

**GBBC Open-Source Ideas Series:
Digital Money**

**Part I: The Rise of Central Bank Digital Currencies,
Spotlight on Project Bakong**



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SORAMITSU
ソラミツ

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Introduction

In the early 2010s, as cryptocurrencies and blockchain technology were growing in popularity, central banks began to consider how to adapt the concepts and technology to create a new kind of money: central bank digital currencies (CBDCs). By some accounts, China was the first to begin formal research, as it began working on its Digital Currency Electronic Payment (DC/EP) in 2014.ⁱ The idea gained further momentum two years later, when Ben Broadbent, the Bank of England's Deputy Governor for Monetary Policy, appeared to coin the term "central bank digital currency" in a speech.ⁱⁱ In 2016, the National Bank of Cambodia (NBC) and several other central banks established working groups to explore blockchain uses for payments; by 2018, the NBC was developing prototypes and beginning tests.ⁱⁱⁱ Three years later, Libra's June 2019 announcement^{iv} brought the concept to the forefront for many central banks and policymakers around the world. More recently, in late 2020, the Bahamas^v and Cambodia^{vi} were the first countries to officially launch their CBDCs.

Benefits

Why did CBDCs go from a novel concept to a reality in six years? The answer lies in the diverse benefits offered by CBDCs, especially in an era of increasing digitization and decreasing cash use. First, it is important to note the distinction between wholesale and retail CBDCs: wholesale CBDCs are intended for use by financial institutions, while retail CBDCs are intended for use by the general population. Some monetary authorities have opted to pursue wholesale CBDCs; this includes Australia^{vii} and Hong Kong, who determined that their existing "efficient retail payment infrastructure and services" made a retail CBDC unnecessary.^{viii} While wholesale CBDCs present benefits for financial institutions and governments, this paper is focused on the benefits of retail CBDCs, also known as "general purpose" CBDCs.

Reduced costs

A National Bureau of Economic Research working paper suggested that CBDCs "would significantly enhance the efficiency of the payments system... CBDC would be particularly beneficial for lower-income households, who tend to rely heavily on cash, and for small businesses, which incur substantial costs for handling cash or substantial interchange fees for taking payments via debit and credit cards."^{ix}

Increased Financial Inclusion

Enhancing financial inclusion is an important motivation for emerging market economies in particular^x. The Cambodian case makes this clear: despite ongoing efforts to increase financial inclusion, as of 2016, only 17 percent of Cambodians were banked and 42 percent had financial access through other formal means; 29 percent were excluded entirely from the financial system.^{xi} As stated by Christine Lagarde, former Managing Director of the International Monetary Fund and current President of the European Central Bank, CBDC "[financial inclusion is] where digital currency offers great promise, through its ability to reach people and businesses in remote and marginalized regions. We know that banks are not exactly rushing to serve poor and rural populations."^{xii}

Enhanced Monetary Policy

While the Bank for International Settlements (BIS) stated (in a joint report with the central banks of the EU, US, UK, Canada, Japan, Sweden, and Switzerland) that monetary policy is generally

not the primary motivation for issuing a CBDC, it added that CBDC could be used to “to stimulate aggregate demand through direct transfers to the public (so-called “helicopter drops”), possibly combined with “programmable monetary policy” (e.g. transfers with an “expiry date” or a conditional on being spent on certain goods).”^{xiii}

Risks

Financial Stability

In the same BIS report, the central banks suggest that depending on the design of a CBDC, there is a potential for “enabling destabilizing runs into central bank money, thereby undermining financial stability. [There is] concern that a widely available CBDC could make [bank runs] more frequent and severe, by enabling ‘digital runs’ towards the central bank with unprecedented speed and scale.”^{xiv} Central banks are thus taking a cautious approach to introducing CBDCs, conducting rigorous tests to mitigate financial stability risks.

Privacy

Central banks are unlikely to design and issue CBDCs that offer full anonymity, and wallets are likely to be linked to government-issued identification. This has raised concerns among privacy advocates, especially when considering China’s soon-to-be released CBDC, the Digital Currency Electronic Payment (DC/EP), “which has the potential to create the world’s largest centralized repository of financial transactions data; while it may address some financial governance challenges, such as money laundering, it would also create unprecedented opportunities for surveillance.”^{xv} While these concerns may not be as significant in other countries, they are still important to consider.

Bakong: Public-Private CBDC Collaboration

The Kingdom of Cambodia was one of several countries to intensify its CBDC research in 2016 and 2017. During the 2010s, Cambodia made considerable investments in its payment infrastructure, upgrading its National Clearing House and developing both an interbank transfer system (FAST) and an ATM/point-of-sale payment network (CSS). Recognizing an integrated digital payment system as a rational continuation of these efforts, the National Bank of Cambodia (NBC) launched Project Bakong in 2016. The goal of Bakong was to determine how digitalization could increase financial inclusion, promote the use of the Khmer Riel (KHR), reduce overhead for banks and MSMEs, and improve the overall efficiency of the financial system.

