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ICT STANDARDISATION OBSERVATORY AND SUPPORT FACILITY IN EUROPE

Forging international ICT standards

International collaboration, knowledge exchange and the social contract

Fiona Delaney

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Open standards contributions

Co-editor: ISO DTR3242 DLT use cases
Co-editor: ISO TR6277 DLT data flows

Contributor: ITU_T FG DLT 1.2 use cases
Art, Entertainment and eSports (2019)

Contributor: UNCEFACT/UNECE
Cross-border blockchain interoperability: legal, technical and governance (2022)

Contributor: ISO DTR6039 Subject and object identifiers for use in DLT design
Agri-food (2022)

Co-author: IEEE P2418.3 Framework for Blockchain and Agriculture

Liaison: ISOTC307 Blockchain DLT/TC211 GIS

FIONA DELANEY

CEO @ Origin Chain Networks

Winner: National Innovation Award 2020 &
EU Innovation + Standards Award 2020

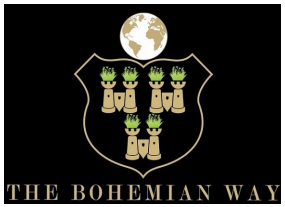
Chair @Blockchain Ireland#Startups
Co-Chair @ EUOS/Block
Advisor: Trust-Eat, Plastiks.io

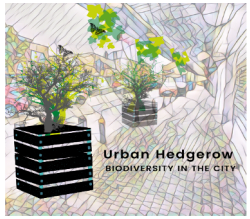
MSc Software Eng, BSc Comp Sci.
Hdip. Arch+Eng Business + Bioeconomy
B.Arch+Eng. Landscape Management

