



TECHNICAL ASSISTANCE REPORT

REPUBLIC OF KAZAKHSTAN

Next steps and Considerations for the Digital Tenge
October 2025

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Monetary and Capital Markets Department

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DM5 Reference: 18540157

Mission ID: 25MME25; 25MME60

Funding Program ID: MCM_APD_2023_01

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Acknowledgments

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This technical assistance mission was made possible thanks to the financial support of JSA Donors, which is funded by The Government of Japan.

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Glossary

AFSA	Astana Financial Services Authority
AI	Artificial Intelligence
AIFC	Astana International Financial Center
AML / CFT	Anti-Money Laundering / Counter-Financing of Terrorism
ARDFM	Agency for the Regulation and Development of Financial Markets
ATM	Automated Teller Machine
BIS(IH)	Bank of International Settlements (Innovation Hub)
B2[B/G/P]	Business to [Business/Government/Person] (payment type)
CBDC	Central Bank Digital Currency
wCBDC	Wholesale Central Bank Digital Currency
CNI	Critical National Infrastructure
DLT	Distributed Ledger Technology
DT	Digital Tenge
DvP	Delivery versus Payment (settlement)
FI(s)	Financial Institution(s)
FMI(s)	Financial Market Infrastructure(s)
FSAP	Financial Sector Assessment Program
G2[B/P]	Government to [Business/Person] (payment type)
IMF	International Monetary Fund
ISO	International Standards Organization
KASE	Kazakhstan Stock Exchange
NBK or NBRK	National Bank of the Republic of Kazakhstan
NPC or NPCK	National Payments Corporation of Kazakhstan
P2[B/G/P]	Person to [Business/Government/Person] (payment type)
PoC	Proof of Concept
PoS	Point of Sale
PSPs	Payment Service Providers
PvP	Payment versus Payment (settlement)
QR	Quick Response (code)
RTGS(S)	Real Time Gross Settlement (System / Service)
STB(s)	Second-Tier Bank(s)
VAT	Value-Added Tax
WBG	World Bank Group

Preface

At the request of the National Bank of the Republic of Kazakhstan (NBK), the International Monetary Fund (IMF) conducted a technical assistance (TA) mission, led by the Monetary and Capital Markets department (MCM), on central bank digital currency (CBDC), otherwise known in Kazakhstan as the Digital Tenge (hereafter “DT”). To support authorities’ evaluation and understanding for their next steps in the DT Project, the mission has conducted two phases of technical assistance to date: 1) a virtual phase from 20 February 2024 to 20 March 2024, and 2) a hybrid mission, visiting Astana, Kazakhstan from 22 May 2024 to 25 May 2024, and Almaty, Kazakhstan from 26 May 2024 to 4 June 2024.

This has been a hybrid technical assistance mission, formed by a team of eight experts spanning CBDCs, retail payment systems, legal issues, technology, and cyber resilience. Staff members from the Monetary and Capital Markets Department (MCM), the Information and Technology Department (ITD) and one Short-Term Expert traveled to both Astana and Almaty, while members from the Legal Department (LEG) and a second Short-Term Expert joined relevant meetings virtually. The team composition reflects an ambitious set of topics in scope agreed for this TA, which in turn was based on the advanced nature of Kazakhstan’s work on CBDC.

The mission met with Yerlan Ashykbekov, Director of Payments Systems Department, NBK, Alina Imangazina, Head of Payment Systems Policy Division, NBK, Binur Zhalenov, (then) CEO of the National Payments Corporation of Kazakhstan – NPCK¹, Dina Balkina, Director of Payment Technologies Development Department, NPCK and related teams and staff. Departments from the NBK engaged included the Payment Systems Department, Legal Department, Monetary Policy department, Financial Stability and Economic Research Department, alongside staff across the NPCK. In the second phase regulators, government agencies, commercial banks, the wider payments industry, and consumer and business groups were also engaged. The mission wishes to thank both the NBK and NPCK staff, for their cooperation, productive discussions, and their hospitality.

This TA report presents the mission’s assessment and main conclusions.

¹ Mr. Zhalenov now holds the title of Chief Digital Officer and Advisor to the Governor of the NBK, and Chairman of the NPCK.

Executive Summary

The NBK took a decision to pursue the issuance of a CBDC (Digital Tenge / DT) in 2022. This decision follows the NBK and NPCK's exploration and subsequent experimentation work in 2021.² Stated objectives for the DT include: (i) modernization of the national payments system, (ii) increasing the efficiency of state-related payments, and (iii) increasing innovation, efficiency, and competitiveness of the domestic financial market. The mission noted a focus from stakeholders on two objectives: promoting innovation, efficiency and competition in the payments landscape, and improving transparency in public spending. Authorities are targeting end-2025 for realization of an "industrial grade platform" of the DT. In preparation for this, a "limited production" mode of the DT platform (with real users) was launched in November 2023, testing DT-linked card payments and digital school meal vouchers.

The mission covered a wide range of topics to support an analysis of the implications of different DT use cases. Topics included legal considerations of issuance and operation, macro-financial implications, technology risks and opportunities, institutional capacity, and cyber readiness of the financial landscape. These issues were explored in the context of authorities' interest in understanding the implications of the broader use cases for DT beyond retail payments. The mission's recommendations sought to build upon and enhance the ambitious workplan of authorities. They were given with the understanding that authorities may need to strengthen their capacities (within the NBK/NPCK and also related public bodies) to cover feasibility study, implementation, and assessments of DT.

