**Case Studies in Design Informatics 1 - INFR11094**
Week 7 – 28th October 2024

# Blockchains & looking at CW1.1

**John Lee**
Professor of Digital Media
john.lee@ed.ac.uk


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# What we will do today

- Look at how you did in CW1.1
- Questions from your prep work
- Designing with blockchain
- Ethics of blockchain
- Prep work for next week

# Looking at CW1.1

# Let’s jump straight into Miro!

https://miro.com/app/board/uXjVLOaptes=/

# Activity 1: 20 minutes

*In the Miro …*

1. *Read the example your group has been assigned*
2. *After reading it, add feedback via post-its (green for "this is good", orange for "this could be better"). Some things to consider:*
   - *Is the writing clear?*
   - *Does the example make it obvious what the papers are about that are being reviewed?*
   - *Are the approaches to design in the papers described clearly?*
   - *Does the example compare and contrast the approaches taken in the papers?*
   - *Are the references in the correct format?*

# Some broad feedback …

- See on LEARN (in the CW1.1 folder)
- Do make sure to use the ACM reference format correctly! (https://www.acm.org/publications/authors/reference-formatting)
- This may seem relatively trivial, but actually correct documentation of sources is a very important part of formal writing, publishing and scholarship, not only in academic contexts.
- All publishers, journals, conferences etc. will insist on their particular choice of format being followed (although there are many different formats).

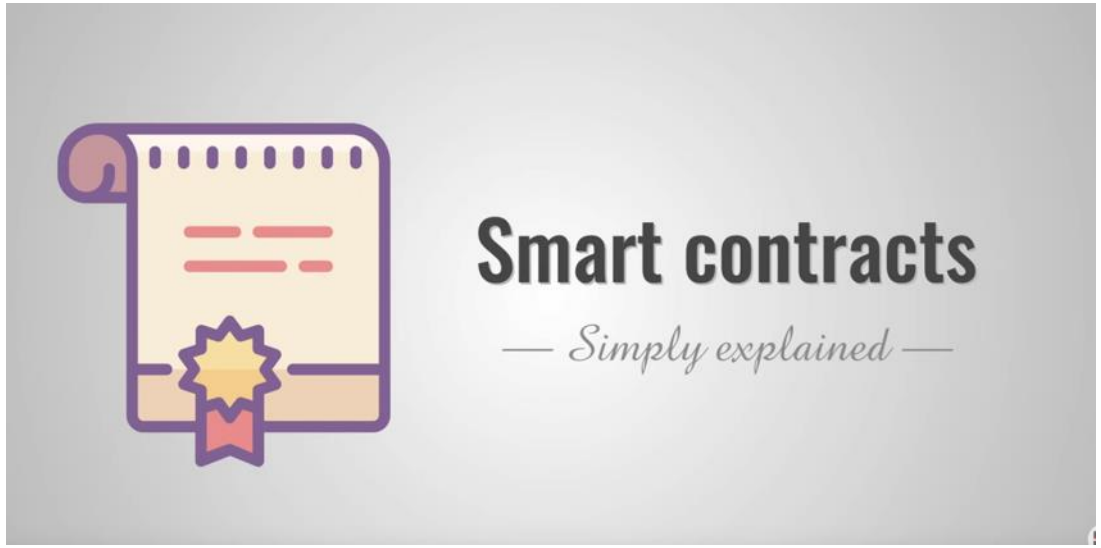
# Questions for this week

# Student questions!

*The different examples of "understanding blockchains" experiments were interesting to hear about – I feel like "demystifying" the blockchain is a critical part to expanding its use beyond cryptocurrency traders. How can we expand these learning opportunities to more people at a larger scale?*

*As someone who didn't know much about blockchain before, I feel that it is very complex and difficult to explain. Will there be a more visual or simplified version of blockchain in the future to make it easier for us to understand and use?*

# Some easy intros




https://youtu.be/ZE2HxTmxfrI


https://youtu.be/FkUn86bH34M?t=26

**Student question!**

*What is the connection between blockchain technology and information design? Are there examples of using blockchain in design?*

# HCI and Blockchain

## Making Sense of Blockchain Applications: A Typology for HCI

**Chris Elsden[1], Arthi Manohar[1], Jo Briggs[1], Mike Harding[2], Chris Speed[3], John Vines[1]**

Northumbria University[1]
Newcastle upon Tyne, UK
{chris.elsden; arthi.manohar; jo.briggs; john.vines@northumbria.ac.uk}

