Designing Smart Money on a Digital Ledger: Central Bank issued Digital Currencies

Makayla Lewis
Brunel University
London, UK
makayla.lewis@brunel.ac.uk

Mark Perry
Brunel University
London, UK
mark.perry@brunel.ac.uk

Panos Louvieris
Brunel University
London, UK
panos.louvieris@brunel.ac.uk

Abstract

The use of blockchain in creating Central Bank issued Digital Currencies allows precision data management of financial information that has value for a variety of users. However, for such a form of 'smart money' to be relevant, useful, and usable, requires a deep understanding of the needs, requirements, impact and value that it offers citizens, government agencies, financial institutions, and central banks themselves. This paper introduces the *Smart Money* project and its approach to designing Central Bank issued Digital Currencies.

Author Keywords

Smart money, digital currencies, distributed ledger technology.

Introduction

The *Smart Money: precision data management for Central Bank issued Digital Currencies* project (Fig. 1) will investigate the data management, governance, and social utility challenges concerned with how central banks, financial institutions (e.g. retail, commercial, internet, and investment banks, credit unions, and insurance firms), government agencies (e.g. department of finance, financial services agency, and treasury), and citizens (the public) can make effective
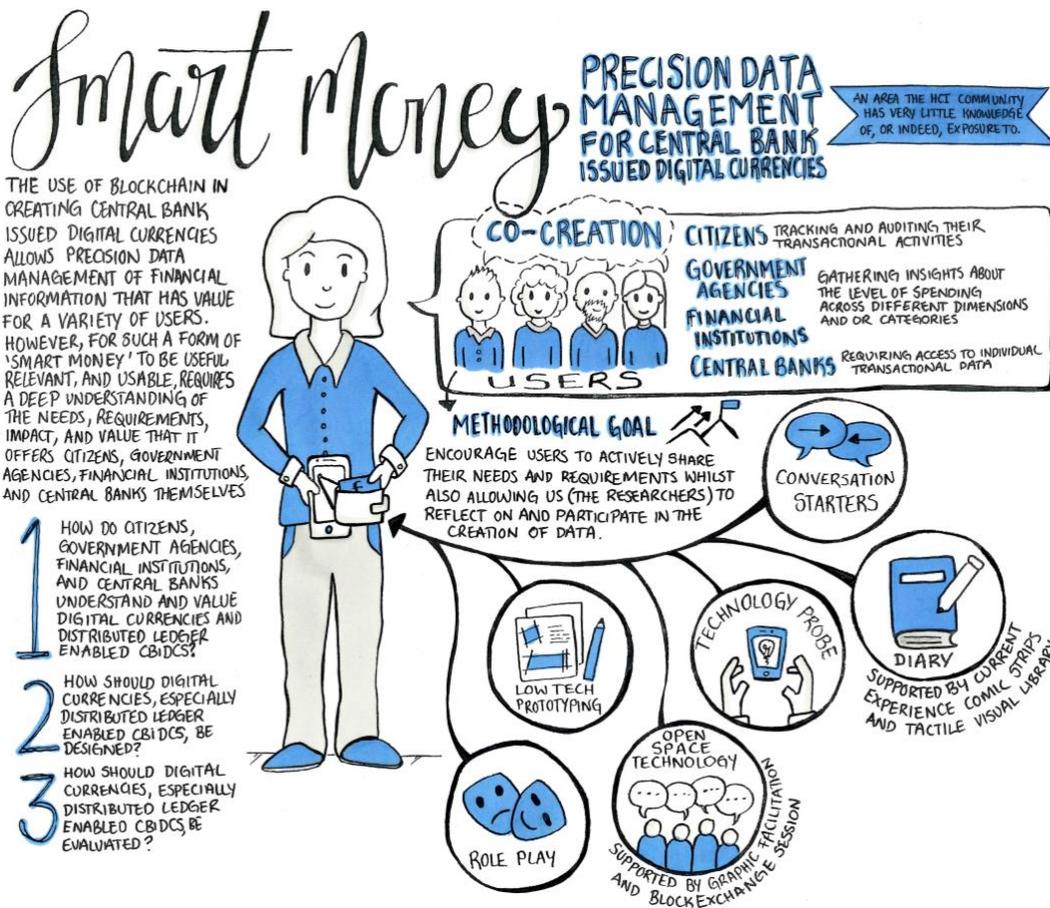
Figure 1: Visual summary of the *Smart Money* project.

