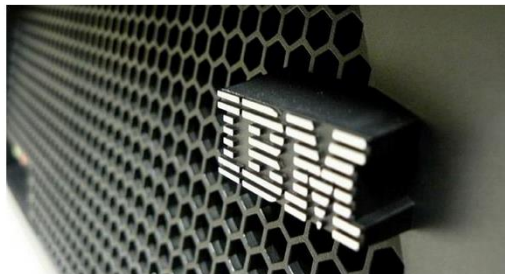20/09/21

Blockchain in the seafood industry

IMPORTANCE OF BLOCKCHAIN TECHNOLOGIES IN SEAFOOD INDUSTRY

Fish Focus ·

May 4, 2018

Blockchain in seafood discussion at Advania in Iceland

IntraFish

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IBM

Norwegian seafood industry association partners with IBM on blockchain

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

Food and Agriculture Organization of the United Nations

FIAM/C1207 (En)

FAO Fisheries and Aquaculture Circular

ISSN 2070-6065

BLOCKCHAIN APPLICATION IN SEAFOOD VALUE CHAINS

Norwegian Salmon Exporter Fights Food Fraud With Blockchain

Norwegian salmon producer Kvarøy Arctic has joined the IBM Food Trust to increase transparency and help prevent fraud in the seafood industry.

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marin Trust | MARINE INGREDIENTS RESPONSIBLY SUPPLIED

BLOCK CHAIN

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

🇬🇧 UNITED KINGDOM
Thursday, July 09, 2020, 01:00 (GMT + 9)

Salmon farmers urged to adopt blockchain technology

By Vince McDonagh - 7th July 2020

Kvarøy Arctic CEO Alf-Goran Knutsen

Blockchain technology has suddenly become a new tool in aquaculture in helping to ensure traceability from farm to plate and eliminating fish fraud.

PT PublicTechnology.net

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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 how new tech could be used in seafood sector

September 2008

October 2008

Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
satoshin@gmx.com
www.bitcoin.org

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.

1. Introduction

Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model.

The identity of Satoshi Nakamoto is still unknown

Blockchain news articles …

"It is estima... products are adulterate... blockchain] tampered p... entified and isolated, pr... luct recalls."

"In [a Wal... it took 2.2 seconds to ... rm. Without blockchain, t... er six days, 18 hours and 26... original farm."

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
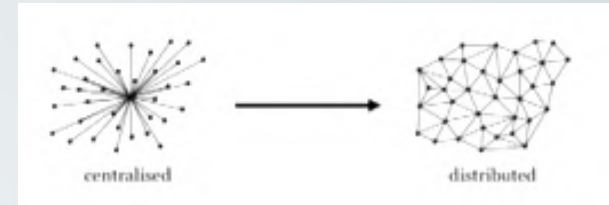
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Blockchain is a database of transactions

Online
(many users)
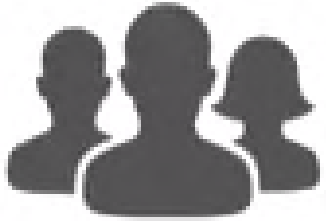
Distributed
(many copies)

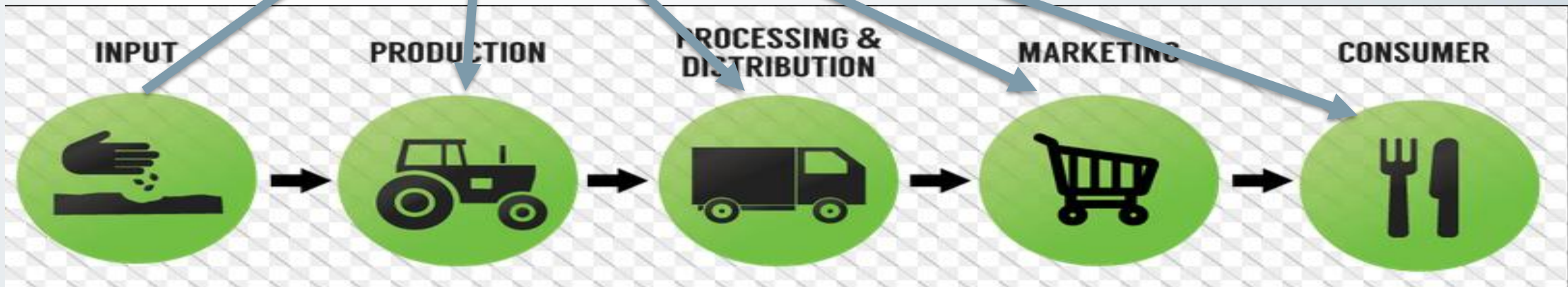**Database**

Synchronised
(every 10. minutes)

**Encrypted,
Immutable**

Blockchain and supply chain

Online
Virtual

Physical

Getting accurate data into the blockchain is the challenge

INPUT
PRODUCTION
PROCESSING & DISTRIBUTION
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Can blockchain improve the traceability system?

