the payments association

Coding Cash:

Exploring the Horizon of Programmable Money and Payments

Foreword

I was extremely pleased to hear that our Digital Currencies Working Group called on Dr Ruth Wandhöfer to synthesize the findings of a series of workshops where our members have come together to openly discuss the programmability of money and payments.

It was necessary to produce a white paper like this one, because too often industry experts speak between themselves and tend to forget that the rest of the world is not very familiar with the nuances, technicalities, and subtle differences with these technologies and regulations and often focus on what just makes sense to them.

Providing a clear definition and distinction of what are programmable payments, smart contracts and programmable money, discussing principles and determinations as well as outlining a list of real-world use cases will help not only the agnostic or semi-agnostic reader to navigate through the complex world of finance digitization. Rather, I am confident that policy and law makers will find this short but dense and detailed "guide to knowledge" extremely useful when basing their thinking to steer policy decision making and ensure the UK remains the forefront of payments innovation. Although we can be proud of our domestic payment system, we cannot afford to just observe innovation from our comfortable box at the opera.

We must take action to ensure we are at the centre of the new digital system and this requires a forward looking strategy, deep understanding of the various elements at stake, and agile regulatory framework to build a truly world-class payments ecosystem, where the usage of modern technology in our industry can better serve economic growth.

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Introduction

As digitisation in finance continues to accelerate, The Payments Association gathered 25 members, particularly those involved in its Digital Currencies Working Group, to debate the topic of programmability of money and payments. Through a series of workshops held in March, they discussed the developing technologies and solutions in this space, as well producing recommendations to steer the industry forward.

This whitepaper opens with an outline of what is understood today by the terms of programmable payments and programmable money, including examples of how these are used or can be used in the future and what differences we observe between them.

We then dive deeper into the drivers for both programmable payments and the emerging nature of programmable money and discuss existing and future use cases for these applications.

From our research and interactions, it is clear that various programmable payments solutions are already in play with more on the horizon. From the perspective of programmable money, this type of approach will depend on new infrastructure with blockchain and smart contracts to be in place. There are existing solutions here, for example stablecoins, but in order to have programmable commercial bank or central bank money, new infrastructure is a key requirement. When it comes to assessing the potential impact of programmable money, this whitepaper signposts a number of considerations and requirements that will need to be in place so that this new form of money will benefit all stakeholders in our economy. We end by considering what other elements would need to be in place in the UK economy in order to truly move this market into the digital age. Only then will existing solutions such as programmable money advance further and only then can new solutions with programmable money be built and launched successfully.

PART I:

An Introduction to Programmable Payments and Programmable Money

What are Programmable Payments?

When discussing programmable payments, we are using the term in an asset-class-agnostic way, i.e. it should not matter what type of digital money I am transacting, whether this is commercial bank money, central bank money or cryptocurrency, including stablecoins. Irrespective of the nature of the underlying digital asset, the transaction is all about moving this asset or value based on a set of pre-determined conditions. The ingredients for programmable payments therefore are 1) an asset, e.g. commercial bank money; 2) a set of conditions that determine when and how such a payment is to be executed and 3) an infrastructure that enables the execution of the programmed payment from initiation at the sender to receipt by the beneficiary.

To bring this into the real world, examples of programmable payments that consumers or businesses use today and that are based on commercial bank money include direct debits, automated bill payments, variable recurring payments and standing orders. Equally, buying your fuel at the station can be done with a programmable payment via preauthorisation of a certain amount on your card, again using commercial bank money.

As a business, for example, you can embed payments according to specific business logic, whether that is an automated commission payment, refunds to merchants, or other workflow-based payment transactions. The increasing adoption of Application Programming Interfaces (APIs) with Open Banking and the future of Open Finance and Smart Data constitutes a key building block of programmable payments in the UK market.

Today the programmability options in terms of functionality are provided by those offering payment services, e.g. banks, e-money institutions or payment institutions. Users can decide which products they want to use for which purpose and where specific products enable specific features in terms of programmability. In some cases, beneficiaries such as utilities mandate the use of certain payment instrument, e.g. direct debits.