Data Science Institute[2]
Lancaster University
Lancaster, UK
m.harding@lancaster.ac.uk

Design Informatics[3]
University of Edinburgh
Edinburgh, UK
c.speed@ed.ac.uk

**ABSTRACT**
Blockchain is an emerging infrastructural technology that is proposed to fundamentally transform the ways in which people transact, trust, collaborate, organize and identify themselves. In this paper, we construct a typology of emerging blockchain applications, consider the domains in which they are applied, and identify distinguishing features of this new technology. We argue that there is a unique role for the HCI community in linking the design and application of blockchain technology towards lived experience and the articulation of human values. In particular, we note how the accounting of transactions, a trust in immutable code and algorithms, and the leveraging of distributed crowds and publics around vast interoperable databases all relate to longstanding issues of importance for the field. We conclude by highlighting core conceptual and methodological challenges for HCI researchers beginning to work with blockchain and distributed ledger technologies.

**Author Keywords**
Blockchain; Distributed ledger technology; Bitcoin; Trust; Identity; Typology;

**ACM Classification Keywords**
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**INTRODUCTION**
As HCI has grown and matured as a field, its scope has extended far beyond the user interface. We now ask more fundamental questions about what the design and socio-technical assemblage of new technologies means for 'being human' [22,62], and the ways in which technical infrastructures shape, and in turn are shaped by, social and cultural phenomena. These are questions of experience, politics and human values [11,19,79]. In this vein, this paper discusses the role HCI researchers, and designers, can – and should – play in the study and development of blockchain technologies and related distributed ledgers.

A blockchain, of which Nakamoto's Bitcoin Protocol [49] was the first and most popularized example, can be described as a combination of three powerful technologies: a *distributed ledger*, a database shared between multiple actors who are all allocated read and write permissions; *immutable storage*, where changes to the ledger, or transactions, are stored in 'blocks' and where each copy of the database retains every block in the 'chain' as an immutable history; and *consensus algorithms*, which are protocols for trustless actors in the network to verify the transactions made on the blockchain, and which achieve a secure, shared consensus about the state of the database. Most famously, these three core features have supported cryptocurrencies, primarily Bitcoin. However, of late, there has been a proliferation of blockchain-based applications. Proponents of blockchain view the technology as utterly transformative, comparable to the Internet in its potential scope and impact [1,32,75,78]. Proposed applications include crowdfunding, payment services, voting, copyright management, supply-chain tracking, authentication services and distributed, autonomous organizations. All of these applications concern elementary issues of establishing online identity, managing online data and privacy, and peer-to-peer online collaboration, underpinned by decentralized, algorithmic governance. As such, blockchain technologies and their emergent application areas all speak to a broad set of longstanding topics of interest for the HCI community.

While many of the challenges related to blockchain technologies may be perceived as technical, or deeply infrastructural, these technologies have the potential to profoundly impact human experience. HCI researchers are increasingly pursuing research funding for blockchain-related projects and, in our own experience, starting to grapple with the hyperbole, implications and place of human interaction and agency in relation to this technology. In this spirit, we set out to produce the first detailed mapping and examination of applications of blockchain technologies to chart the space for HCI and raise implications, issues and challenges for future research. To do so, we have undertaken a qualitative survey of more than 200 emerging blockchain startups, projects and



*CHI 2018*, April 21–26, 2018, Montreal, QC, Canada
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ACM ISBN 978-1-4503-5620-6/18/04.
https://doi.org/10.1145/3173574.3174032

**Studying the ethical implications of blockchain apps:**
- Biases in datasets
- Excluded user groups
- Tools for regulators

**Methods for co-design:**
- Develop applications with more diverse users
- Techniques to help non-experts understand the technology

**Designing blockchain interfaces:**
- More usable e-wallets
- Creating smart contracts
- Tracing the histories of digital property

**Expanding imagination of applications:**
- Creating more provocative systems
- Identifying use cases with more diverse users