ORIGINCHAIN Networks

Open source
Open data
Open innovation

Community action & citizen science





EUOS EU Observatory for ICT Standardisation

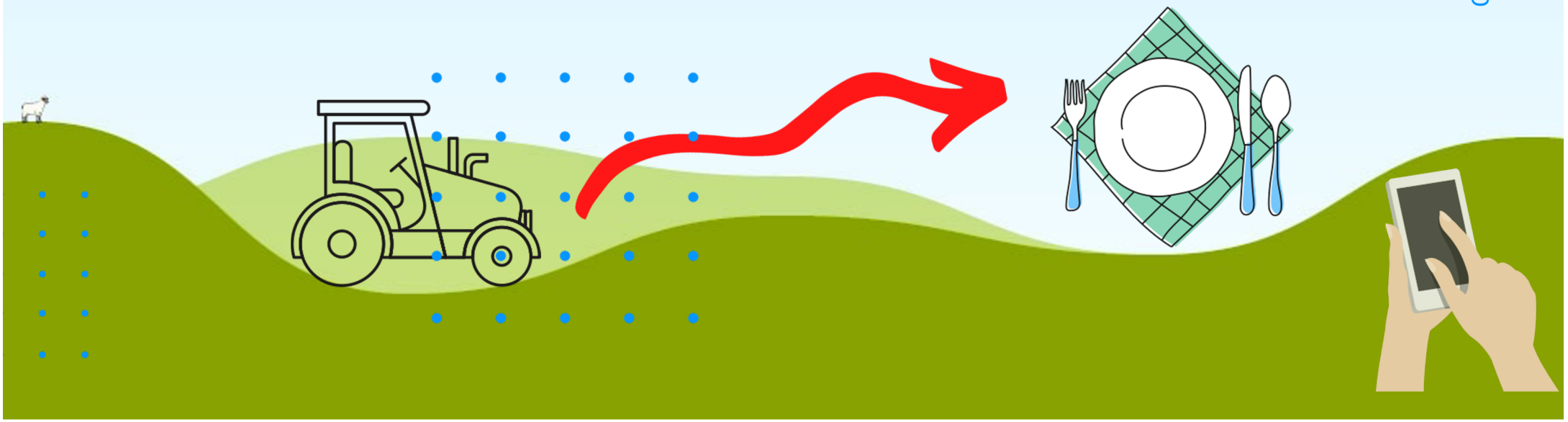
BLOCKCHAIN IRELAND

eit | European Institute of Innovation & Technology

Problem

Gaps in the origin story of food

Provenance + farming practice	Freshness + time to market	End of life waste mgt



ORIGIN CHAIN NETWORKS AGRI-TRUST

Co-creation of digital food provenance

ORIGIN CHAIN NETWORKS AGRI-TRUST

Provenance + farming practice

	gCO2e/kg
Dairy	4.5g
Beef	20 g

80% accumulates over lifetime on farm

Freshness + time to market

gCO2e/kcal		Retail
5 kcal	+	up to 12%
14 kcal	+	up to 23%

10% transport

10% storage

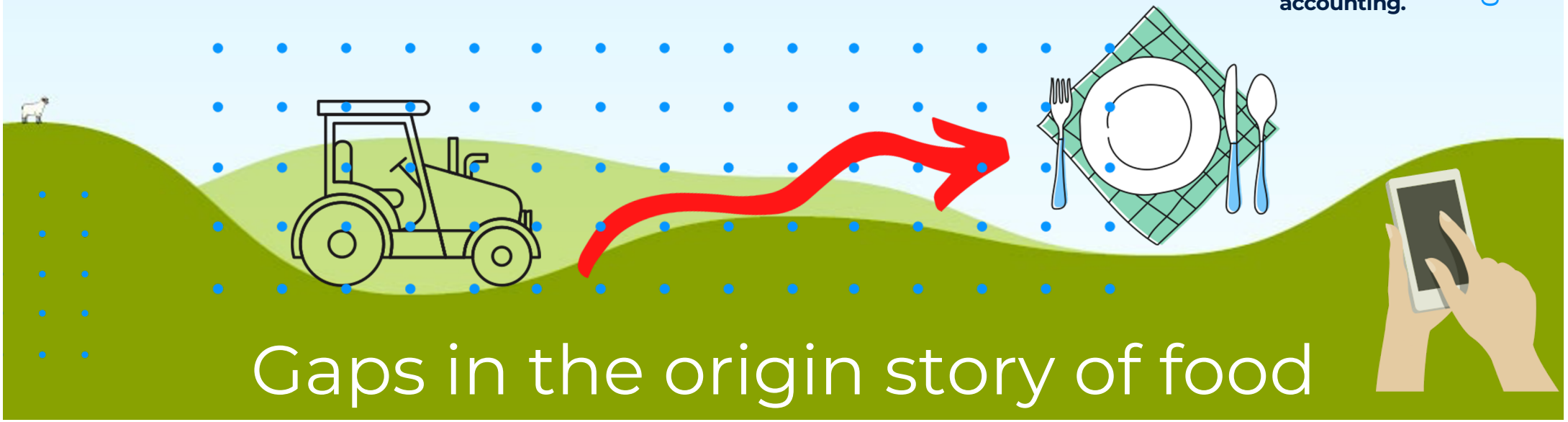
End of life waste mgt

Consumer	Waste
6%	18%
31%	56%

+18-56% loss due to waste

Carbon Footprint Analysis

GHG Protocol Scope 3: corporate value chain accounting.



Gaps in the origin story of food

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ISOTR3242:2022 DLT use cases
Universal Farm Compliance

Award-winning open source solution to digital trade and interoperability challenges in the single digital marketplace.

