Can Blockchain Technology Help Regulatory Science?

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Outline

• What is Blockchain?

• What are the big promises?

• How can it help the food sector and society?

• What are the risks, challenges & uncertainties?
So, what is Blockchain?

- A **digital ledger**, distributed between members of a community and their computers, which records the history of **transactions** and enables transactions to take place securely.

- Participants need a cryptic key to record a transaction. The record must then be **encrypted** via an **algorithm** and shared with everyone’s computers for validation, before being stored on the blockchain.

- When a record is updated, information from the previous record and the new one are combined to produce a new ‘hash’, creating a **co-dependent chain** of records.

- If someone tries to change a record the algorithm will spot the difference. Since everyone has a copy of the ‘true’ record, this can substituted for the doctored one.

- **Different types of blockchains** - some can record more information (e.g. images for copyright) or enable ‘**smart contracts**’.
What’s so great about it?

- Transactions recorded on the blockchain are **immutable**
- Verification devolved to computers/algorithms => ‘trustless’
- Information is **secure** and **verifiable**
- Records are **transparent** (everyone has a copy) but **anonymous** (they don’t know what it means)
- **Accountable** because changes are visible to everyone and historical records and changes are **traceable**
- May allow **peer-to-peer** transactions without institutional middle-men like banks, lawyers and governments
- Can prevent **identity theft**, as IDs are encrypted
- May be linked to **devices (IoT)** or **biometrics**
- **Automates** processes necessary for verification = Faster administration & lower costs

“Simply put, the blockchain is a machine for creating trust.”

—The Economist

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Public vs Private Blockchains

- Public blockchains, like Bitcoin, are fully decentralised, disintermediated, can be joined by anyone and are anonymous.
- Private (corporate) blockchains are restricted to known members of a permissioned network.
- ‘Blockchain as a service’ = cloud-based platforms which businesses or communities can rent to build or host blockchain apps.
• Still few actual use cases in biomedical research or the food sector

• Many innovations ‘in progress’

• More caution since cryptocurrency hacks
Challenges for biomedical research

Efficient Management – Smooth trial conduct, reproducibility, effective data sharing, patient enrolment etc.


Similar issues for the food sector, although medicine is more concerned with patient confidentiality
Good Governance

Usually reserved for conversations about global development, the term Good Governance is useful in this context.

Key features:

Consumer Participation, Rule of Law/Regulations, Transparency, Responsiveness, Consensus Orientation, Equity, Effectiveness and Efficiency, Accountability, Strategic Vision


> Ethics
> Integrity
> Processes
Strawberries in December
“Backbone of Supply Chain Digitisation”

In supply chain applications, blockchain has already taken off its Sex Pistols T-shirt and started wearing a cardigan.

CP Quoted in Chemistry World, Aug 2018
Counterfeiting

Fake medicines are rife in LMIC. Fake malaria and tuberculosis drugs alone cause c 700,000 deaths p/a

**Sproxil** - Scratch code reveals a QR or SMS which can be sent by SMS or App, to a call centre or checked on the web. Now blockchain backed

**Blockverify** targets pharmaceuticals, luxury items, diamonds & electronics. Every product has its private key stored in blockchain. With a track and trace number it is possible to trace change of ownership

“Adding scannable blockchain-connected tags, tamperproof seals or imprints to products is one of the most convincing use cases of distributed ledger technology in fighting counterfeits” WIPO, 2018
Substitution

Studies have found that up to 41% of seafood samples tested in Canada were mislabelled.

Fifth of meat tests reveal unspecified DNA

bbc.co.uk
Mis-labelling

Food fingerprinting

“As the fruit grows, it’s picking up a unique signature at the isotopic level. These chemical barcodes can help us prove that the product comes from a specific location. If that orange travels to a factory in another state, it is logged in the system and its place of origin recorded. If it’s made into marmalade, that’s also logged in the system. If we picked that marmalade up at the supermarket and tested it, we could still confirm the fruit’s place of origin ... If the test failed, we could easily look back through the chain to see where things went awry” (Not yet in place)

Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO) Sept 4th, 2018 on the use of blockchain in food counterfeiting
Preventing Food-Borne Illness

After implementing blockchain Walmart went from needing 6 days to 2 seconds for tracing a contaminated product from shelf to source.
Protecting reputations
Compliance, safety & IoT

Modium.io uses Internet of Things sensors to measure the temperature of medicines during transportation from source to retailer. Data is automatically sent to the blockchain creating immutable and transparent records.