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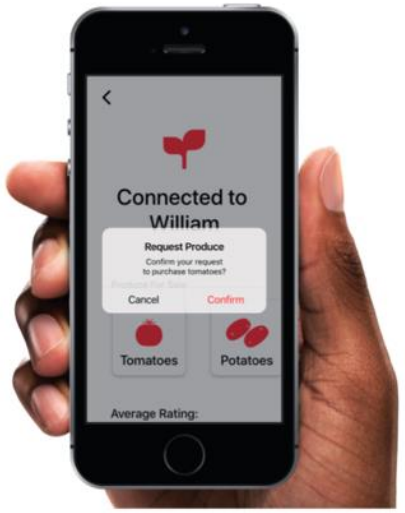
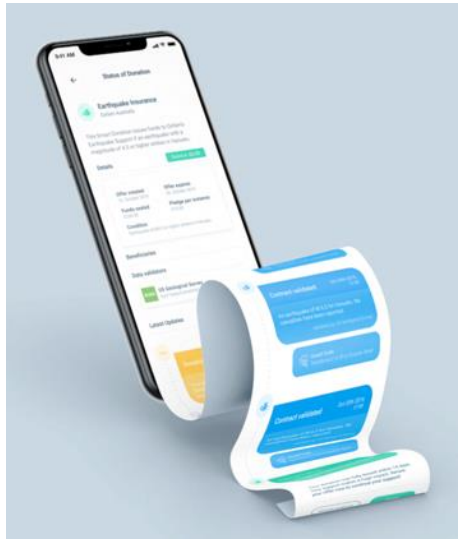
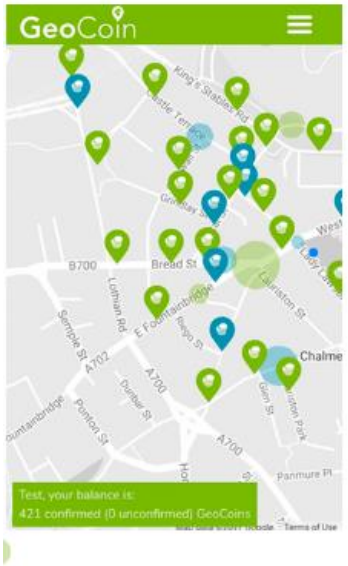
# Take a break!
# Back at 16:10