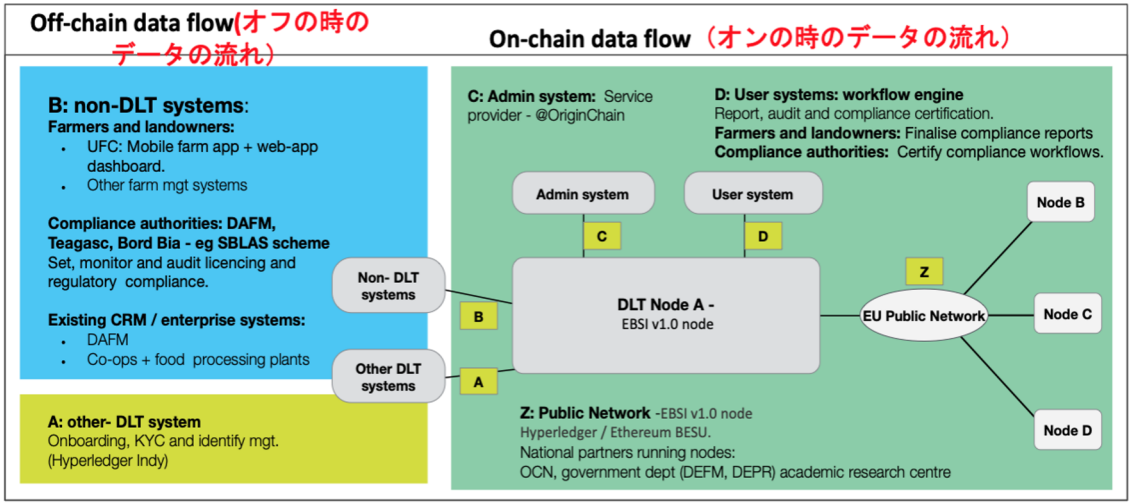
F. Delaney – Individual researcher
Winner: CENLEC Innovation + Standards Award 2020

@OriginChain - Company
Winner: NSAI National Innovation Award 2020

Universal Farm Compliance App - on/off chain data flow analysis
汎用農業規制アプリ

Data-related operations of stakeholders: Farmers, landowners, agri-food compliance authorities (Dept. of Agriculture, Teagasc, Bord Bia and others eg Organic Trust), co-ops and food processors and technology service provider (OriginChain).

ORIGINCHAIN



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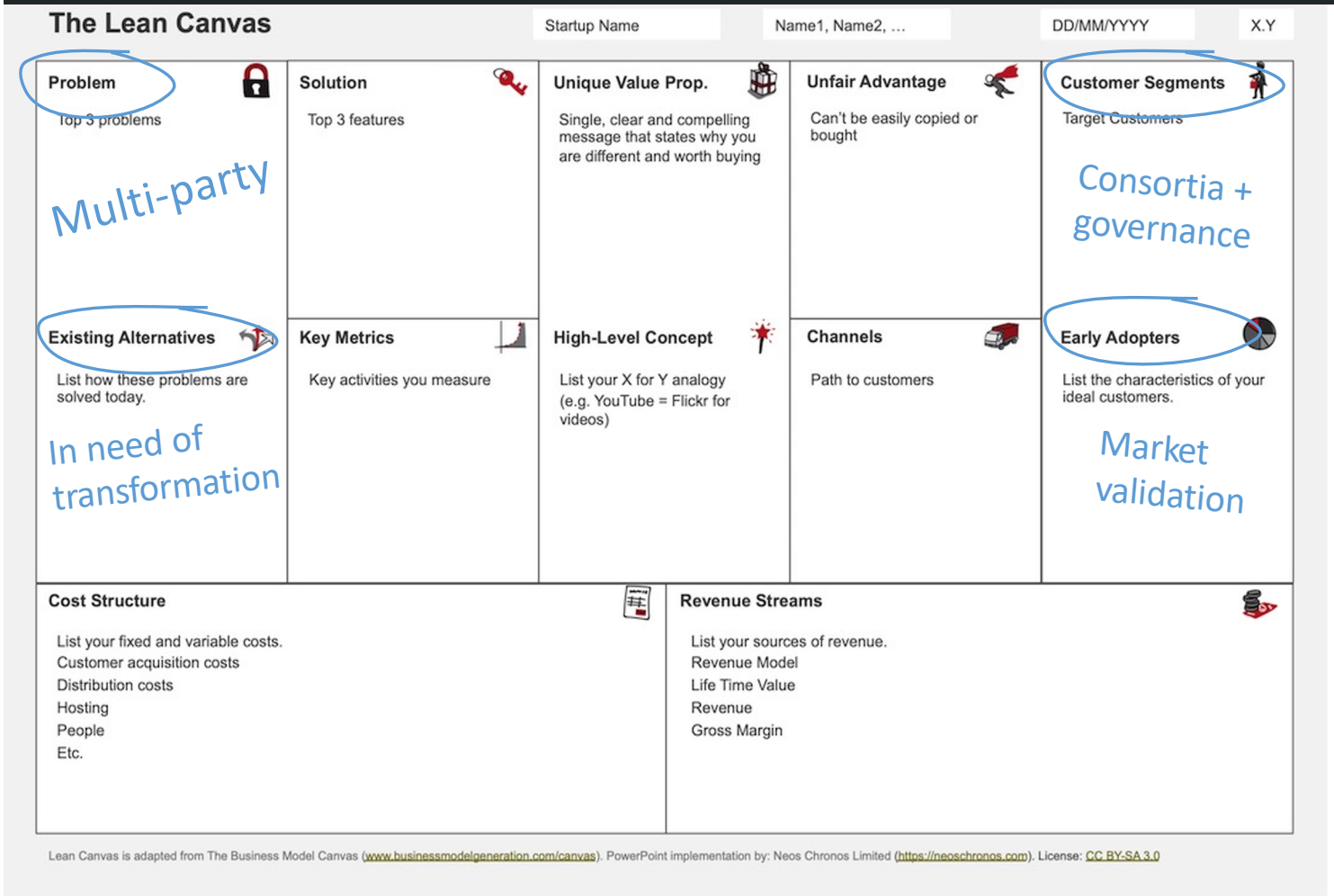
EU Standards and Innovation Award 2020
+ National Innovation Award 2020