When we look to another underlying asset class such as cryptocurrency, we can program the conditions under which such a transaction is going to happen, using so-called smart contracts. The infrastructural technology prerequisite for this is the blockchain/DLT.

What are Smart Contracts?

Given we encounter smart contracts in the context of programmable payments for cryptocurrencies, let's briefly clarify what smarts contracts are and how they work.

First of all, a smart contract is simply a self-executing program, where certain actions are based on an agreement or contract, which has been automated.

Currently, programmable payments using smart contracts can only be enabled on the basis of blockchain/Distributed Ledger Technology (DLT). The first platform allowing for smart contracts was Ethereum, followed by Bitcoin, and now by many permutations of private blockchains.

How do you create a smart contract?

There are six key steps in the process of creating of a smart contract:

1. Parties have to agree on the terms and conditions that they want to see implemented.
2. These terms and conditions are translated into programming language in order to create a smart contract, covering rules and consequences if these rules are followed or not followed. A badly designed smart contract can pose major risks.
3. The smart contract needs to be deployed by broadcasting it on the blockchain. Once this 'transaction' has been confirmed, the smart contract is live.
4. If the terms and conditions in the smart contract are met, these are automatically verified.
5. The smart contract is then executed.
6. The execution is recorded on the blockchain.

If the terms and conditions become too complex then it is difficult for the smart contract to self-execute without a third-party intervention (e.g. in some cases a third party may need to verify something has happened or event has occurred).

Equally the legal status of a smart contract is crucial. What conditions need to be in place for a smart contract to be legally executed? Does a certain person or entity need to authorise or notarise the smart contract and is there a requirement for an entity to orchestrate the smart contract against the resulting payment, for example?

What is Programmable Money?

Here we change the application of programmability from the payment transaction to the underlying asset itself, i.e. the value, money or asset class. Again, for the purpose of this paper, any reference to "money" can include commercial bank money, central bank money or cryptocurrencies, including stablecoins.

We note that there is a distinction between programmable payments and programmable money. Both can in fact leverage a smart contract as the programmability engine, but in one case it is programming the flow of value or asset, whilst in the other case it is about programming the value or asset itself.

And to be clear, not every value, or asset, can be programmed. For example, physical cash (the current form of retail central bank money) cannot be programmed with a smart contract as its form is non-digital. Equally, at this point in time, digital commercial bank money cannot be programmed either in terms of transacting it or with regard to its nature. This limitation is due to the current technical infrastructure, i.e. the payment systems and processes. On the other hand, we do observe smart contracts being used in the context of digital currencies or assets that are transacting on blockchains or distributed ledgers (DLs).

The next frontier of programmable money using smart contract technology is expected to be driven by the development of central bank digital currencies, or CBDCs.

In addition, new ways of programming commercial bank money are also on the horizon. This can be put into practice via tokenising commercial bank money. Tokenised commercial bank money is different from stablecoins and other cryptocurrencies. It is basically the same money that you hold in your bank account today but, by tokenising this money, it can transact on a blockchain infrastructure, which is not the case today with traditional payment systems and underlying operations.

As stated above, for both CBDC and commercial bank programmable monies we currently lack the infrastructure to process these, i.e. the type of blockchain or DL that can process smart contracts linked to those asset classes. It could, however, be executed if using cryptocurrencies as discussed, including stablecoins.

"Simply put, without a reliable and secure system to identify, there is no access or ability to transact in the digital economy. At the same time, individuals will require a certain level of privacy when it comes to the question of where and how their money is spent."

The Rationale for Programmable Money

A key question to ask at this stage is why do we see the emergence of programmable money? What is the rationale for it and its purpose?

From the lens of the financial services industry, programmability could simplify compliance by, for example, encoding elements of consumer protection and anti-money-laundering provisions into money itself, which could remove the need for post-factum regulatory interventions. This triggers questions such as: What will that mean for the regulatory framework, compliance and enforcement? Would this be an automated mitigation tool in the context of money laundering, i.e. the money is programmed to get to certain destinations or would it behave in certain ways embedding regulatory principles and rules?