# Designing with Blockchain

# An introduction to blockchain and smart contracts





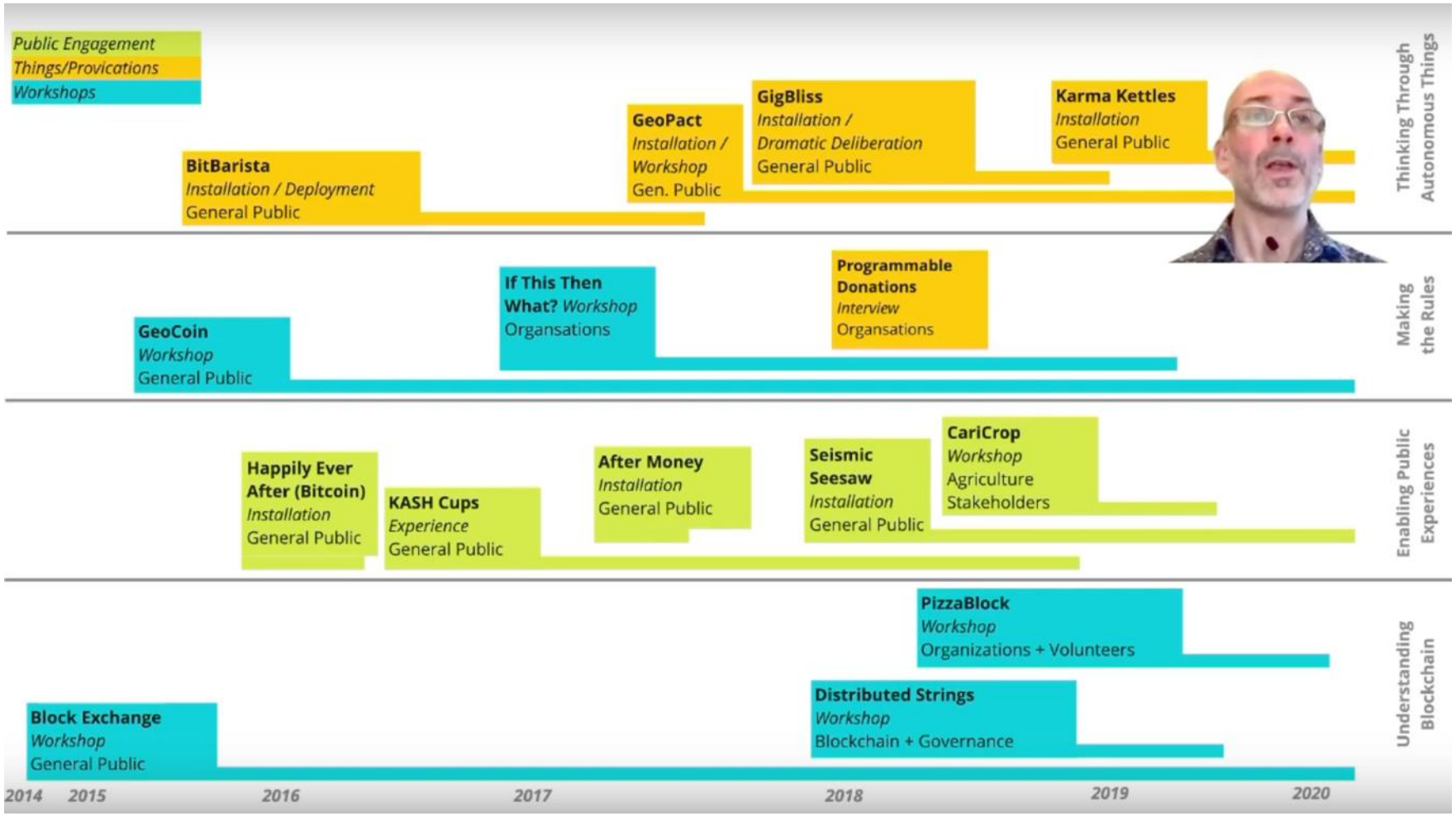


## 6 case studies of designing from, with, through blockchain

# Quite a variety …

- CariCrop
- designed to critically understand how Distributed Ledger Technologies (DLTs) could be designed to support socioeconomic development in rural communities
- Geocoin
- an open bodystorming experience that leads into ideation and prototyping of geolocated currencies
- BitBarista
- a Bitcoin enabled coffee machine that explores cryptocurrency, autonomous objects and supply chains; it has its own Bitcoin wallet, and negotiates with its users about the supply chains of their coffee
- Gigbliss
- speculative hairdryers designed to discuss the impact of algorithmic transactions in a context of distributed energy provision; the hairdryers can trade energy with a smart grid, and use smart contracts
- Programmable Donations
- engagements with a partner NGO and emerging blockchain applications in the wider humanitarian sector to identify and explore a variety of possibilities for programmable donations
- Oxfam Smart Donations
- a real-world trial with Oxfam Australia of a “Smart Donations” Ethereum App – an outcome of Programmable Donations workshops and activities

# Design and blockchains




Dave Murray-Rust, Chris Elsden, Bettina Nissen, Ella Tallyn, Larissa Pschetz, and Chris Speed. 2023. Blockchain and Beyond: Understanding Blockchains Through Prototypes and Public Engagement. ACM Trans. Comput.-Hum. Interact. 29, 5, Article 41 (October 2022), 73 pages. https://doi.org/10.1145/3503462

# Let’s go back to Miro…

https://miro.com/app/board/uXjVLOaptes=/

# Activity 2!: 10 minutes

## Thinking about blockchain features and value

Immutable (can’t be changed)

Anonymous (users not identified)

Smart contracts (extensible functions)

Transparent (nothing can be hidden)

Distributed (not tied to one place/provider)

Decentralised (no single authority)

**Student question!**

*Are there any ethical considerations to be considered when working with blockchains?*

## Reminder: our simple ethical framework…

| Choices & decisions | Implications | | |
|---|---|---|---|
| | Social | Environmental | Legal |
| Design process | | | |
| Interface design | | | |
| Data gathering & use | | | |
| Model development & use | | | |
| Openness & transparency | | | |

# Issue #1: Tokenising and smart contracting life

Making the Blockchain Civic

**Insights**

→ Blockchains promise to decentralize administrative systems and invite us to consider distributed civics and the roles of algorithmic governance.

→ Interaction designers should explore the embodied and social experiences of interacting with abstract data transactions, smart contracts, and automation.

→ Making the blockchain civic requires thinking across philosophical, political, interactional, and social layers.

To what extent can the application of blockchain technologies be employed toward civic empowerment, organizing local civic and circular economies, reinstating trust in civic institutions, or, perhaps, creating entirely new types of institutions?