users. CBiDCs could help central banks to better forecast financial and economic content, e.g. at a national level assess aggregate exposure to bank debt. At an institutional level (financial institutions and government agencies), CBiDCs could help to assess levels of consumer debt and the economic impacts of government policy, and gather insights into patterns of spending and mining patterns of financial traffic for national security. At a citizen level, CBiDCs could enable tracking and auditing of transactional activities.

Background
Central banks, such as the Bank of England (BoE), support the settlement of payments between financial institutions and allow the smooth running of the national and global economy. In the UK for example, such payments cover millions of transactions every day valued at £230 billion; these include transactions as a result of spending in shops and online, payment of bills, wages, benefits, and withdrawals from cash machines [14]. A key BoE responsibility is to design, print, and distribute banknotes, authenticated by serial numbers and other security devices but which is not auditable. The online and non-'fiat' equivalent 'digital currencies', e.g. cryptocurrencies, offer secure and cost-effective methods to create and manage a borderless and permissionless financial asset database that issues currency by a global collaborative endeavor and makes available a history of transactions (via a distributed ledger) that ensures authenticity [2, 3, 13]. Although citizens and government agencies have viewed digital currencies with suspicion, mostly due to their confusing terminology and strong association to Bitcoin (resistance to censorship, fluctuating value, and instances of 'dark web' transactions) [13], central banks are exploring the distributed ledger technologies

use of distributed ledger enabled Central Bank issued Digital Currencies (CBiDCs). The distributed ledger technologies that underpin digital currencies could offer an opportunity to share data between institutions and

that underpin digital currencies with great interest. For example, if the BoE *"were to issue a digital currency everyone, including businesses, households and financial institutions other than banks, could store value and make payments in electronic central bank money in addition to being able to pay with cash"* [5]. Although, the BoE recently confirmed it has no immediate plans to launch a digital currency, it is keen to continue to research the area [32], reiterating its 2015 call for the wider central banking and academic community to help investigate the possibilities of CBiDCs [4]. The *Smart Money* project aims to assess the impact, value, and practicability of a how a fully auditable, tamper-proof, responsible smart governance system could make all users accountable for their data access and processing activities, whilst ensuring the protection of data and user privacy and security. It will offer insights and recommendations into the design of current and novel distributed ledger infrastructures grounded in worked examples of use, evaluate their likely potential impact and value and identify to whom these issues should be of concern to, and work alongside users (central banks, financial institutions, government agencies, and citizens) to ensure that design solutions meet their needs. This position paper focuses on the social utility of the *Smart Money* project, exploring the means by which this could be understood and supported through design solutions.

Goals and questions
To understand the needs, requirements, impact, value, and practicability of distributed ledger enabled CBiDCs for citizens (tracking and auditing their transactional activities), government agencies and financial institution (gathering insights about the level of spending across different dimensions and or

categories), and central banks (requiring access to individual transactional data). The *Smart Money* project aims to answer the following questions:

1. **How do citizens, government agencies, financial institutions, and central banks understand and value digital currencies and distributed ledger enabled CBiDCs?** *Who are the users of digital currencies and distributed ledger enabled CBiDCs? How are digital currencies and distributed ledger enabled CBiDCs understood by the various stakeholders that will use them and the meta/paradata that they generate? How are digital currencies being used? What are the social and interpersonal relationships surrounding digital currencies? What value do digital currencies and distributed ledger enabled CBiDCs provide? How could a distributed ledger enabled CBiDCs be problematic? How do users think digital currencies and distributed ledger enabled CBiDCs will be used in the future?*