NSAI

Tools for industry: Decentral Business Model Canvas



Note: are your customers system users or system viewers?

Are your users co-creators of value in the system? eg. prosumers; data owner-providers?

Blockchain: a tool for innovation

ISO 5000 series: Innovation Management

Blockchain offers "increased value for partners cooperating in a decentral network, by providing data and process integrity, automation potential and enabling the transparent transfer of values and rights."

Klein, S. (2018) A Use Case Identification Framework and Use Case Canvas for identifying and exploring relevant Blockchain opportunities. Proceedings 1st ERCIM Blockchain Workshop 2018
Reports of the European Society for Socially Embedded Technologies

Five agri-food contexts where DLTs are already implemented (Source: ISO DTR6039:2022)

Context	Description
Corporate social responsibility schemes	Corporate brand values are enhanced by limiting impact and/or protecting endangered habitats - boglands, native woodlands, fresh watercourses e.g. JBS's (global beef producer) Green Platform initiative in the Amazon.
Traceability optimisation	Farm to fork transparency, swift product recall and enhanced consumer trust e.g. IBM Food Trust, Trace Alliance and GS1 /EVRYTHNG pilot scheme
Food integrity assurance + fraud countermeasures	IGP, protected marine species and other high-value product category protection e.g. Consorzio Arancia Rossa, FishCoin, BeefLedger, TMail
Decentralised Finance (DeFi)	Peer to peer market place, transparent securitisation and crowd-funding. E.g. tokenising produce and on-farm assets in Argentina with Abakus Co., World Bank's sponsored Agri-Ledger Co. to deliver fair and timely payments to farmers in Haiti and Congo.
Industry/Agriculture 4.0/ Bioeconomy	Integrated approach to applying emerging technologies including Cloud (IoT, edge, fog and transparent computing) AI and DLT to accelerate, efficiency, sustainability and profitability. E.g. Breedr, Ripe.io, Origin Chain Networks

ISO TR6277 Data flow model for DLT use cases

Transformation in the global digital economy

Urban geography defines **5 sectors of an economy,** a continuum of distance from the natural environment, beginning with primary economic activity and the utilization of raw materials. (Fischer, 1939; Quiggin, 2014; Schafran, 2018).