In May 2018, researchers from the Amsterdam University of Applied Science's Faculty of Digital Media and Creative Industries, Northumbria University's interdisciplinary NorTH Lab, and local—Amsterdam-based—professional partners gathered for a speculative design charrette to explore the opportunities and challenges of designing for futures of civic good with blockchain technologies.

This design charrette was intended to broaden these discussions and introduce a value-driven perspective to debates around blockchain. We see an important role for the design community in linking the design and application of blockchain technology toward matters of public and social concern. While blockchains raise suspicions as instruments of market-driven "financialization" (e.g., [1,2]), they may also be configured to radically regulate and distribute common resources. Specifically, we set out to ask what these emerging technologies could mean for the organization of civil society and civic practices. What future imaginaries and design trajectories can we envision that could shape these new technologies from a civic perspective?

Our charrette asked participants to reverse engineer a future scenario they developed, in which civic technologies in Amsterdam were underpinned by blockchain technologies. What would

"… the rise of blockchain and smart contracts facilitates the functions of a city to be expressed as a number of licences to provide services which can be auctioned off to citizens, companies or organizations, (e.g. parking, housing, energy etc). In practice, the city depends upon a set of distributed autonomous organizations (or DAOs) that run these licensing programmes themselves, administering these temporarily granted rights and cryptocurrency payments on a blockchain."

Chris Elsden, Inte Gloerich, Anne Spaa, John Vines, and Martijn de Waal. 2019. Making the blockchain civic. interactions 26, 2 (March - April 2019), 60–65. https://doi.org/10.1145/3305364

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# Issue #2: The right to be forgotten


## What is the right to be forgotten?

The right to be forgotten appears in Recitals 65 and 66 and in Article 17 of the GDPR. It states, "The data subject shall have the right to obtain from the controller the erasure of personal data concerning him or her without undue delay and the controller shall have the obligation to erase personal data without undue delay" if one of a number of conditions applies. "Undue delay" is considered to be about a month. You must also take reasonable steps to verify the person requesting erasure is actually the data subject.

The right to be forgotten dovetails with people's right to access their personal information in Article 15. The right to control one's data is meaningless if people cannot take action when they no longer consent to processing, when there are significant errors within the data, or if they believe information is being stored unnecessarily. In these cases, an individual can request that the data be erased. But this is not an absolute right. If it were, the critics who argue that the right to be forgotten amounts to nothing more than a rewriting of history would be correct. Thus, the GDPR walks a fine line on data erasure.

# Issue #3: Energy consumption

Bus Inf Syst Eng 62(6):599–608 (2020)
https://doi.org/10.1007/s12599-020-00656-x

CATCHWORD

## The Energy Consumption of Blockchain Technology: Beyond Myth

Johannes Sedlmeir · Hans Ulrich Buhl · Gilbert Fridgen · Robert Keller

Received: 10 February 2020 / Accepted: 9 May 2020 / Published online: 19 June 2020


**Abstract** When talking about blockchain technology in academia, business, and society, frequently generalizations are still heared about its – supposedly inherent – enormous energy consumption. This perception inevitably raises concerns about the further adoption of blockchain technology, a fact that inhibits rapid uptake of what is widely considered to be a groundbreaking and disruptive innovation. However, blockchain technology is far from homogeneous, meaning that blanket statements about its energy consumption should be reviewed with care. The article is meant to bring clarity to the topic in a holistic fashion, looking beyond claims regarding the energy consumption of Bitcoin, which have, so far, dominated the discussion.

**Keywords** Blockchain · Cryptocurrency · Energy consumption · Distributed ledger technology · Sustainability

### 1 Introduction

Blockchain technology entered public awareness with its first application, the cryptocurrency Bitcoin (Nakamoto 2008), which was established in 2009 and currently exhibits a market capitalization of more than 100 billion USD. In the last decade, blockchain technology has developed significantly and is now implemented in a wide range of scenarios, including Ethereum or Hyperledger Fabric, which allow distributed platforms to function with