Most critically, the NBK needs to ensure that issuance of DT is founded on a robust and ideally explicit legal basis ahead of the launch of an "industrial-grade platform." The mission has explored different approaches globally, and noted that most central banks require an update to their mandate under the organic law to provide legal certainty to issue a *digital* form of currency to the public. DT should be founded on a robust legal basis under Kazakhstan's legal framework and the mission highlighted the NBK's current mandate on currency issuance is currently limited to "banknotes and coins."³ While the authorities are considering designating DT as e-money and have performed sufficient clarifications for small-scale testing, the mission noted this may not provide typical certainty in the long term and widespread operation of the platform. In addition to the legal treatment of DT under central bank and monetary law, the mission discussed further legal considerations on potential amendments to the civil, payments, and private laws. A further TA from the IMF could be requested once the NBK has identified the relevant laws required for amendment.

To support Kazakhstan's ambitious DT plans, capacity building across particularly the analytical and operational divisions of the NBK was considered important in the short term. The primary work and project (as run by the Payment Systems Department of the NBK and NPCK) would benefit from the wider buy-in from other departments as DT awareness and adoption increases. Establishing governance structures that normalize DT discussions within analytical and operational divisions could better ensure that timely and thorough decision-making can occur beyond the 2025 operational target. The mission recommended a cross-NBK taskforce, with the involvement of related agencies (i.e., the Agency for the Regulation and Development of Financial Markets – ARDFM), would be important to ensure a structure is

² The mission, in its discussions has not commented on if the decision to pursue CBDC, and with which technology, is 'correct' – decisions on issuance and technology solutions chosen are for individual jurisdictions to determine. Our work on 'feasibility' covers considerations to support implementation and broader stability.

³ Law of the Republic of Kazakhstan "On the National Bank of Kazakhstan" (Article 8(3)).

in place for critical decisions on design and operation, particularly where macro-financial implications emerge.

Whilst the DT poses low risks to financial stability for the current “limited production” retail scenarios, the broader range of use cases requires further targeted analysis. A single DT platform to support all use cases and players allows for a wide set of innovation, but also uncertain demand dynamics. This increases the challenges in forecasting macro-financial risks, and specifically the impacts for commercial banks. For example, allowing access to all actors in the financial landscape could, in periods of financial stress, increase the risk of runs into DT as a perceived “safe asset.” Uncertainty in demand makes it important to maintain flexibility to implement future limits or access criteria. The mission noted that the current framework for opening a DT account (requiring a bank account, and subsequent Kazakhstan ID or legal entity registration) may mitigate severe macro-financial impacts from cross-border non-resident use. The mission also reiterated the recent FSAP’s guidance on interconnectedness with crypto assets – the use of DT or a DT-backed stablecoin could increase risk transmission channels among the crypto asset market, the traditional financial industry, and NBK directly – this would require a review of the domestic regulatory approach.

Authorities could consider TA on payments systems supervision and regulation to maximize the benefits of DT for supporting payment systems’ objectives such as choice, resilience, and competition. As DT will be implemented into a concentrated payment landscape, the NBK and the NPCK may need to carefully consider the rules and schemes placed for both DT and existing systems, including public-supported payment infrastructures, such as the instant payment system in development. Closer alignment or interaction may help maximize the value of either system and manage any excess substitution effects and regulatory gaps. As regulation and supervision of existing systems was not within the scope of this mission, a further TA may best support these aspects.

The mission’s initial pilot analysis exercise offered guidance on how to enhance the ongoing experimentation and engagement. This analysis focused on three areas: how objectives and experimentation of DT fit together and where they could better align, how further piloting could help evaluate future design choices, and how stakeholder engagement could be further developed – up to and beyond implementation, in line with experiences of other central banks.

Strong cyber practices and mitigation of technical capacity constraints should underpin the next stage of DT operationalization. For the DT use cases being prioritized for end-2025, building operational and cybersecurity resilience remains a fundamental principle and prerequisite.⁴ To avoid gaps in the operation and supervision of the DT platform, a periodic assessment of DT’s role as a critical financial market infrastructure (FMI) could be undertaken, and capacity to discuss and monitor cybersecurity issues of the broader landscape between NBK, NPCK and ARDFM needs to be strengthened. Equally, the mission encouraged the establishment of a technical board, with second-tier banks (STBs) to provide a practical forum to oversee the management and capacity of all nodes in the DT platform. Other technical stakeholders could be engaged to secure a larger market readiness, based on authorities’ priority use cases. When determining the use cases prioritized in the first stage of full production, the NBK and NPCK would need to align with, and not exceed, the tested operational capacity of the platform by end-2025 to avoid operational and reputational risks.

⁴ See for example, the discussion in [Public Policy Principles for Retail CBDCs \(G7 2021\)](#).