20th Century economics quantified input-output relationships between industry sectors and enumerated the concept of 'value add'. In the 21st Century, the key is to account for the 'value of information'.

Purpose and justification

- **to develop a data flow model and framework for BDLT use cases with robust descriptive capabilities to enhance BDLT application design and interoperability.**
- Clear understanding of data types and data flows in use cases allows for better designed systems; better governance and risk management provision and a sound basis from which to perform interoperability modelling where use cases may require interoperability between BDLTs in an orchestrated systems environment.

References:

Fisher, A. G. (1939). Production, primary, secondary and tertiary. *Economic record*, *15*(1), 24-38.

Quiggin, J. (2014). National accounting and the digital economy. Economic Analysis and Policy, 44(2), 136-142.

Schafran, A., et al. (2018). Replacing the services sector and three-sector theory: urbanization and control as economic sectors. Regional Studies, 52(12), 1708-1719.

ISO TR6277 Data flow model for DLT use cases: case studies

Transversal	Horizontal	Vertical ISO DTR3242 use case categories
Public sector information and open data	Automation	Health informatics (ISIC Q) Sustainable agriculture (ISIC - A)

Pharmaledger ePI Project use case(ISO TC307/CENLEC JTC19 use case repository) Condova, G (2021)

The PharmaLedger introduces ePI or Electronic Product Information leaflets into the healthcare value chain. The use case describes OpenDSU (Open Data Sharing Units) a standard that defines how to store data and code outside the Blockchain (off-chain) in order to meet data self-sovereignty requirements. Data and code build a container which is cryptographically secured and anchored in the Blockchain, we call that a Data Sharing Unit (DSU). With this approach, we combine the benefits of Blockchain such as integrity, traceability, and non-repudiation while preserving confidentiality and data privacy for the data owners. OpenDSU is designed with privacy and security in mind. As OpenDSU is Blockchain technology agnostic, it supports any kind of programmable Blockchain technology.

Open-data earth observation resources in habitat classification in the production of sustainable food. Delaney, F. Solomon, M. (2021).

This paper discusses the precarity of utilizing Open-Source Resources (OR) in remote habitat classification on the part of non-public sector actors. Earth Observation (EO) is an emerging tool in the digital transformation process and technology start-ups, social change policymakers and food traceability stakeholders are keen to access this potential. The importance of the food value chain traverses all economic sectors (Fisher, 1939; Quiggin, 2013; Schafran, 2018;) and the imperative to forge trusted value chain transparency, interoperable data availability, and data governance strategies are required (Criado and Gil- Garcia, 2019).

BLOCKCHAIN IRELAND

European DIGITAL SME Alliance

D4A Democracy4All
BLOCKCHAIN FOR GOVERNANCE

Blockchain Ireland

#StartupsLunchbox

Podcast events **@1pm IST**

[Bitesize conversations with DLT entrepreneurs and trailblazers from Ireland and overseas. Emerging trends, early adoption and advice on getting started]

BCIRL #Startups YouTube Channel Link

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Blockchain and the Bioeconomy

H. Mooney, F. Delaney. Copyright @ Origin Chain Networks 2022

Problem/Background

Background: EU/IE Regulatory context: A European Green Deal, EU Environment Law, EPA Licencing, The Digital Markets Act, EU Data Regulation and Data Strategy, EU Open Source Software Strategy, European Electronic Communications Code (EECC).

Problem: how to accelerate growth and minimize risk for the bioeconomy in Europe [1], coordinating climate action, regulation and cross-border inter-operable infrastructure. The transition from a fossil-based economy to a bioeconomy happens at three levels: technological, organizational and social [2]. We determine that cloud architecture and converging technologies such as blockchain, AI and IOT are now available to enable techno-social solutions in the climate-action sphere.

Requirements: a holistic, measurable view of the bioeconomic value chain, with capacity to model existing and future challenges.