Another rationale could be the expansion of value propositions to retail and business users of payments, by offering both programmable payments and programmable money as a menu of choices. When considering the retail market, another key driver is data privacy and identity. We will require a resilient system and framework to ensure the secure identification and verification of individuals as well as businesses and assets in the digital economy. A good example here would be the distribution of welfare benefits, which necessitates identification of the intended recipient before disbursement. Simply put, without a reliable and secure system to identify, there is no access or ability to transact in the digital economy. At the same time, individuals will require a certain level of privacy when it comes to the question of where and how their money is spent. This need for privacy will be a key determinant in the discussions around a potential digital sterling, or CBDC, for the UK.

For the wholesale market, the topic of liquidity is one of the key drivers for programmable money. Exposed during the financial crisis of 2007/8, liquidity management in financial institutions is a serious challenge. Optimising intraday liquidity and allowing for more accurate liquidity forecasting are real benefits that programmable money could deliver. At the same time increasing the velocity of liquidity of central bank money with wholesale CBDCs is another key benefit of the next iteration of money, where programmability can support risk management and financial stability.

From the perspective of a central bank, we can imagine various purposes for programmable CBDC, such as the application of interest rates, whether positive or negative, or the expiry of CBDCs at a certain point in time (e.g. time-bound money), which would be done in order to encourage spending in the economy. Both such measures would support the effectiveness and speed of implementation of a central bank's monetary policy decisions.

If we look at the spirit of decentralisation in the context of the emergence of DeFi, we will have to acknowledge that hardcoded purpose of an asset effectively defeats the spirit of decentralisation. However, the situation is rather the opposite when it comes to the perspective of a central bank.

Key Principles and Determinations in relation to Programmable Money

When discussing programmable money, we need to clarify a number of criteria first, which will vary across the different forms of money that we have touched upon, private money (commercial bank money and cryptocurrencies/stablecoins) and public money (central bank money).

Criteria 1:
Who is the issuer of the programmable money? Options include central banks (for CBDCs), commercial banks (for digital private money based on fractional reserve banking) and other private entities or networks (for cryptocurrencies, including stablecoins).