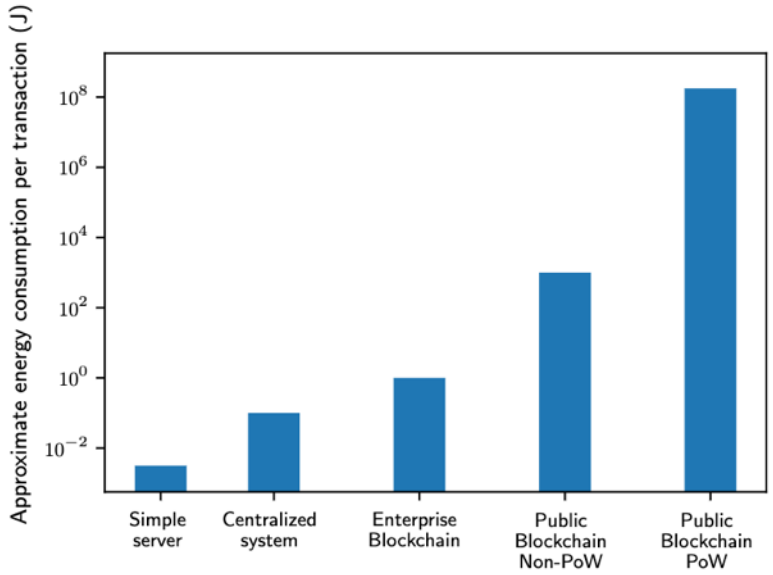



**Fig. 2** A rough comparison of the order of magnitude of energy consumption per transaction for different architectures. A simple server can operate transactions with very low energy consumption. A typical non-blockchain, centralized system in applications will use a more complex database and backups, thus mildly increasing the energy consumption. A small-scale permissioned blockchain as used in cross-enterprise use-cases has a similar degree of redundancy, but some additional yet limited overhead due to, e.g., PoA consensus and more complex cryptographic operations. A non-PoW permissionless blockchain with a large number of nodes can already exhibit a significantly increased energy consumption due to the high degree of redundancy. However, compared to a major Proof-of-Work blockchain, energy consumption is still negligible

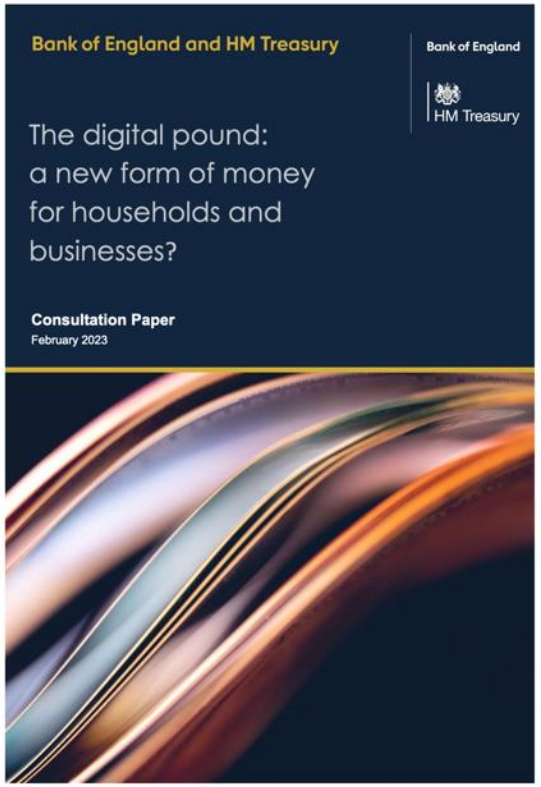
Sedlmeir, J., Buhl, H.U., Fridgen, G. et al. The Energy Consumption of Blockchain Technology: Beyond Myth. Bus Inf Syst Eng 62, 599–608 (2020). https://doi.org/10.1007/s12599-020-00656-x

# Issue #4: Lack of Regulation

## Bitcoin paradise? Briton creates 'crypto utopia' in South Pacific

Anthony Welch and partner try to woo cryptocurrency investors to regulation-free island on Vanuatu archipelago

Vanuatu is a South Pacific Ocean nation made up of approximately 80 islands. Photograph: Westend61/Getty Images




https://www.theguardian.com/technology/2022/feb/12/bitcoin-paradise-briton-creates-crypto-utopia-in-south-pacific