2. **How should digital currencies, especially distributed ledger enabled CBiDCs, be designed?** *What considerations, constraints, assumptions, and dependences should be considered when designing distributed ledger enabled CBiDCs? What would a successful interface look like (e.g. features, function, and appearance)? How could distributed ledger enabled CBiDCs be more useful? How should regulatory and infrastructures be represented or abstracted?*

3. **How should distributed ledger enabled CBiDCs systems be evaluated?** *What are real world user requirements? How might this work impact the design of distributed ledger enabled CBiDCs?*

Methodological goal

The methodological goal of the *Smart Money* project is to develop a method that encourages users to actively share their needs and requirements whilst also allowing us (the researchers) to reflect on and participate in the creation of data. To do this, co-creation methods will be used because they generate user data that spans disciplinary boundaries; they allow users to co-construct a product or service experience to suit their context, in an environment where users and researchers have an active and continuous dialogue [13, 26]. It is hoped this method will steer the *Smart Money* project from conventional HCI 'user as subject' approach, often referred to as user-centered design, where verbally based capture (e.g. observation, interviews, questionnaires, and focus groups) are used to illicit opinions about technology concepts from passive users [29]. We are considering the following co-creation methods to understand digital currencies and distributed ledger enabled CBiDCs and the difference and value it could make in the lives of citizens, government agencies, financial institutions, and central banks.

Conversation starters small sessions, 4 to 10 users, that aim to get a reaction and start conversations around digital currencies and distributed ledger enabled CBiDCs could be carried out early in the *Smart Money* project. To encourage idea generation, users will be reassured that we are interested in all ideas; there are no 'silly or wrong' responses. Ideas will be recorded on post-it notes, users will be encouraged to add, remove, or adjust the post-it notes [11].

Diary studies could be used to construct a temporal view of user's digital transactional events, feelings and attitudes. Users would be asked to record 'in the moment' (via a voice recording or SMS) digital transactions over a period. Follow-up workshops, supported by ***current experience comic strips and tactile visual library*** [22], will seek to visualize users understanding of digital currencies, feelings about their transactional events, who they think should have access to their transactions (e.g. what information should be viewable, how often should be viewed etc.), and how they will use digital currencies in the future. The outputs could support the creation of a meta-story, e.g. [23], about users (esp. citizens) feelings, attitudes, and use of cash and digital currencies.

Open space technology (OST) workshops are often used in meetings of between 20 and 200 people [27, 28] users create the agenda for themselves and the researchers, acting as facilitators, lead and record the resulting discussions. They work best when the technology to be discussed is new and complex, has diverse users, and can generate conflict (strong interest and passion) [24, 27, 28], criteria we believe matches the *Smart Money* project. However, OST can be difficult to focus users on goals or questions. We would use 'The Twist' process will give focus while keeping the benefits (users feeling 'real' freedom and ownership of the outcomes) [24]. Prior to the OST, we would ask users 'What are the most important questions they would like to be answered at the workshop?' Responses would be categorized and shortlisted. We are aware some users may find the technology or terminology confusing [15]; therefore, an introductory ***BlockExchange*** [10] session will be offered. The agenda will also include empty discussion sessions to allow for discussions that may arise. The agenda will be shared at the beginning of the OST; users will be given the opportunity to

suggest amendments [27, 28]. To ensure the reporting is as accurate as possible *graphic facilitation* would be used. A graphic facilitator, a silent partner, that uses words, symbols and pictures to create a large-scale conceptual map of the 'real time' discussions would be hired. We believe this could promote 'big picture' thinking, clarify and define ideas, provide memory hooks, and organize users' thoughts [1, 7, 11, 17, 30].