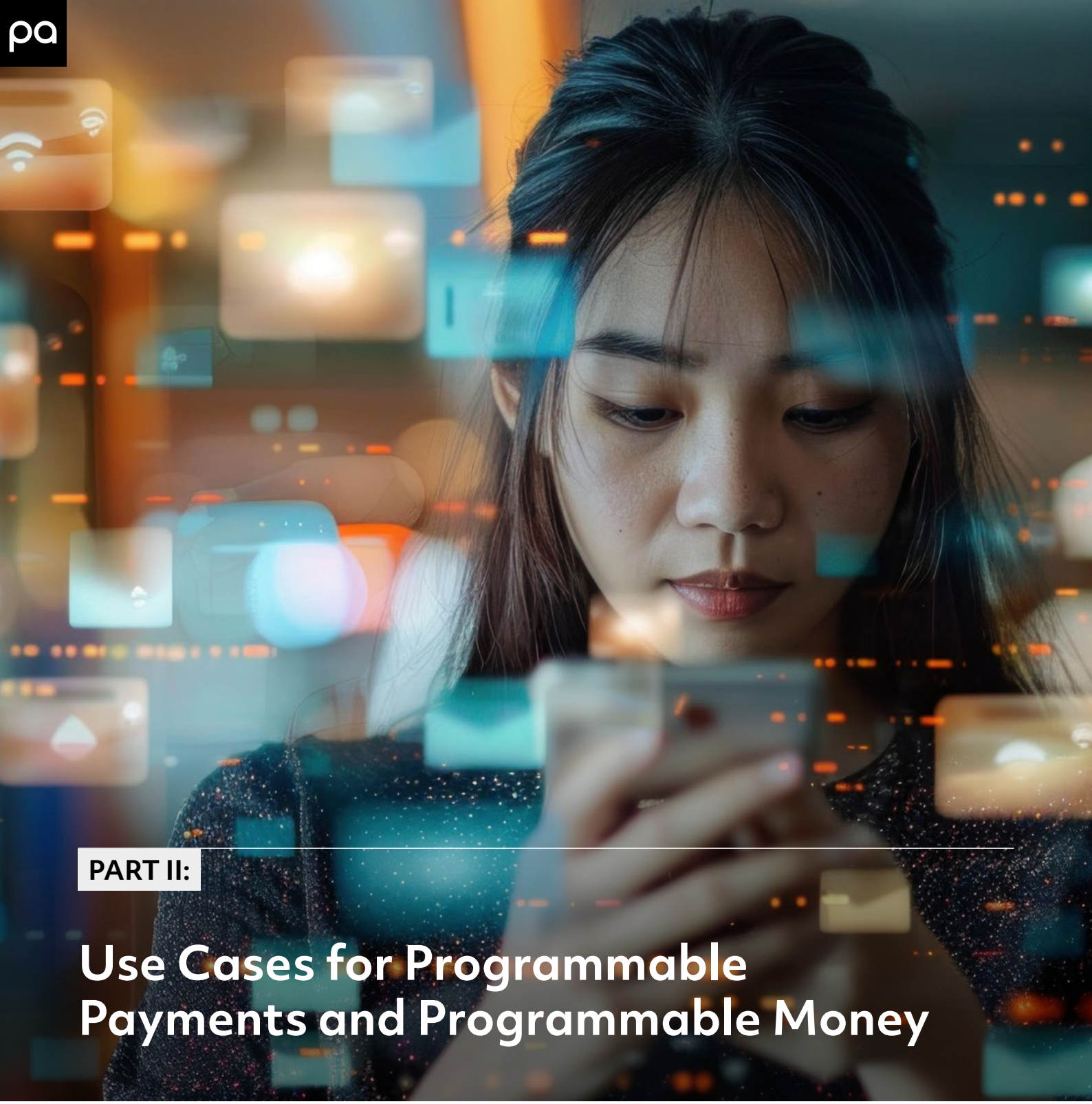
Criteria 2:
Who will program the money? Options here can be equally varied. For CBDCs it is likely that if a central bank chooses to issue programmable CBDCs that these will be programmed by that central bank. In the context of commercial bank programmable money, the tokenised commercial bank money we mentioned above, there could be options for consumers or businesses to program that money themselves according to their needs.

Criteria 3:
Will the programmable money be interoperable with other systems? For example, can the programmable money that I send from a CBDC ledger be received into a commercial bank account as its final destination? Can I withdraw CBDC in the form of cash?

Criteria 4:
Can users initiate a programmable money transaction with the known types of identifiers, e.g. IBAN in Europe, or account number and sort-code in the UK? An option to achieve this would be the use an oracle, which is an entity that connect blockchains to external systems, thereby enabling smart contracts to execute based upon inputs and outputs from the real world. This oracle would for example be able to support enable initiation of programmable money e.g. via IBANs.

Criteria 5:
Would the programmable money be able to travel cross-border? If so, what standards should be in place to enable programmable money to travel at a domestic and cross-border level? Will interoperability interfere with monetary controls?

Criteria 6:
Which regulatory framework is in place or will be put into place to support different forms of programmable money?



PART II:

Use Cases for Programmable Payments and Programmable Money

The discussion of use cases during workshops held in March by The Payments Association's Digital Currencies Working Group largely focused on the concept of programmable money, which is often considered as the next level of innovation that follows programmable payments. That does not mean that programmable payments have limited purpose, hence we will begin this section with a discussion of benefits and use cases for programmable payments, particularly in light of the existing mainstream underlying asset of commercial bank money.

Programmable Payments: Use Cases

The opportunity in the space of programmable payments is to advance beyond the current situation, where certain payment solutions embed a specific logic, such as direct debits, that are automatically applied to a specific account once or twice a month. Evolving programmable payments to enable payment users to program the payment would be a natural next step of evolution and could be a game changer in the payment industry. A point of caution here on the general preference of users for programmable payments. Research[1] has shown that whilst long-term economic relationships are mostly based on simple direct payments, programmable payments will only be used in situations where economic relationships are of short duration, due to the liquidity cost of locking up funds from the moment the paper commits to the programmable payment until the conditions are satisfied to release those funds to the payee. Let us look at some future use cases in this space.