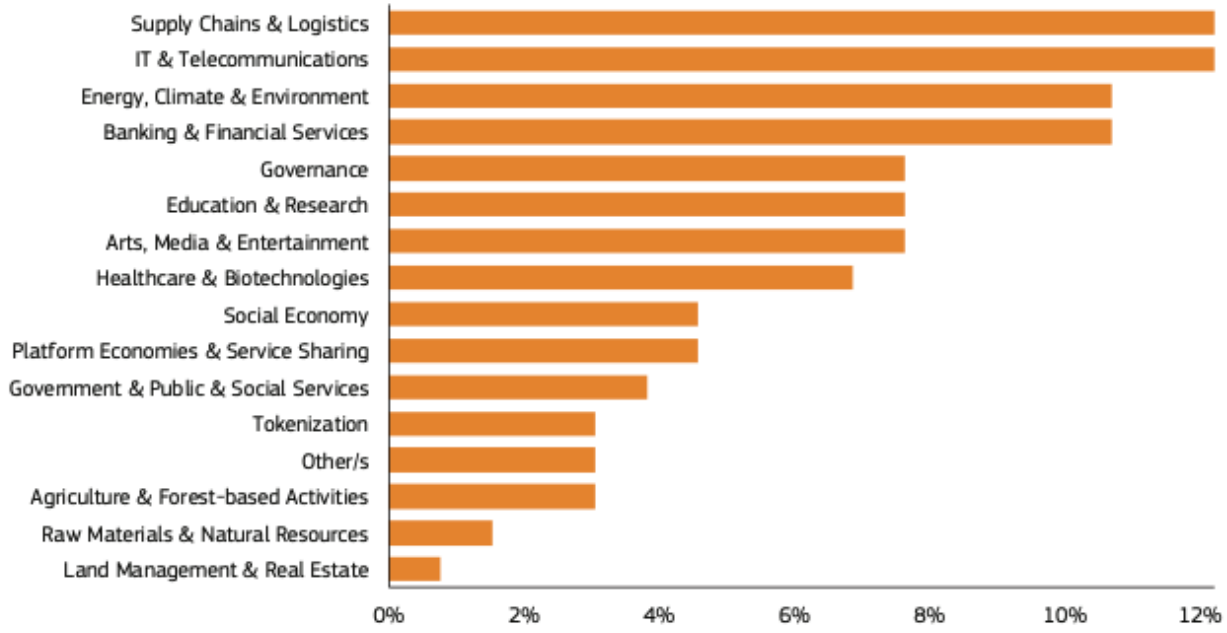
https://www.bankofengland.co.uk/-/media/boe/files/paper/2023/the-digital-pound-consultation-working-paper.pdf

**Student question!**

*What design challenges are associated with applying blockchain technology in civic contexts?*

# Blockchains for social and public good


https://op.europa.eu/en/publication-detail/-/publication/8be60290-0d00-11eb-bc07-01aa75ed71a1/language-en

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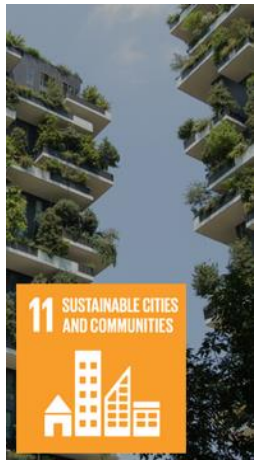
# Blockchain and Sustainable Development …….??

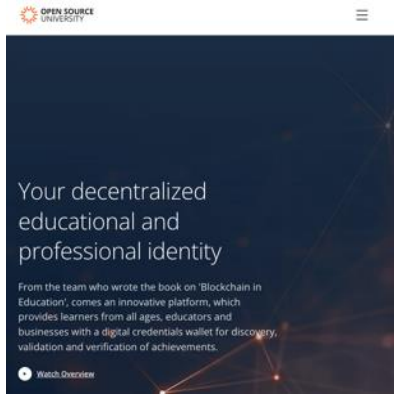


https://medicalchain.com/en/

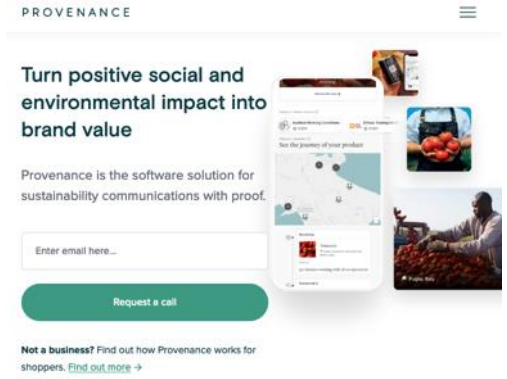




http://the-incredible-machine.com/fairbike.html


https://os.university/#


https://www.provenance.org/

# Blockchain and Information Management

## E.g. in Healthcare contexts

Claimed to be helpful (or game-changing) for:
- clinical trial improvement
- pharmaceutical supply chains
- data ownership and control
  (*patient-centred data management systems*)

But widely not seen as attractive or acceptable by healthcare-related professionals. Why?
- Various concerns echoed by many of your questions!