Recommendations

Table 1. Main Recommendations 1/

Recommendations (Authority Responsible for Implementation)	Priority	Timeframe 1/
Legal Considerations for the Digital Tenge (DT)		
Review the current legal and regulatory framework in Kazakhstan to identify the gaps and provide legal clarity in terms of mandate of the NBK to issue, distribute, and circulate DT. (NBK)	High	ST
Prepare draft amendments to the relevant legislations for purposes of issuance, distribution, and circulation of DT. (NBK)	High	ST
Existing Payments Landscape and Interoperability of DT		
Take stock of current regulatory powers and investigate the feasibility of extending powers as needed. (NBK) ▪ Evaluate the central bank's current role and mandate in payments regulation and what powers currently exist (NBK) ▪ Understand if/how scope needs to expand to support interoperability (NBK) ▪ Build dedicated capacity to consider the scheme (rulebook) and service level agreement for DT (NBK, NPCK) ▪ Seek further TA on regulatory framework for payments systems (NBK)	High	MT
Evaluate the benefits of integrating DT and the instant payment system as an alternative / additional choice to card scheme integration. (NBK, NPCK)	High	MT
Institutional Capacity, Technology and Cyber resilience		
Establish a Taskforce or Steering Committee representing all NBK departments and relevant teams of ARDFM to refine a common vision of DT. (NBK, NPCK, ARDFM)	High	ST
Consider creating a technical board with STBs to oversee the operational and technical management aspects of the DT platform. (NPCK)	High	ST
Assess which use cases are feasible relative to the existing and forecasted technical capacity of the platform. (NPCK)	High	ST
Consider how to maintain flexibility in the DT platform's design and ensure a clear decision-making process for such changes is in place. (NBK, NPCK) ▪ Ensure ISO20022 compliance (NBK, NPCK)	High	MT
Further develop a set of minimum-security requirements to guide the design, development, and operationalization of the DT platform ahead of broadening the use cases. (NPCK, NBK)	High	MT
Commission an independent security and resilience test of the DT platform before production and regularly thereafter. (NBK, NPCK)	High	MT
Develop a strategy to build, upskill, and retain the technology and cybersecurity expertise required to support implementation and protection of critical payment systems with other stakeholders. (NBK, NPCK, ARDFM) Potential areas for action:	High	MT-LT

Recommendations (Authority Responsible for Implementation)	Priority	Timeframe 1/
- Establish a regular joint forum to raise cybersecurity and privacy awareness in the financial sector to combat digital fraud and discuss emerging threats (NBK, NPCK, ARDFM) - Enhance and expand proactive cyber incident detection and response (FINCERT ARDFM) - Develop strategy and guidelines together with regulators (such as ARDFM) to ensure market participants safely and securely adopt emerging technologies (NBK, NPCK) - Periodically assess if DT is classified as a critical FMI as DT use grows, to determine the appropriate level of protection from cyber threats (NBK)		
Exploring Broader Use Cases and Macro-financial implications		
Increase capacity and engagement within analytical and operational departments and divisions in preparing for the design and monitoring of DT production. (NBK)	High	ST
Undertake a baseline assessment of the macro-financial implications of the key DT use cases for production at end-2025 using regulatory/supervisory data. (NBK, supported by ARFDM)	High	MT
Continue to seek clarity on core metrics of success for Ministry of Finance and other agencies for government use cases (NBK, NPCK)	Medium	ST
Reflect on cross-border implications for future design changes or choices (NBK) Engage proportionately with ongoing cross-border experimentation internationally (NBK, NPCK)	Medium	LT
Developing the Pilot Experimentation (Pilot Analysis)		
Provide clarity on the vision for DT through a future roadmap / status report outlining key use cases targeted for production at end 2025. (NBK, NPCK) Work with industry to sort use cases into the short and long term based on objectives and capacity (NBK, NPCK)	High	ST
Dedicate capacity to refine use cases centered in core objectives. (NBK, NPCK) - Engage with other central banks in emerging practices on providing offline services to support financial inclusion goals, whilst maintaining strong security posture (NPCK) - To support goals of innovation, competition, interoperability and choice, further emphasis needs to be given to testing DT in real-world settings (NBK, NPCK)	High	MT
Establish evaluation criteria for each use case which correspond to the broader objectives of DT. (NBK, NPCK)	High	MT
Identify and design user education strategies to avoid misinformation risks. Future pilots could test these strategies. (NBK, NPCK)	High	MT
Seek out smaller or less-vocal stakeholders to understand the wider opportunities and implications for DT in the long term. (NBK, NPCK) Ensure interests of both larger and smaller FIs as well as consumer and business groups can be represented in future engagement	High	LT

1/ Short term (ST): < 6 months; Medium term (MT): 6–18 months; Long term (LT): 18–36 months

Introduction

1. The mission's objective was to support authorities in their analysis of the next steps on the DT project. Authorities are targeting end-2025 for the launch of an “industrial-grade” platform of the DT across Kazakhstan following a limited production pilot in 2023.⁵ In preparation for this, the mission has looked to structure the request from the NBK around five elements: i) legal considerations, ii) architecture and interoperability of DT, iii) security and resilience of payment systems, iv) broader use cases for DT, and lastly v) an analysis of the pilot work to date to inform next steps.