RETAIL USE CASE

Tenant scenario:

Take the situation of a tenant that has been advised that their bathroom will be repaired. Enabling the tenant to program the payment in such a way that 30% of the rent for this particular month is paid on the rent pay date and 70% is paid once the bathroom has been fixed. This gets even more interesting if we take the case of a council house, where a government contribution to the bathroom repair is involved. The latter contribution should only get released once the conditions that have been imposed on the council house owner or other relevant parties in this use case have been fulfilled.

Energy Bill Payment:

One solution that goes into this direction is the Variable Recurring Payments, or VRP. In this case a consumer can choose the amount and frequency of payment to, for example, settle an electricity bill, while all the rest is automated. However, for more complex programmable payments, where we want to see the embedding of specific conditions that need to be fulfilled to trigger transactions, we will require payments product innovation and potentially changes to be applied to existing payment infrastructure in order to carry programmable logic within a transaction.

Embedded Payments:

With the economy becoming more digital and the increased roll-out of Internet of Things (IoT) devices, programmable payment features are becoming more relevant in the context of machine to machine communication. For example (1) The sensor in the fridge is activated when the milk is almost empty so that the fridge can reorder and pay automatically and get delivery; (2) Car subscriptions: payment of usage can be programmed, creating a pay-as-you drive model; (3) Vehicle payment: automatic payments for toll, tax, maintenance, servicing, fuel, etc.

1 *C.M. Kahn, M.R.C. van Oordt, (2022), "The Demand for Programmable Payments", Tinbergen, Link: https://papers.tinbergen.nl/22076.pdf*

BUSINESS USE CASE

Fund Sector:

We could innovate programmable micropayments to enable money market fund weekly or even daily payouts of interest at very low cost, rather than monthly or quarterly payouts. This is an interesting area in light of the increasing attractiveness of money market fund investing versus spreading your money across different bank deposits and could include variation margin, triggering multiple payouts a day.

GOVERNMENT USE CASE

Energy Support Scheme:

For example, in the context of energy support schemes, the government could automatically program benefit payments for consumers to be directly paid to energy companies. The existing situation where support payments are paid to energy consuming users, which they then use to pay their energy supplier can result in suboptimal outcomes and money being spent on other things. The government could use its taxpayer data base to directly distribute those payments or even to apply a commensurate tax relief or tax credit instead.

Programmable Money: Use Cases

As discussed, in the case of programmable money, specific logic is embedded into the asset itself, in this case, money. Logic and asset become inseparable. In principle, embedded logic within an asset can result in a number of benefits, including the elimination of otherwise necessary intermediaries, the application of regulatory measures to a transaction or process, automation of execution including regulatory compliance therefore, transparency and automated auditability and overall removal of the risk of human error.

One of the most important drivers of programmable money is the ability to fight fraud. For example, a certain amount of money could be programmed in such a way that it can only be spent on tax debt or between two identified individuals or business entities or within a closed loop commercial ecosystem.

Programmable money is particularly interesting in the context of government related use cases.

GOVERNMENT USE CASE

Government Procurement:

With government spending in the UK having reached £1.15 trillion during 2022-2023, representing roughly 45% of national GDP, there are instances where government funding does not always end up in the right channels and thus does not deliver the expected outcomes or reach its intended beneficiaries.

Deployment of programmable money on a public blockchain could solve this problem – at least in the context of public procurement cases – by not only programming the exact conditions for money to be released to specified counterparties at specific times, e.g. reaching specified milestones, but also delivering such an end to end public funding process in a transparent way, where every citizen could check that their tax money is spent on the designated cause. There would need to be a process in place where, if government money is spent in ways that are not in line with government policy, those transactions would be reversed, stopped or prevented in the first place because payments are based on conditionality, which is based on specific government policy and related contracts.