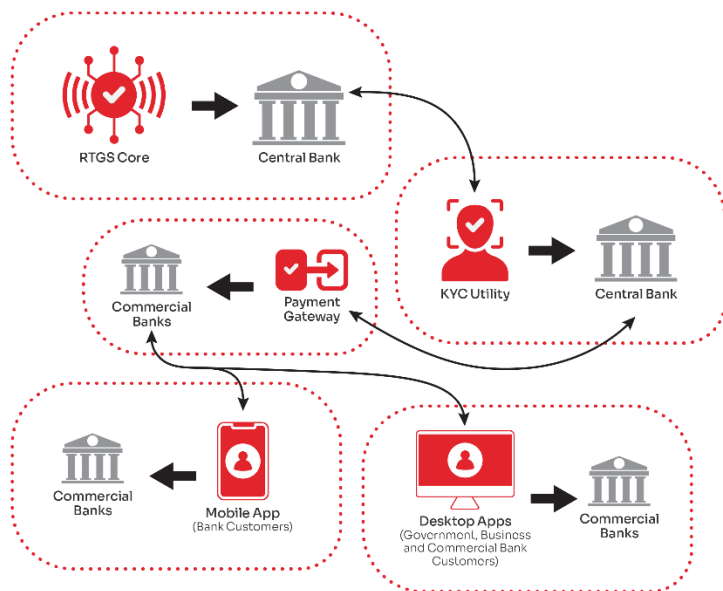
The NBC quickly determined that a retail CBDC would prove the most effective means of realizing these goals. In 2017, the Bank selected Hyperledger Iroha as an ideal technological basis upon which to build a retail CBDC. Hyperledger Iroha is a permissioned append-only distributed ledger—better known as a permissioned blockchain—which immutably records all transactions in a chronological chain of records stored in multiple nodes. Hyperledger Iroha was contributed to the Linux Foundation’s Hyperledger Project by a team of developers led by Japanese/Swiss fintech company SORAMITSU.

The NBC brought SORAMITSU onboard Project Bakong in early 2017. Effective cooperation between the NBC and SORAMITSU teams made an ambitious timeline possible. In 2018, minimum viable product specifications were established using Hyperledger Iroha as a basis. In Q2 of 2019, Bakong was integrated with legacy systems (FAST and CSS) and soft-launched with four financial institutions and their end customers, using fiat-backed digital Riel (as well as USD).

A nationwide soft launch followed in Q3 of 2019. Excellent stakeholder feedback and end-user reviews substantiated the NBC’s decision to officially launch Bakong in 2020.

System characteristics and design

As of October 2020, Bakong is supported by 18 major financial institutions. It can handle the needs of 17 million end customers, with a transaction time of approximately 2-5 seconds and throughput of nearly 2,000 transactions per second. Anyone with a domestic phone number, bank account, and smartphone can use Bakong to keep digital KHR and USD wallets, transfer between accounts, and make person-to-person and point-of-sale payments via phone number or EMVCo-compatible QR code scan, all free of charge.



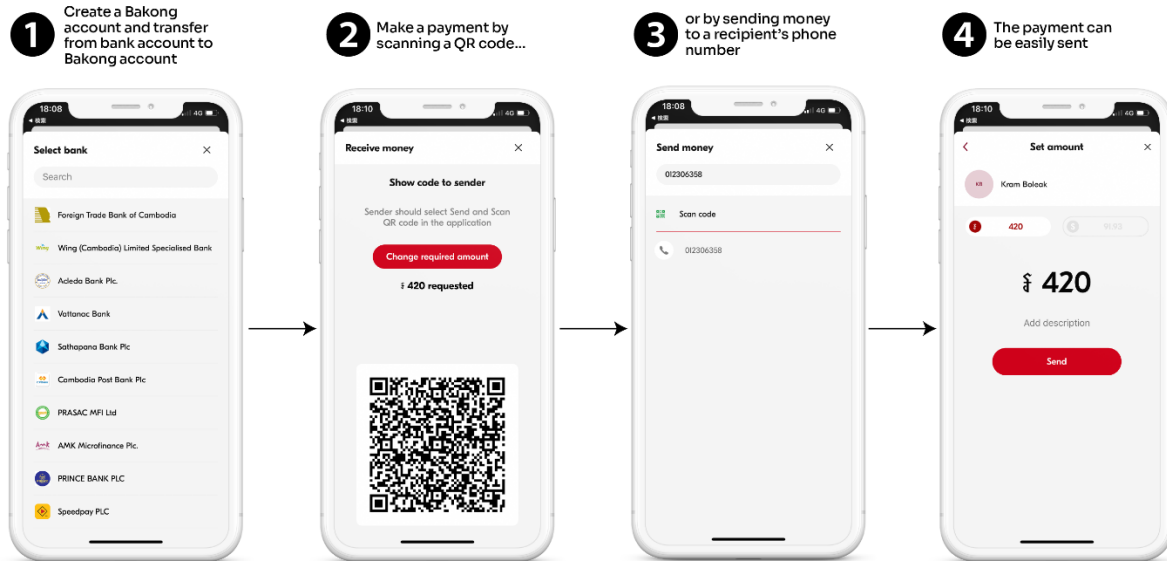
The Bakong architecture is parsimonious by design. It consists of a Bakong Core maintained by the NBC on secure physical infrastructure; individual domains or payment gateways assigned by the central bank to commercial financial institutions; and digital wallets assigned by commercial financial institutions to their end customers. Permissions can be set for all system functions on a user-by-user basis, thus preserving the central bank’s regulatory authority. KYC and AML/CFT regulations are established by the central bank and implemented by participating financial institutions, which Bakong supports via a tiered KYC system. Financial institutions use Bakong via a desktop app, while end customers can use both desktop and smartphone apps.