2. The mission presented on several core aspects of CBDC. These included the policy and technical considerations for interoperability of a retail DT, legal considerations of issuance and operation of DT, cross-border CBDC design and implications, and wholesale CBDC considerations. The second phase supported discussions through a range of stakeholder engagement. Both internal NBK and NPCK staff of different divisions were engaged. External stakeholders included the regulators (ARFDM, AFSA), government agencies, the payments and banking industry and civil society.

3. The mission considered developments within the broader payment system in Kazakhstan. The DT will face the challenge of launching within a concentrated and possibly “fragmented” payments landscape. Kazakhstan’s payment landscape has seen a rapid transformation to a near-cashless state in urban areas. Rural areas with less reliable connections still rely on cash and banking services via the bank branch networks. A young population and the pandemic have accelerated digital trends. Authorities are working through a set of ambitious measures to reinforce public digital payments infrastructure in Kazakhstan, including a fast payments system, however the bulk of payments presently run through two non-interoperable systems. Lack of transparency of these private systems partly underpins the NBK’s motivation to achieve a more efficient, open and interoperable payment landscape. Within this context, a retail DT’s success may be characterized by the added value it can provide as an alternative to or “efficiency improvement” on traditional bank and card rails. However, if not designed and implemented correctly, it could result in further fragmentation and contribute to inefficiencies.

4. Other factors are influencing design and pilot work. An increasing desire for transparency in public spending has raised the priority and importance of G2P and G2B use cases for DT. The mission came to understand this as the current priority to test during the second phase and some considerations were covered accordingly. The macro-financial implications of such use cases require further analysis. Attention will need to be paid to the potential size of such use cases, particularly to understand the impact on the banking sector, and the amount of time for which large DT balances will be held outside of the banking sector’s balance sheet.

5. This report summarizes the learnings from the mission and the recommendations for next steps for the DT project. Recommendations cover the topics explored during the mission alongside considerations for bolstering institutional capacity. Raising internal capacity and getting the right support from external counterparts is critical to scaling some of the desired use cases whilst undertaking the appropriate analysis (see Table 1).

6. The structure of this note is the following: section I discusses the legal considerations of DT issuance and operation, section II considers interoperability of DT with the existing landscape, section III covers the discussion on expanding use cases, including the pilot analysis, and section IV covers cyber and operational resilience approaches in Kazakhstan. Annexes I—IV provide supporting details.

⁵ “industrial-grade” refers to an operationally-viable platform enabled for specific real-world DT use cases.

I. Legal Considerations for DT

7. This section discusses legal considerations from central bank, monetary and private laws perspectives to ensure legal certainty for the issuance, circulation and distribution of DT. TA on legal considerations was primarily conducted virtually during the first phase of the TA, with a short update session covered in the second phase to reflect on developments.

A. Legal Considerations: Central Bank and Monetary Law

8. The issuance of CBDC constitutes a new function for central banks, which requires legal certainty. CBDC is a digital currency issued by the central bank and represents a claim on the central bank. As such it forms part of the legally broad concept of “money” which encompasses currency, commercial and central bank book money, and electronic money. Electronic money is commonly referred to as electronically stored monetary value represented by a claim on the issuer that is issued on receipt of funds for the purpose of making transactions and is accepted by natural or legal persons other than the issuer.⁶ While it is noted under the Law of Republic of Kazakhstan “on Payments and Payment Systems” that e-money may also be issued by the NBK⁷ and that the authorities are temporarily considering leveraging e-money framework to issue DT, the mission recommended that authorities conduct a further assessment on the appropriateness of this approach. This should take into consideration the design features and the applicability of e-money regulatory requirements on NBK.

9. The legal treatment of CBDC under central bank and monetary law will depend on its operational and technical design features. The design features of CBDC can be analyzed on four axes: (i) account-based v. token-based; (ii) wholesale v. retail; (iii) direct v. indirect; and (iv) centralized v. decentralized. While some central banks do not clearly distinguish between account-based and token-based CBDC, this distinction helps to think through the legal implications of envisaged CBDC. A token-based CBDC would truly be a new form of money; a central bank liability incorporated in a digital token and transferred by transfer of that token. This is not a credit balance in the current account of the central bank and entails no contractual relationship between the central bank and the holder of token-based CBDC (Bossu and others 2020). In contrast, account-based CBDC is not a new form of money, but merely book money expressed in digital form. The transfer would be by debiting and crediting current account of holders, and the legal ramifications is by enforcement of contractual rights and obligations.

10. The introduction of CBDC raises important legal questions from the perspectives of public and private law.⁸ From a public law perspective, the two most important questions are whether (i) the central bank has a sound mandate to legally issue CBDC and (ii) CBDC legally is currency. It is emphasized that issuance of CBDC should be founded on a robust, ideally explicit, legal basis in the central bank law. In light of the principle of attribution of powers, the issuance of CBDC will require a firm anchor in the mandate established by the central bank law i.e., functions (what a central bank must do to achieve its objective) and powers (how a central bank can act to implement its functions). Monetary law, on the other hand, provides the legal foundations for the use of monetary value and that it is for a sovereign State to determine and establish its own currency system.

⁶ In Kazakhstan, the Law of Republic of Kazakhstan “on Payments and Payment Systems” has defined e-money as unconditional and irrevocable monetary obligations of the issuer of e-money stored in electronic form and accepted as a means of payment in the e-money system by other participants of the system.