GOVERNMENT USE CASE

Financial Inclusion:

Around 13 million adults face financial exclusion in the UK. 1.2 million people are 100% cash reliant. To address this issue, we could see the role for a dedicated Welfare wallet with programmable money. For instance, programmability could support instant rent and utility bill payments on behalf of individuals that benefit from the welfare system. Such a process would also avoid unnecessary budget constraints and high interest credit challenges. The Inclusion Foundation[2] conducted a study in 2019[3] that being unbanked costs £500 GBP per user. Financial inclusion using such a Welfare wallet would save customers £1.3 bn and unlock £500 m. The statement ´being poor is expensive´ is true and programmable money with a CBDC wallet can reverse this situation, releasing more funds into the economy.

Automated Tax Payments:

In the context of CBDC, programming of tax payments for automation could be created. Citizens and corporates could be incentivised to use programmable CBDC for tax payments in return for a discount.

Programmable CBDC including off-line capability:

The delivery of programmable CBDC in combination with offline functionality can deliver significant benefits in terms of financial inclusion. Another critical use case would be in case of natural disaster response, for example for flood relief or when solar flares trigger network disruption. In such cases the recipient would get credited directly and would be able to make transactions in offline mode. Again, programmability could ensure that government support money could only be spent under clearly defined conditions or to identified beneficiaries.

COMMERCIAL USE CASE

Remittance use case:

Programmable tokenised commercial bank money, stablecoins or CBDCs could all be playing a part in improving cross-border remittances. We already observe the increased usage of stablecoins across borders. Taking the next step of programmability could enrich such services in order to improve the value delivered to users on both sides. Particularly in the context of combating fraud and in the context of cost and speed of these transactions, government intervention can play a key role in support of the poorest that today pay the most for these transactions. This is clearly in line with the G30 Roadmap on Cross Border Payments. With the emergence of CBDCs across different countries, there is an even broader cross-border remittance and payments use case emerging, where programmability could again add more value. For this to become a practical future scenario interoperability will be critical; this is an area that SWIFT for example is working on.

2 *https://theinclusionfoundation.org/index.php/statistics/*
3 *https://www.bbc.co.uk/news/business-48006905*

COMMERCIAL USE CASE

Global Trade Supply Chain:

For corporates, trade supply chain digitisation is an area where programmable money can be used, leveraging the opportunity of smart contracts to establish trigger-based payments in response to fulfilment of certain conditions.

In the UK in particular, such a use case complements the arrival of the Electronic Trade Documentation Act. Again, it will be crucial here to identify entities and assets that are part of the global trade supply chain and to convert all trade documentation into a digital process along the supply chain. The UK has a unique opportunity to support the development of standards and best practice, enabling the creation of a 'Reliable System' that can move trade supply chain data into the digital age.

Swift, the global financial messaging provider, recently trialled payment programmability in the realm of international trade with the goal of reducing trade payment delays, enhancing trust among trade parties and lowering transaction costs. **Conducted as part of a wider set of sandbox experiments**, Swift's trade use case demonstrated how complex, cross-jurisdictional payments could be automated for a clean/open account trade, using smart contracts. The CBDC-based payments were orchestrated by a simulator of Swift's Transaction Manager solution, while its connector solution was employed to automate communications between digital trade platforms and local CBDC networks.

The simulated digital trade network used in Swift's experiments included corporate participants which were pre-configured as buyers, sellers, carriers and port authorities, along with a network authority such as the digital trade platform operator. This setup – integrated with standard CBDC network configurations – ensured a comprehensive testing environment for the successful trialling of real-world trade scenarios that included the creation and fulfilment of POs, issuance of invoices, and automated payment execution. The use of smart contracts ensured that payment events were automatically triggered once trade conditions had been successfully fulfilled.

OTHER USE CASES

Consumer protection use case to fight fraud/loss of device:

In order for consumers to truly benefit from programmable money we need the other major ingredient – the ability to verify and authenticate the owner of programmable money. If digital money, whether this has been programmed or not for that matter, is linked to a specific owner, then even in case of a lost device, that owner can prove via digital identity verification and authentication that she/he is the owner. This is a major benefit over physical cash which, when lost, is lost forever.