Low-tech prototyping workshops could be used to illicit creative ideas that explore possible features, functions, and the appearance of a distributed ledger enabled CBiDCs interface [8, 9, 21]. Users will be asked to present and explain their paper-based sketches to each other and the *Smart Money* researchers to clarify sketches and spark new ideas. The outputs could act as a starting point for working out technically feasible solutions [16, 20].

Role play workshops, a type of improvised (open) prototyping that supports realistic exploration of an idea, experience, technology, or user values and needs [12, 21, 25, 31], could be used to build scenarios of distributed ledger enabled CBiDCs. Teams of 3 to 5 users would be asked to detail an idea, assign the necessary roles, and identify what they are looking to investigate e.g. interpersonal or social relationships, interactions, motivations, or responses to distributed ledger enabled CBiDCs. Props, e.g. low-tech prototypes, would be made available to users; there use will be optional [29]. Spectators (researchers and users) would observe and comment on each role-play [21, 25]. The outputs could broaden our understanding of the uses, practicality, and problems of a distributed enabled CBiDCs.

Technology probes, instruments deployed to envisage the unknown (a new technology) using prototypes [18, 19], e.g. a digital wallet and dashboard, could deployed into a real context. We would observe how they are used over a period, users will be encouraged to use the technology probes in unexpected ways (varied scenarios) [18]. We believe the technology probes could allow insights to emerge more strongly [19] supporting us to further understand and inspire design.

Contribution to workshop

We believe on completion of the *Smart Money* project a better understanding of users (citizens, government agencies, financial institutions, and central bank's) needs, problems, experiences, and value of distributed ledger enabled CBiDCs will be established. This is an area that the HCI community has very little knowledge of, or indeed, exposure to. We hope the project will stimulate discussion about how to use co-creation methods to design for distributed ledger technology, how to engage with diverse users especially those unwilling to participate in co-creation for complex systems and dealing with failure and unexpected results.

References

1. Agerbeck, B., 2012. *The graphic facilitator's guide: how to use your listening, thinking & drawing skills to make meaning*. loosetooth.com library.

2. Bank of England., 2014. Innovations in payment technologies and the emergence of digital currencies. Available: https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2014/quarterly-bulletin-2014-

q3.pdf?la=en&hash=874BAD99E54170C8DB5C082D6E8962D3F10997DF [Mar 5, 2018].

3. Bank of England., 2015. One Bank Agenda. Available: https://www.bankofengland.co.uk/-/media/boe/files/research/one-bank-research-agenda---summary.pdf?la=en&hash=B2C820FBF6A960C4A625C2DAB5B5B6CE4FEDF120 [Mar 5, 2018].

4. Bank of England., 2015. Digital currencies research questions. Available: https://www.bankofengland.co.uk/-/media/boe/files/research/cbdc.pdf?la=en&hash=27D6074B68121BCAA5E2BB50693C031CCE9F8658 [Mar 5, 2018].

5. Bank of England., 2018. Digital Currencies. Available: https://www.bankofengland.co.uk/research/digital-currencies# [Mar 5, 2018].

6. Baskinger, M. and Bardel, W., 2013. *Drawing Ideas: A Hand-drawn Approach for Better Design*. Watson-Guptill.

7. Brand, W., Koene, P., Ars, M. and Verheijen, P., 2017. *Visual Thinking: Empowering People & Organizations through Visual Collaboration*. Bis Publishers.

8. Colombo, L. and Landoni, M., 2013. Low-tech and high-tech prototyping for eBook co-design with children, *Proceedings of the 12th international conference on interaction design and children*, ACM, pp. 289-292.

9. Dam, R. and Siang, T., 2017. Stage 4 in the Design Thinking Process: Prototype. Available: https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype [Jan 26, 2018].