Current challenges: Incoherent ad hoc processes defined in embedded and centralised systems, communications anomalies (synchronous with many dependencies), data silos, lack of transparency or accountability, resource-based digital inequalities and exclusion.
Future challenges: Pace of global transformation, digital sovereignty challenges, digital skills and literacy deficits, and difficulties in widespread participation in the formation of a decentral administration infrastructures through cooperation.

State of Art: EU current use cases

Simply put, blockchain technology is a way of storing and sharing information across a network of users within a defined process. Blockchain technology allows for users to look at all transactions simultaneously and in real-time." (Klein, 2018) [7]

1. European Blockchain Services Infrastructure (EBSI)

Established by European Blockchain Partnership (EPB) in 2019 to deliver EU-wide cross-border public services. www.EBSIBSP.eu/

Classed as a 'major political innovation'. *EU Standardisation Rolling Plan.* [5]
April 2018: Cooperation on European Blockchain Partnership was signed by agreeing to cooperate in the realisation of the potential of blockchain-based services across the EU single-digital marketplace. www.Blockchain Partnership | Shaping Europe's digital future.

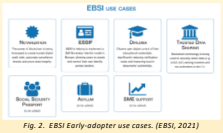

Fig. 2. EBSI Early-adopter use cases. (EBSI, 2021)

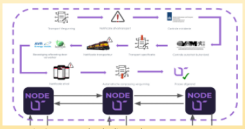

Fig. 3. EU cross-border licensed waste transportation (LTO Network, 2019)

2. EU cross-border licensed waste transportation management

ISO TR3242 In this use case, 4 actors are involved each with their own computing system. Two governmental authorities (Belgium and Dutch Government), inspection authority (Rijkswaterstaat) and Waste Disposal company (Indaver). The Belgium Government uses a cloud-based Enterprise Resource Planning system, Dutch Government an on-prem legacy system, inspection authority and Waste Disposal company use API-based web apps. Here they integrated a hybrid blockchain solution with a private blockchain (to create Live Contracts) and a public blockchain (for anchoring only). *ISO DTR3242 Blockchain and DLT use cases.* (2021). [6] www.Ronetwork.com/use-cases/waste-transport-on-blockchain/

3. Plastiks.io – Recycled polymer marketplace

A blockchain-powered marketplace where Single-Use Plastic (SUP) producers and recyclers connect and do their part in making sure plastic waste doesn't end up in the environment. An extra revenue stream for recycling companies. By enabling recycling companies to sell their recycling guarantee as NFT's on the Plastiks marketplace. A marketing tool for Single-Use Plastic companies. By buying these NFT's the companies show their commitment to the environment and strengthen their brand. www.plastiks.io/

Fig. 4. Recycled polymer decentralised marketplace Interaction diagram (Plastiks.io, 2021)

4. Technological solution to widespread participation in the bioeconomy

Open-source, cloud-architected blockchain system for friction-free onboarding and low-cost SaaS services that enable widespread community participation in the conversion of food-waste to biogas feedstock in the green bioeconomy.

Why open source? The EC 'Think Open' Strategy promotes the sharing and reuse of software solutions, knowledge and expertise, to deliver better European services that benefit society and lower costs to that society. EC Open source software strategy 2020-2023.

Why cloud? Cloud computing is a key objective to increase Europe's data sovereignty as outlined in the European Commission's Data Strategy, Digital Strategy, Industrial Strategy and the EU recovery plan. Cloud-based, serverless and API-based digital services are the emerging paradigm for swift-evolving decentral online business models. Low cost, low-friction, modular designs, implementable across diverse territories, organisational boundaries and within evolving value frameworks.