General fraud management with programmable money; example stablecoin:

There are already solutions in the market where a stablecoin provider is able not only to track every single transaction that happens with that particular stablecoin, but also to freeze stablecoins that reside in an individual 's wallet (e.g. Tether). Such an approach could also be applied to tokenised commercial bank money or CBDCs, as new technology infrastructure becomes available.

Programmability and Ethics

When we examine both programmable payments and programmable money, and in particular when we look at the category of programmable CBDC, we will need to address the question of ethics. How far should a central bank go in terms of deciding the nature and features of its money through the use of programmability? Let's explore some scenarios.

Programmable Money and Monetary Policy:

A central bank might find it very attractive to issue programmable CBDCs in order to embed monetary policy decisions directly into the money itself. Considering CBDCs that are exposed to interest rate changes, this would mean that interest rate increases by central banks could be directly reflected in the CBDC itself, as could interest rate cuts. In economic theoretical discussions over the past few years, during times of negative interest rates, some economists argued that negative interest rates could be passed on directly to the population via the use of programmable CBDCs. Passing those on directly to citizens is ethically problematic and has never been tested. In terms of its effectiveness, this approach would only really work if no other forms of money were to exist in an economy. With cash still circulating, such a move by central banks would result in the hoarding of cash for example. Similarly, if CBDCs were to be programmed with a certain expiry date in order to entice spending in the economy, people would prefer to hold physical cash or commercial bank money, thus making this policy approach potentially completely ineffective.

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Programmable Money and Welfare Benefits:

Another example worthy of ethical consideration is the use of programmable CBDCs in the context of welfare benefits. Whereas a national tax authority could see benefits in programmability of CBDCs in order to ensure that welfare benefits are used in the prescribed way, this could clash with an individual's or family's civil liberties as well as the need for flexibility. Yes, in principle one could argue that using welfare money to buy food for the family, rather than spend it on alcohol and cigarettes would be in the interest of both government and ultimate recipient, but programming this into the money itself in terms of where and how it can be spent could ethically going to be a step too far.

PART III:

Creating a Digital Smart Economy with Programmable Money

Both programmable money and programmable payments could play a crucial role in accelerating the development of a Digital and Smart Economy. Looking specifically at the UK, it is clear that many other foundational elements need to be in place first, as discussed in the recently published Report "From Fintech to Ubiquitech: Accelerating the wider UK Digital Economy".[4]

Those foundational elements cover the following:

1. In order to build consumer and organisational trust in the digital age, Cyber Security and Fraud Controls are of paramount importance and must be the Government's core concern.
2. For the purpose of digital and economic inclusion, productivity and communication there is an underlying requirement that ubiquitous network coverage and connectivity is achieved. Without fast internet or mobile network being available in a ubiquitous way, the UK cannot deliver economic productivity and will not be ready for the future of the Internet with Web3.
3. A crucial component of any trust framework in the digital age is the confidence in identifying the relevant parties and the confidence in a liability framework when errors occur. Therefore, it is paramount to deliver secure digital systems for the verification and authentication of users, entities and assets that transact in the Digital Economy.
4. For the Digital Economy to be successful and comprehensive in all areas, UK society should be comfortable in their understanding and abilities to exploit the benefits on offer.
5. Moving beyond the purely Digital Economy, reforms to digitise and optimise the movement of physical goods are also necessary to streamline both financial systems and supply chains. The UK's leading role in trade with the Digital Trade Documentation Act and the fact that more than 80% of global trade is executed under English Common Law constitutes a key opportunity for the UK to lead the digitisation of the international trade system.

With those building blocks in place, programmable money would be able to form a critical part of an evolving Smart and Digital Economy in the UK. Experiments to initially accelerate the development of selected Smart Cities could leverage the combination of broad sensor distribution and collection of electronic data from and about people and infrastructure with the capabilities of programmable CBDCs in delivering efficiencies, mitigate financial crime and fraud and support improved allocation of resources over time.