Benefits

Building a CBDC using distributed ledger technology brings several advantages, first and foremost, resilience-by-design: because copies of the ledger are kept on multiple servers and updated and synchronized in real time, cyberattack and fraud risks are minimal, while the double-spending problem and counterparty risk are mitigated entirely. Additional advantages are:

- **Financial inclusion:** Anyone with a domestic phone number, bank account, and smartphone can use Bakong. In stark contrast to existing quasi-formal OTC payment services, Bakong transactions are instant, risk-free, and free of charge. Bakong will raise the bar for financial institutions, incentivizing them to develop efficient, low-cost online services for underprivileged citizens—especially the young and digitally oriented. The entry of unbanked or underbanked Cambodians into the financial system will yield reciprocal benefits for financial institutions and the economy as a whole.
- **Cost efficiency:** Transactions by end customers are free of charge. All financial institutions will save on the cost of building out proprietary infrastructures and partner networks. Those financial institutions without online banking can default to the Bakong app, while those which do offer online banking can take advantage of the Bakong API to achieve full financial system integration.

- **Speed and scalability:** Hyperledger Iroha is an extraordinarily efficient DLT. Transaction times of 2–5 seconds and throughput of around 2,000 transactions per second promise scalability at acceptable costs.
- **Security and resilience:** Hyperledger Iroha has been audited by Nettle. It utilizes a Byzantine fault tolerant consensus mechanism, which ensures the integrity of the ledger even if multiple nodes are compromised by accidents or bad actors.



Regarding monetary policy, Bakong is neutral: the digital Khmer Riel does not bear interest and is fully backed by fiat currency. Bakong does not change the fundamental structure of the Cambodian financial system; rather, it integrates formerly disconnected networks and actors within the context of an advanced ledger that is resilient by design. Commonly cited CBDC downsides, such as bank run risk and liquidity risk, are minimal as all digital Riel and USD wallets are backed by fiat currency held at the central bank.

Next Steps

As of winter 2020, Bakong has steadily increased its partner network and user base. Bakong provides the NBC and its partners with a powerful new means of creating opportunities for citizens, especially the currently unbanked and underbanked. It also establishes a best-practice case for other emerging-market central banks, particularly those who wish to harness the security and efficiency benefits of distributed ledger technology without completely overhauling their legacy payment infrastructures or disrupting the stability of their financial systems.

For SORAMITSU, Bakong has provided invaluable experience in implementing next-generation technologies under real market conditions, which proof-of-concept and pilot tests cannot fully simulate. The industry has taken note of this achievement: in a year marked by several notable CBDC developments, the Central Banking publication chose to recognize SORAMITSU with its inaugural FinTech & RegTech award for CBDC Partner.^{xvi} SORAMITSU will draw upon its Bakong experience during its ongoing development work on Hyperledger Iroha: an upcoming release, Hyperledger Iroha v2, will meet the central banking and e-governance use cases with features such as digital asset programmability, greater throughput and performance, and more features for decentralization.

Conclusion

The success of Bakong and other first-mover CBDCs is likely to further motivate countries to issue their own CBDCs. China, the world's second largest economy, has made progress towards introducing its DC/EP, engaging in numerous trials with users and businesses around the country. While it seems all but certain that China will be the first G20 country to introduce a CBDC, other large economies are also making progress. In November 2020, Christine Lagarde, President of the European Central Bank (ECB), speculated that the ECB would introduce a digital euro in two to four years.^{xvii} The United States has also begun researching CBDCs, with the Federal Reserve citing the emergence of Facebook's Libra (now known as Diem) and China's DC/EP as primary motivators.^{xviii}

As these and other countries move from research to pilot projects to deployment, they will undoubtedly learn from existing CBDCs, including Cambodia's Bakong. CBDC early movers will provide invaluable information to new CBDCs while also continuing to improve. If designed thoughtfully, central bank digital currencies have the potential to reduce costs, increase financial inclusion, and improve monetary policy, all of which can benefit the poorest and most vulnerable populations.

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- ⁱ <https://www.ft.com/content/e3f9c3c2-0aaf-11ea-bb52-34c8d9dc6d84>
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