⁷ Article 42(2).

⁸ See Bossu and others (2020) on Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations.

11. Against this backdrop, the Law on the National Bank of the Republic of Kazakhstan (Law on NBK) does not yet contain a legal basis permitting the issuance of CBDC. The Law on NBK adopts a narrow wording referring to exclusively “banknotes and coins” with respect to the power of the NBRK to issue, organize and withdrawal of circulation of currency.⁹ If CBDC were to be qualified as account-based, the Law on NBK does not contain explicit provision which allows the central bank to open accounts for the general public. Instead, the Law on NBK clarifies that the owners of bank account in the NBK are those legal entities that have opened account in the manner established by the NBK, and banks, and branches of non-resident banks of the Republic of Kazakhstan are considered the holders of the bank accounts.¹⁰

12. Legal clarifications would also be needed with respect to the monetary law aspects of CBDC.¹¹ The Law on NBK provides that the monetary unit (national currency) of the Republic of Kazakhstan is the Kazakhstani Tenge¹², and the Civil Code stipulates that the monetary unit in the Republic of Kazakhstan is the Tenge.¹³ Since the CBDC is a means of payment issued in the existing official monetary unit and not a new currency, there is no need to clarify or amend the definition of the official monetary unit in Kazakhstan. However, the legal framework limits (i) the monopoly of issuance, (ii) legal tender and (iii) the exchange at face value (*cours forcé*) to banknotes and coins.¹⁴ To this end, these provisions would have to be extended to DT. In discussing the attribute of legal tender status, while arguably the State’s power to attribute by legislation legal tender status to a means of payment is unlimited, it is only fair that the means of payment must be easily receivable by most of the population. To this end, authorities must assess if the law can oblige general public to accept CBDC given dependency on technical infrastructure and issue of privacy, and a limited scope could be considered for the CBDC.

B. Other Legal Considerations

13. Roles and responsibilities of entities involved in DT operations need further clarifications from payment system and payment services law perspectives. In the context of payment systems and payment services law, it will be essential for the legal framework to regulate the DT platform and to determine the role of the operator and the relationship with the financial institutions for distribution of the CBDC, and other roles as may be defined by the legislation. Therefore, it will be critical to determine when CBDC payments are to be considered definitive or final. Settlement finality is intended to address the insolvency risk of the payor and the ensuing financial stability risk. Accordingly, the applicable settlement finality rules in Kazakhstan should be reviewed in light of the design and use case of the DT. Moreover, the legal framework should ensure legal certainty as to whether there will be any application of rules for payment services to payments in DT, as well as regarding the obligations of payment service providers related to DT.

⁹ Articles 8(3) and 40 of the Law on NBK.

¹⁰ Article 52 of the Law on NBK.

¹¹ Five key attributes of the legal concept of currency are (i) legal tender status which entitles a debtor to discharge its monetary obligations by tendering currency to the creditor; (ii) *cours forcé* which means value of a banknote is the amount printed on it denominated in the official monetary unit, which can be exchanged at par for other banknotes or coins, or deposited in a bank account; (iii) a monopoly on issuance by the State or central bank; (iv) protection under criminal law (counterfeiting), and (v) privileges under private law e.g. protection of good faith acquirer of banknotes that had been lost or stolen.

¹² Article 38 of the Law on NBK.

¹³ Article 127 of the Civil Code of the Republic of Kazakhstan.

¹⁴ Articles 8(3) and 40 of the Law on NBK reserve the monopoly of issuance to the NBK, Article 1 of the Law of the Republic of Kazakhstan “On Currency Regulation and Currency Control” deals with the legal tender of banknotes coins, while Article 127 of the Civil Code of the Republic of Kazakhstan refers to the exchange at face value (*cours forcé*) of banknotes and coins deals with the legal tender of banknotes coins.

14. Private law should provide legal certainty for the circulation of the DT. The mission encouraged the authorities to provide legal clarity in certain areas of private law that would govern the DT, especially in terms of: (i) defining the private legal nature of the DT; (ii) addressing the interaction between the DT and the private law mechanisms that underpin its circulation. Determining the legal nature of token-based CBDC under property law will shape how CBDC can be transferred, held in custody with commercial banks (i.e., intermediaries) and pledged. In addition, further consideration should be given as to whether token-based CBDC as a fully-fledged intangible would make sense. Arguably, the token-based CBDC could be given a hybrid property law status, whereby this means of payment is considered as an intangible for some issues, and a tangible for others.

15. Private law rules should establish with certainty how ownership and other rights in token-based the DT can be transferred between economic agents. Private law needs to define how ownership rights in token-based CBDC will be held and evidenced. In this context, it will be essential to determine the role of “ledgers,” “private keys,” and “custodial wallets” in holding tokens. Token-based CBDC can be held “indirectly” through wallets whereby holders access and transfer CBDC through financial intermediaries. However, CBDC should remain a direct liability of the central bank (i.e., the monetary claim on the central bank cannot transform into a monetary claim on the intermediary).