10. Design for Informatics. 2018. BlockExchange. Available: http://blockexchange.designinformatics.org/ [Mar 5, 2018].

11. Design Kit., 2015. Conversation Starters. Available: http://www.designkit.org/methods/44 [Jan 26, 2018].

12. Design Kit., 2015. Role play. Available: http://www.designkit.org/methods/36 [Jan 26, 2018].

13. Design Kit., 2015. Co-creation session. Available: http://www.designkit.org/methods/33 [Jan 26, 2018].

14. Ganley, J., n.d. Your money and the financial system pamphlet. Bank of England, UK.

15. Government Office for Science. 2016. Distributed Ledger Technology: Beyond block chain. Available: https://www.gov.uk/government/publications/distributed-ledger-technology-blackett-review [Mar 5, 2018].

16. Greenberg, S., Carpendale, S., Marquardt, N. and Buxton, B., 2011. *Sketching user experiences: The workbook*. Elsevier.

17. Health Improvement Scotland., 2014. Graphic Facilitation. Available: http://www.scottishhealthcouncil.org/patient__public_participation/participation_toolkit/graphic_facilitation.aspx#.Wm71L5OFhAY [26 January, 2018].

18. Hutchinson, H., Mackay, W., Westerlund, B., Bederson, B.B., Druin, A., Plaisant, C., Beaudouin-Lafon, M., Conversy, S., Evans, H. and Hansen, H., 2003. Technology probes: inspiring design for and with families. *Proceedings of the SIGCHI conference on Human factors in computing systems*, ACM, pp. 17-24.

19. Innella, G., Papeschi, F. and Nisi, V., 2011. The participatory technique of "Technology Probes": a case study in Burkina Faso. *Proceedings of the Create11*.

20. Johansson, M. and Arvola, M., 2007. A case study of how user interface sketches, scenarios and

computer prototypes structure stakeholder meetings, *Proceedings of the 21st British HCI Group Annual Conference on People and Computers*, British Computer Society, pp. 177-184.

21. Iacucci, G., Iacucci, C. and Kuutti, K., 2002, October. Imagining and experiencing in design, the role of performances. In *Proceedings of the second Nordic conference on Human-computer interaction* (pp. 167-176). ACM.

22. Lewis, M., & Coles-Kemp, L., 2014. A Tactile Visual Library To Support User Experience Storytelling. *DS 81: Proceedings of NordDesign*.

23. Lewis, M., & Coles-Kemp, L., 2014. I've Got Something To Say: The Use of Animation to Create a Meta-Story about Professional Identity. *Extended Abstract for Workshop at StoryStorm: A Collaborative Exchange of Methods for Storytelling at DIS'14 Designing Interactive Systems.*

24. Martin, N., 2009. Team Building Activities Explained Simply: Open Space Technology.
Available: https://workshopbank.com/open-space-technology [Jan 26, 2018].

25. Matthews, M., Gay, G. and Doherty, G., 2014, April. Taking part: role-play in the design of therapeutic systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 643-652). ACM.

26. Mehrpouya, H., Maxwell, D. and Zamora, D., 2013. Reflections on co-creation: an open source approach to co-creation. *Participations: journal of audience & reception studies,* 10(2), pp. 172-182.

27. Owen, H., 2008. *Open space technology: A user's guide.* Berrett-Koehler Publishers.

28. Owen, H., 2008. A brief user's guide to Open Space Technology.
Available: http://www.openspaceworld.com/users_guide.htm [Jan 26, 2018].

29. Sanders, E.B. and Stappers, P.J., 2008. Co-creation and the new landscapes of design. *Co-design,* 4(1), pp. 5-18.

30. Sibbet, D., 2010. *Visual meetings: How graphics, sticky notes and idea mapping can transform group productivity*. John Wiley & Sons.

31. Simsarian, K.T., 2003. Take it to the next stage: the roles of role-playing in the design process, *CHI'03 extended abstracts on Human factors in computing systems*, ACM, pp. 1012-1013.

32. Thorpe, D., 2018. Bank halts crypto-currency plans over stability fears.
Available: https://www.ftadviser.com/investments/2018/01/04/bank-halts-crypto-currency-plans-over-stability-fears/ [Mar 5, 2018].