4 main themes:
- Administrative and Management issues
  - interoperability
- User Perspectives
  - perception of security and risk
- Future Proofing
  - environmental sustainability
- Regulatory Issues
  - frameworks and national/international governance

healthcare

Article

Identifying the Barriers to Acceptance of Blockchain-Based Patient-Centric Data Management Systems in Healthcare

Ibrahim Mutambik [1,*], John Lee [2], Abdullah Almuqrin [1] and Zahyah H. Alharbi [3]

[1] Department of Information Science, College of Humanities and Social Sciences, King Saud University, P.O. Box 11451, Riyadh 11437, Saudi Arabia; aalmogren@ksu.edu.sa
[2] School of Informatics, The University of Edinburgh, 10 Crichton St., Edinburgh EH8 9AB, UK; john.lee@ed.ac.uk
[3] Department of Management Information Systems, College of Business Administration, King Saud University, P.O. Box 28095, Riyadh 11437, Saudi Arabia; zalharbi@ksu.edu.sa
* Correspondence: imutambik@ksu.edu.sa

**Abstract:** A number of recent studies have shown that wastage and inefficiency are a significant problem in all global healthcare systems. One initiative that could radically improve the operational efficiency of health systems is to make a paradigm shift in data ownership—that is, to transition such systems to a patient-centric model of data management by deploying blockchain technology. Such a development would not only make an economic impact, by radically cutting wastage, but would deliver significant social benefits by improving patient outcomes and satisfaction. However, a blockchain-based solution presents considerable challenges. This research seeks to understand the principal factors, which act as barriers to the acceptance of a blockchain-based patient-centric data management infrastructure, in the healthcare systems of the GCC (Gulf Cooperation Council) countries. The study represents an addition to the current literature by examining the perspectives and views of healthcare professionals and users. This approach is rare within this subject area, and is identified in existing systematic reviews as a research gap: a qualitative investigation of motivations and attitudes among these groups is a critical need. The results of the study identified 12 key barriers to the acceptance of blockchain infrastructures, thereby adding to our understanding of the challenges that need to be overcome in order to benefit from this relatively recent technology. The research is expected to be of use to healthcare authorities in planning a way forward for system improvement, particularly in terms of successfully introducing patient-centric systems.

**Keywords:** blockchain; blockchain barriers; blockchain in healthcare; future of healthcare GCC countries

check for updates

**Citation:** Mutambik, I.; Lee, J.; Almuqrin, A.; Alharbi, Z.H. Identifying the Barriers to Acceptance of Blockchain-Based Patient-Centric Data Management Systems in Healthcare. *Healthcare* **2024**, *12*, 345. https://doi.org/10.3390/healthcare12030345

Academic Editors: Giner

Mutambik I, Lee J, Almuqrin A, Alharbi ZH. Identifying the Barriers to Acceptance of Blockchain-Based Patient-Centric Data Management Systems in Healthcare. *Healthcare*. 2024; 12(3):345. https://doi.org/10.3390/healthcare12030345

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# Tasks for the next 7 days:

1. Your prep work for next week's lecture
    i. Watch this!: https://youtu.be/XuwP5iOB-gs?si=cycwUVL7-JFqaorm
    ii. And this!: https://youtu.be/ppPLDEi82lg?si=Mg6uiRdBTV_FNaC4
    iii. And this… (not on robots, but a critical take on technology for "elder" care!): https://youtu.be/Ear8W-C96bk?si=gmpJaCCD2YU1WMAf
    iv. Read this!: https://www.technologyreview.com/2023/01/09/1065135/japan-automating-eldercare-robots/

2. Complete your Class Notebook submission in MS Teams:
    i. Write 3 reflections from last week's prep work and today's lecture – what did you learn (go beyond what you wrote last week)?
    ii. Write 2 questions you have based on the prep work to consider for our lecture next week.
    iii. Write 1 comment – something you have learned, are intrigued by, something related to your background and interests – prompted by the prep work.

# Reminder ….

Tutorials!

Last week, we were introduced to design fictions as an approach to question the social, environmental and legal implications of new technologies. At this week's tutorial you will have the opportunity to try your hand at developing design fictions for a case study of your choice.

# Any questions?

If you have any questions about this week's lecture, contact me at :
john.lee@ed.ac.uk