16. A robust legal framework for use of DT in cross-border payments must be established if NBK plans to move beyond the domestic retail CBDC.¹⁵ Assessment on the current framework on the use of Tenge by non-residents must be carried out and consequently, whether this should be extended to DT. With respect to the power of the NBK, in addition to the clear mandates of the NBK as discussed above, there must be legal certainty as to the powers to issue and use of DT in a multilateral or multijurisdictional platform and to sign agreements with other central banks or foreign counterparts for these purposes. From the regulatory front, clear scope of authorization and regulation/supervision of the participation of financial institutions in both domestic and foreign payment systems and on common platforms must be established to ensure seamless integration between these infrastructures.

C. Recommendations

17. The NBK should complete their review of the current legal and regulatory framework with a view to providing legal clarity on its mandate for DT issuance before the launch of an industrial grade platform. The holistic review of all applicable laws underpins a comprehensive set of amendments necessary prior to initiating a mandate change. While the 2023 White Paper noted that these amendments would be identified by June 2024, the mission was not provided with a list for review during the second phase.

18. The next step would be to ensure draft amendments to the relevant legislations are prepared and can take effect within the targeted timeline in accordance with Kazakhstan legislative procedures. IMF Legal TA could be further sought to review the draft amendments in alignment with the scope and recommendations covered in this TA. Whilst financial integrity aspects of CBDC was not in scope of this TA, the mission notes this may be an area for further legal consideration as DT operational rules are developed.

¹⁵ While the authorities explore DT in the wholesale use cases, the legal considerations as discussed in this section are equally applicable with appropriate modifications, e.g., power to open account to legal entities other than banks and branches of non-resident banks.

II. Interoperability of DT with Existing Payments Systems

19. This section covers considerations for how DT may fit into the existing landscape. In this context the mission considered the existing payments landscape of Kazakhstan and regulatory arrangements in place, as well as key systems and infrastructures for DT to interoperate with.

A. The Existing Payments Landscape

Payments Trends in Kazakhstan

20. Payments and financial services in Kazakhstan have experienced rapid digitalization in the past seven years. In 2024 the share of non-cash payments was 98 percent of the total number of payments (85 percent in terms of value), up from 50 percent in 2017.¹⁶ Electronic transfers are primarily undertaken by mobile phone, QR payments and mobile apps, or card payments at point of sale (PoS). Preferences for digital payments also reflect Kazakhstan's young population, however an estimated 41 percent of the population continue to live in rural regions, where cash plays a stronger role.¹⁷

Payments Players and Systems in Kazakhstan

21. The principal operational infrastructure provider is the NPCK, a subsidiary of the NBK. The NPCK operates several systems, including the Real Time Gross Settlement Service / RTGSS (known in Kazakhstan as the ISMT – Interbank System of Money Transfer) and interbank clearing system (ICS). In conjunction with a private partner, they also support the existing instant/fast payment system. All banks are connected to the ISMT, which processed 9.4 million transactions to the value of 433.5 trillion Tenge during January-April 2024; this represents 34 percent of the 27.4 million transactions, and 99 percent of value (436.9 trillion Tenge) that was conducted through both the ISMT and ICS. Settlement of retail payments values is relatively low due to the high level of *intra*bank payments¹⁸; card schemes can clear and settle payments through their own schemes or locally via Interbank System of Payment Cards (ISPC) for domestically-issued cards. The NPCK has multiple initiatives underway including a new instant/fast payments platform, an open banking initiative, and a unified QR code standard.¹⁹

22. Private players play an important role in the landscape. Of the twenty-one commercial banks, the two largest banks (Kaspi and Halyk) are the dominant payment providers, offering proprietary closed loop ecosystems akin to similar super-apps found in parts of Asia and Africa. Payments and financial services within these networks are easily accessible through a mobile phone, for purchases at PoS, or cash withdrawals at ATM. The fast payment system operated through a public private partnership between the NPCK and a private partner involves a limited subset of banks.²⁰ The international card schemes currently in operation consist of Visa, Mastercard, UnionPay and Amex. There are several non-bank service providers or agents, who all have access to the clearing system via one of the banks. Non-

¹⁶ National Bank of Kazakhstan, Statistics on Payments, (as of May 29, 2024).

¹⁷ Estimate of population age distribution and urban-rural split based on the UN's Demographic Yearbook 2021 (UN, 2021); See Box 1 for some further considerations on supporting factors for payments in Kazakhstan.

¹⁸ Intra

¹⁹ Kazakhstan's new instant payments system would allow payments to be received instantly, but settlement is still scheduled to happen in a deferred net settlement basis.

²⁰ NPCK's instant payment initiative aims to be complementary, ensuring wider access and lower friction for inter-bank payments.

bank e-money institutions (EMI) represent a smaller share in the payments environment, with 36 registered e-money systems as of May 21, 2024.²¹

23. Kazakhstan’s digital payment landscape exhibits signs of market concentration and fragmentation. Estimates provided during interviews suggest about 90 percent of digital payments by volume occur in-house or “on-us” through two of the largest banks’ networks. Whilst interoperability is technically achieved through the existing interbank settlement mechanisms, incentives for users to remain within each ecosystem and use proprietary QR Codes are strong, in part due to the costs (fees) to exit such systems. The mission noted for those inside the largest systems, payments worked well for end-users and provided many benefits. However, stakeholders also consciously noted the potential challenges and inertia of money being “stuck” inside such systems. The network effects, alongside inter-bank frictions, increase the barriers to entry and lower contestability of payment services. The ongoing initiatives driven by the NPCK seek to address challenges of interoperability.