Why blockchain? Blockchains enable cooperative governance and oversight in multi-party business systems. Examples in supply chain include: IBM Food Trust, supply chain finance Trade Trust, diamond provenance assurance Everledger, fair trade farm management system Agri-Ledger. Blockchain technology offers "value for partners cooperating in a decentral network, providing data and process integrity, automation potential and enabling the transparent transfer of values and rights." Klein, S. (2018) [7]

Public, private, permissioned and permissionless
Blockchains can be permissionless, permissioned, or both. **Permissionless:** 'pseudo-anonymously' join the network without restriction. **Permissioned:** users are 'known', access to the network is restricted and may restrict the rights of network participants and nodes. **Public:** No central authority. **Private:** Governing entity. **Hybrid:** aspects of both public and private blockchains. Permissionless blockchains are considered more secure. Permissioned blockchains tend towards greater processing efficiency. Foley & Lardner (2021).[8]

Fig. 5. Permissioned and Permissionless subsets of blockchain and DLT systems. (Foley and Lardner, 2021. [8]

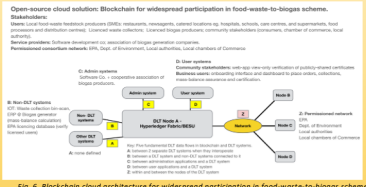

Fig. 6. Blockchain cloud architecture for widespread participation in food-waste-to-biogas scheme (F. Delaney, 2021)

Benefits and Challenges Blockchain

Benefits of a permissioned blockchain system
- Data security: timestamped, immutable record of data transactions.
- Cooperative oversight: asynchronous data resource availability, in-built assurance of system transparency.
- Autonomous process management: programmable smart contracts.

Benefits of proposed system
- Cooperative, ecosystem-based, holistic value chain approach to circular and cascading life-cycles.
- Verifiable methods to demonstrate that food waste has been used for renewable energy and verify circular economy and bio-energy claims.
- Transparent view of feedstock availability for all participating actors.
- Community visibility on rate and growth of waste to bioenergy conversion.

Challenges
- Disruptive, early stage technology
- Maturity status
- Multi-party interoperability deficit - connecting multiple legacy enterprise systems via API cloud service
- Crafting market-segmented value propositions for multiparty actors: eg. SMEs vs. waste disposal actors.

Conclusion and Recommendations

Conclusions

Implementing a blockchain solution across the lifecycle of waste-to-renewable-energy sector will not only improve the feedstock challenge but also provide significant benefits to all parties.
We have identified a potential area to accelerate growth and minimize risk for the bioeconomy in Europe with transparent ledger services across multiple steps in the waste valorization process.
Blockchain offers a simple and secure, asynchronous, immutable communication channel between key participants.
Once implemented the system can expand in other horizontal processes such as the management of other waste streams and production of other foodstuffs and integration with other software technologies to provide a complete end-of-life waste management solution.

Key recommendations

* Engage with key parties in the waste to energy lifecycle regarding a pilot blockchain project.
* Connect with other horizontal technologies for integration.
* Explore other areas in the biogas or renewable energy sector for blockchain initiatives i.e. spreading of leachate, food reduction, community focused projects.
* Engage with regulation bodies regarding the measurability of sustainable indicators within the Bioeconomy, including token-based solutions.
* Develop a communication and education strategy regarding blockchain and the bioeconomy. Link with industry networks such as Blockchain Ireland. blockchainireland.ie
* Continue to engage with regulatory authorities in EU and Ireland regarding upcoming legislation and guidance.
* Seek funding and access to blockchain early adopter programs eg EU Blockchain Service Infrastructure.

References

[1] European Commission. Directorate General for Research and Innovation. (2012). Innovating for sustainable growth :a bioeconomy for Europe. Publications Office. https://data.europa.eu/doi/10.2777/6462
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[3] Mobilising an Irish Biogas Industry. (2019). IRBEA and CRE. https://www.irbea.org/wp-content/uploads/2019/08/IrBEA-Cre-Biogas-Policy-Paper-Final_1.pdf
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[8] Types of Blockchain: Public, Private, or Something in Between | Foley & Lardner LLP. (2021). www.foley.com/en/insights/publications/2021/11/types-of-blockchain-public-private

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