No **Identification of TRUs**

Identifier code type and structure

Identifier uniqueness and granularity

Association of identifier to TRU

Recording of transformations (direct or indirect)

Recording of weights or percentages

Transformation metadata (time stamp, location, owner, etc.)

Documentation of transformations

YES!

**Attributes of the TRUs**

Yes, but…

Various TRU attributes carried by the traceability system

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Summary

- Blockchain is an exciting technology that has the potential to underlie a major technological paradigm shift

- Solution providers are currently overselling the benefits of systems based on blockchain technology

- Confidentiality and speed can be a challenge for traceability systems based on blockchain technology, but otherwise the technology is well suited for the purpose, and interoperability will be simpler

- For traceability in the supply chain, blockchain can remedy some potential problems because while claims that are recorded in the blockchain might still be wrong, it will be quite clear who made these claims, and we will know that these claims have not been tampered with

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For more details…
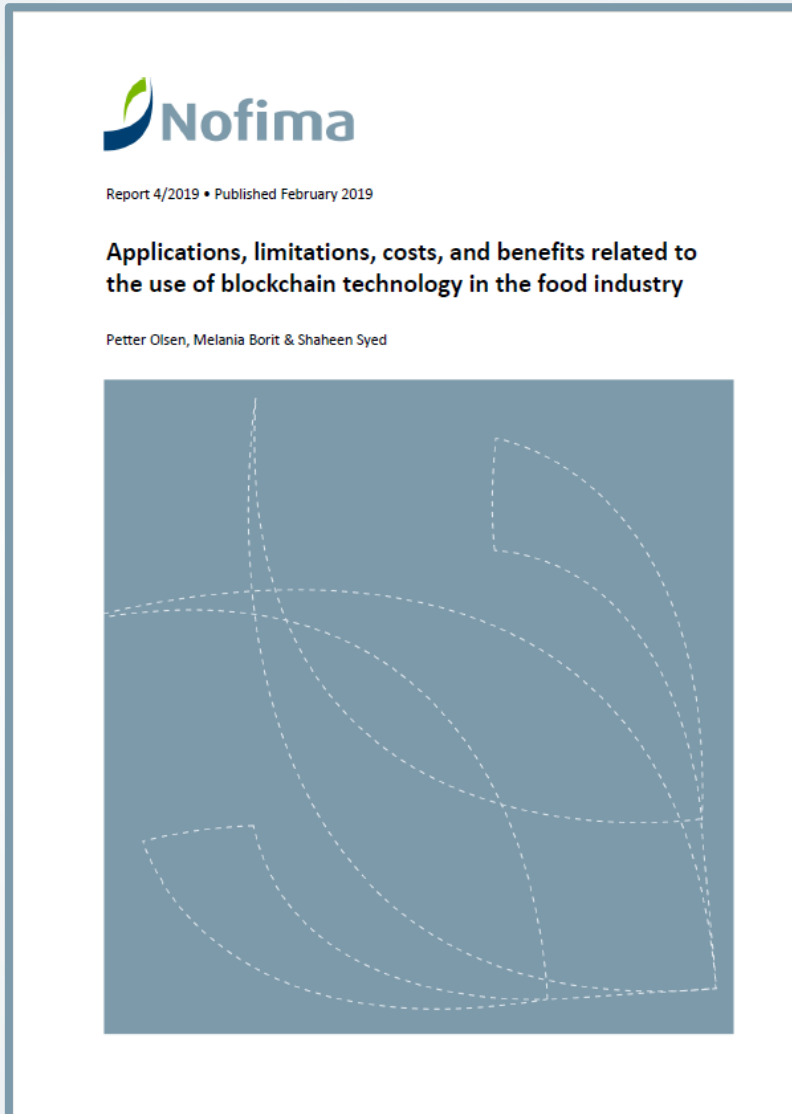
Nofima Report 4/2019

Applications, limitations, costs, and benefits related to the use of blockchain technology in the food industry

20/09/21

Thanks for your attention

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www.nofima.no