This automatically audits compliance with the “Good Distribution Practice of medicinal products for human use” (GDP 2013/C 343/01), which requires proof that shipped medicines have not been exposed to conditions that may compromise their quality.
Engaging the consumer

“The way we produce food is sometimes hidden from the consumer. Without real transparency ... we will be producing our own scandals”

Bernhard Url, Opening this meeting
Regulatory Innovation

- Automating regulation?
- Digitisation ->
- Automation ->
- Codification
- Smart contracts

Blockchain Technology as a Regulatory Technology

From Code is Law to Law is Code

Primavera De Filippi & Samer Hassan

1 CERSA/CNRS & Berkman Center for Internet and Society, Harvard University
2 Universidad Complutense de Madrid & Berkman Center for Internet and Society, Harvard University

Looking at the speed of change outside our domain of #FoodSafety I ask myself: how can we keep pace with #Innovation & keep our methodologies up to date? How can we keep a small organisation like EFSA agile enough to be able to absorb the complexity of future challenges? #EFSA2018
Unlike drugs, medical devices can evolve rapidly in basic design or technology. This is largely unregulated (by FDA).

‘The competitive position of the European food and drink industry’ report states that most innovations can be characterised as 'incremental innovations or imitations” (European Commission 2016)
• Copyright, Intellectual Property, Knowledge Capital
• Could blockchain enable more agile and adaptive IP/copyrighting?
• Risk of complexifying copyright beyond human ability to understand?
• New report on Blockchain from the World Intellectual Property Organisation 2018
• EU Commission plans a blockchain observatory. US Congress recently created a Congressional Blockchain Caucus. Global standards for self-executing contracts are being discussed by various organizations
Scientific currency?

- Unpublished negative research
- Blockchain solutions exist
- Could aid open science for better decision making
- Potential provenance tool for academics to record their micro contributions
Hackers are stealing food science data. With blockchain it’s distributed & connections are protected.

Securing the data may lead to cost-efficiencies e.g. automated due-diligence.

However future decryption technologies (e.g. quantum) may threaten information encrypted and stored on public blockchains.

“The agri-food business is filled with secrets, so blockchain technology could be problematic for many companies”

In high accountability sectors, balancing confidentiality with transparency is a challenge.
Challenges: Maintaining Data Integrity

How ‘immutable’ are the data?

Need to understand how human error might play a role and how to deal with this

What happens if erroneous data ends up in an immutable BC?
Who is really ‘in charge’, is it always the community or is there a core party?

Government vs corporate values

Companies like Walmart, have more power and influence over other companies within the same supply chain

Private vs public blockchains
Territories

- Multiple blockchains and BC types
- Mega-corporate local or community-owned
- Laws & regulations vary across regions
- Philosophical & cultural factors
New forms of energy consumption

More of an issue for cryptocurrency requiring computer-intensive ‘mining’

The energy sector itself is attempting to use Blockchain to decrease consumption
- Carbon credits as a social machine

Private BC are less energy-hungry
Could reduce waste in the supply chain, potentially -> carbon neutral
Zero knowledge protocols?

Information on a public blockchain may, in fact, be hackable
## Conclusions & Conundrums

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<tr>
<th>Potential benefits: Transparency, accountability, efficiency, safety</th>
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<tr>
<td>Business case still unproven, aside from supply chain logistics</td>
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<td>Hack resilience not yet fully tested (bad actors)</td>
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<td>Decentralised, democratic vision may be disrupted by powerful platform controllers</td>
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<tr>
<td>Private blockchains aren't fully anonymous</td>
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<td>International blockchain governance is needed</td>
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**But let's not give up the baby with the bath water!**
Thank you

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