4 *R. Wandhöfer et al., (2024), "From Fintech to Ubiquitech: Accelerating the wider UK Digital Economy", Link: https://static1.squarespace.com/static/5e7645300510772e85a4ce27/t/65fc33042762ed752701eccc/1711026951379/From+Fintech+to+Ubiquitech+-+Accelerating+the+wider+UK+Digital+Economy+1.15.pdf*

Conclusion

This journey through programmable payments and programmable money, including existing and future applications of these solutions, has shown increasingly flexible payment solutions that can include programmable features and can be part of an overall payment process automation. The new forms of money in the field of cryptocurrencies, in particular stablecoins, go a step further and enable programmability of the money itself, creating improved fraud controls and flexible choices for users. With CBDCs on the horizon, the first question that arises is whether these will be programmable and if so, whether this will be solely driven by central banks or whether users can have a say in programming these. In that regard we inevitably come across both ethical and practical questions. The ethical questions will need to be carefully considered as part of the design phase of CBDCs. So far the Bank of England has confirmed that it will not create programmability in the context of CBDCs in the UK.

From a practical perspective we need to take a broader look at the digital readiness of the UK economy, which requires ubiquitous network availability at speed, secure data highways, robust verification and authentication mechanisms for individuals, organisations and assets and digital inclusion and skills enabling the population to avail of these innovations.

As demonstrated in this whitepaper, we see many positive use cases for both programmable payments and the programmable money of the future. The Payments Association will continue to work with its members, engage with Government and regulators and seek opportunities to test use cases in regulatory and fintech sandbox environments as they become available. We look forward to supporting the UK economy on this journey into the future of programmable digital money.

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Chief Curiosity Officer, Dr. Ruth Wandhöfer is an author, speaker, advisor & educator on the digital economy and the future of finance and money, operating at the nexus of data, identity, regulation and technology innovation.

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Michael Boevink has more than 20 years management experience in the fintech and banking industry and is founder of his own investment company Boevink Group. Mr. Boevink specialises in capital raising, scaling and executing go-to-market strategies and business development growth in global markets and is engaged in companies as Raimac Financial Technology - Raimac.io - a programmable payment solution. He holds an MBA from the University of Bradford.

Digital Currencies Working Group

The Digital Currencies Working Group aims to develop a programme of thought-leadership content that educates and makes recommendations to the industry on a range of topics from the different types of digital assets and regulatory frameworks to wider ecosystem design.

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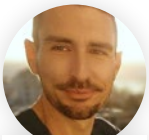

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About The Payments Association

The Payments Association is the largest community in payments. Founded in the UK in 2008, the association now operates communities in the UK, EU and Asia, helping almost 300 companies enhance their commercial interests, solve societal problems such as financial exclusion and evaluate new opportunities for innovation in payments.

Our purpose is to empower the most influential community in payments, where the connections, collaboration and learning shape an industry that works for all.

We operate as an independent representative for the industry and its interests, and drive collaboration within the payments sector in order to bring about meaningful change and innovation. We work closely with industry stakeholders such as the Bank of England, the FCA, HM Treasury, the Payment Systems Regulator, Pay.UK, UK Finance and Innovate Finance.

Through our comprehensive programme of activities for members and with guidance from an independent Advisory Board of leading payments CEOs, we facilitate the connections and build the bridges that join the ecosystem together and make it stronger.

These activities include a programme of monthly digital and face-to-face events including our annual conference PAY360 and awards dinner, CEO round tables and training activities.

We run six stakeholder working Project groups: Inclusion, Regulator, Financial Crime, International Trade, Digital Currencies and Open Banking. The volunteers within these groups represent the collective view of The Payments Association members at industry-critical moments and work together to drive innovation in these areas.

We conduct exclusive industry research. This research is not legal advice. It is made available to our members through our Insights knowledge base to challenge and support their understanding of industry issues. This include monthly whitepapers, insightful interviews and tips from the industry's most successful CEOs.

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