Box 1. Supporting Factors: Digital and Financial Infrastructure

The government is working to connect all citizens through new telecoms infrastructure. In 2017, they launched the “Digital Kazakhstan” national program to improve the country’s digital infrastructure and bridge the digital divide. In addition, the government has set an ambitious target of achieving 100 percent broadband internet coverage of regional centers and 95 percent home broadband adoption by 2025.²² Recognizing that this target can be challenging for a large country with a sparse population, the government has also launched the “250+ program,” which aims to extend high-speed internet to all villages with a population of 250 or more.

Financial inclusion levels are relatively high for the region but still reflect a notable number may sit outside the increasingly digitalized economy. Around 81 percent of the population was estimated to hold a financial account in 2021.²³ As in many jurisdictions, the rural population are at a higher risk of digital and financial exclusion. The DT project has previously noted financial inclusion as a goal and there remains interest in exploring “offline” use cases, however a greater focus is placed on providing digital infrastructure. See Annex II for a discussion of offline experimentation within the DT.

Existing Regulatory and Supervisory Arrangements

24. Kazakhstan has one “systemically-important” payment system and three “important” systems. The Interbank System of Money Transfer (IMTS) is the only one deemed “systemically important.”²⁴ Kaspi and Halyk bank as operators of the two largest “networks” are noted in the payment systems registry, however, they are not supervised and overseen as a payment system / for payment activities by the NBK; instead, both are supervised by the ARDFM for banking services. For operational resilience, both are deemed increasingly systemic and required to be operational 99 percent of the time.

25. The NBK does not undertake any economic regulation of payments. The mission did not discuss the prospect of economic regulation within its scope, however fees (and/or tariffs) were seen as a key area of interest for all parties in determining the incentives or impacts for PSPs for both conventional payment schemes as well as DT. The mission understands an ongoing discussion between NBK and the industry is underway through a committee on tariffs to explore business models for existing payments.

²¹ See [Electronic money system register | National Bank of Kazakhstan](#)

²² [Building a Digital Kazakhstan: Kazakhstan Seeks to Provide 100 Percent of Population with Internet By 2025 - The Astana Times](#)

²³ World Bank Findex 2021. Financial inclusion statistics have likely continued to improve. In 2021, an estimated 78 percent of the rural population have a financial account vs. 83 percent in urban areas.

²⁴ See [NBK Payment systems register](#).

B. Interoperability of DT with Existing Payment Systems

DT Design: Architecture considerations

26. The existing DT architecture could support several payment types. Currently the DT design foresees very few access restrictions and no quantity limits. From a policy perspective the design implies the DT could be used freely by Kazakhstani citizens and residents, as well as legal entities for several use cases, both “retail” and “wholesale.” These could include person to person (P2P), person to business (P2B, B2P), government to person (G2P, P2G), government to business (G2B, B2G). Practical capacity constraints may however lead to a specific prioritization of use cases (See Section III).

27. The two-tier architecture via second-tier banks cements a role for existing financial institutions. At present, the model focuses on only allowing second-tier banks (STBs) to validate DT transactions and distribute DT. These banks will also eventually operate their own node on the platform. Leveraging existing second-tier banks for distribution simplifies the potential participation requirements for distributors of DT as all banks already access to the RTGSS to make redemption and issuance requests in and out of DT. However, this access requirement (via a bank) does set some parameters around onboarding requirements for retail users including a Kazakhstani ID or legal entity registration; therefore, at this stage, DT would not widen access to digital payments in Kazakhstan. Authorities are still considering to what extent some non-banks could support DT services.²⁵

28. Nonetheless, the DT platform demands a detailed core strategy and operational role for the NBK and NPCK. The NPCK will be responsible for the overall implementation of the architecture, whilst the NBK (Payment Systems Department) retains strategic control and direction over design updates. Importantly the central bank will have to consider the governance, scheme, and rules in place for the DT platform and participation. The current deployment of the DT platform relies on NPCK servers, which is a secure and convenient architecture to support the agile pilot phase.²⁶ Some banks have expressed interest in hosting and managing their own node, however the decentralization of the platform should be handled carefully, as it can augment the risks in terms of security, confidentiality and performance degradation. Overall platform maintenance and coordination may become more difficult as well as more banks join and host their node. The NPCK should retain control of key infrastructure parts, such as its own issuance node (for DT asset integrity) and notary node (for double-spending protection) to preserve the trust all stakeholders put in a “sufficiently public” governance of this new infrastructure.

29. The current model also allows users to hold multiple DT wallets in aggregate. While users can only have one DT wallet with each distributing bank, they could hold DT wallets at different banks. The mission did not discuss the potential risks and opportunities of multiple wallets at depth, but a key consideration for future design (to balance any future implementation of limits with DT’s interoperability), includes an effective means to enforce limits over several wallets of the same user.

Objectives and Design Considerations for Interoperability

30. As a new form of money, DT needs to be designed with basic interoperability at a minimum to ensure the singleness of the Tenge (as a currency). The ability to move into and out of other forms of money (reserves, cash, commercial bank deposits) with relative ease, underpins the value of the monetary system and wider confidence in sovereign fiat currencies. Interoperability also supports wider goals of efficiency and convenience for users.

31. A lack of functional interoperability can result in fragmentation of money and systems. A central bank’s role is rooted in maintaining price stability. The central bank provides parity and stability

²⁵ Allowing for a diverse set of intermediaries could enrich the DT ecosystem by fostering innovation, competition, and resilience.

²⁶ While theoretically some STBs own their nodes in the NPCK premises, their interactions remain API-based.

between private liabilities with different issuer risks through offering the domestic unit of account. Cash supports this function today by providing a medium which users can switch in and out of at par. Interoperability can be both strengthened or weakened by incentives and frictions placed within a system or layered by external participants.

32. Interoperability could be designed to be one-way or two-way, and to different degrees between different systems and instruments dependent on users. Designing interoperability of CBDC requires thought to how individuals and entities access CBDC (move into CBDC) and how CBDC is redeemed for other forms of money (out of CBDC); a conscious design choice needs to be made for both. For example, the ECB's approach has been to distinguish access and use of their prospective CBDC (digital euro) by prohibiting the *holding* of digital euro by businesses. Businesses are, however, able to accept digital euro payments, but required to convert on receipt to commercial bank money via a waterfall mechanism (automatically requesting a redemption of CBDC to commercial bank money). This allows businesses to interact with digital euro and benefit from potential efficiency gains without accumulating large balances in CBDC. Individuals (citizens) on the other hand should be able to move into and out of digital euro freely, and hold digital euro up to a certain balance. Both the design choices for businesses (use via interoperability) and individuals (access with limits) reflect the risk tolerance the ECB has considered for balancing convenience and macro-financial implications.

33. Based on the desired objectives, the ability to move both ways between existing forms of Tenge and DT on demand remains an important feature. Interoperability of DT should include funding/defunding of DT wallets for holders of DT *at their request*. This is important for individuals to encourage their use and trust in DT, by providing convenience, and to avoid the perception that their money (whether received in commercial bank Tenge or DT) is restricted to a specific use. The current limited production pilot did not test on-demand issuance or redemption of DT with commercial bank Tenge, but instead focused on interoperability during a payment and withdrawal at an ATM.²⁷ Withdrawal of DT at an ATM is an important feature to affirm confidence in DT as a form of sovereign currency. Equally exploring the mechanism for how depositing cash into DT will be important for supporting broader digitalization efforts. The issuance and redemption of DT on request from bank deposits should now be further tested ahead of production to understand both the policy and operational considerations better – for example, some challenges to test include: do users understand how to request DT or return it? How might banks design such issuance and redemption requests in their mobile applications? What rules and frictions may they be allowed to place over such requests? Should banks hold buffer amounts of DT to honor funding requests outside RTGS operating hours?

34. Interoperability could be established with further systems and assets depending on objectives. Alongside other forms of the Tenge, interoperability requirements of DT with other assets and/or currencies as well as crypto assets may be considered with careful thought and analysis. For example, DT's use as collateral for other financial assets could allow DT to extend its benefits to other market infrastructures (through the backing of new settlement assets such as stablecoins).²⁸ Table 2 provides high-level considerations on different modes of interoperability that could be assessed and prioritized.

High Level Comparison: Integration of DT with Card Schemes and/or Instant Payment Systems

35. The current pilot has successfully tested the integration of DT with card schemes. In this experiment interoperability of DT with commercial bank Tenge (or non-cash Tenge) during a payment was achieved through conversion of DT into bank deposits, which were then transferred using existing card rails. In leveraging card networks, the pilot proved that DT-initiated payments could be accepted by

²⁷ Box A.1 in Annex IV outlines the limited production pilot.

²⁸ This mission notes that the emergence of DT-backed stablecoins may increase interconnectedness of crypto assets to the traditional financial stability – this should be explored with caution. See Annex III for a further discussion.

an existing network of merchants and other users. Such interoperability improves the convenience of DT and minimizes the buildup of user balances in DT; in the short term this mechanism may help to manage substitution risks of DT (away from commercial bank Tenge). It however, does not improve upon the status quo in terms of cost and settlement time for merchants, and does not offer the opportunity for new innovation. To meet such objectives, working on the issuance and redemption of DT on request from bank deposits should be further tested to understand both the policy and operational requirements.

Table 2. Different modes of interoperability 1

	Interoperability choices for DT	Example Mechanism with experimentation		Considerations
Domestic	Conversion with traditional forms of Tenge (commercial bank Tenge and banknotes)	DT-linked card, ATM integration DT-wallet funding/defunding?	✓ ✓ ?	Built in PoS acceptance for DT Proven one-way feasibility via pilot May not achieve efficiency gains on existing systems in terms of speed or cost
	Stablecoin backing	Binance, KASE, DT backed stablecoin pilots	✓ ✓ ? ? ? ?	Supports secure settlements on other platforms (indirectly) Low technical implementation costs for NPCK Review regulatory approach required by NPCK & regulator Stablecoin issuer adds risk in context of meeting demand for tokenized asset settlement / DvP use cases Unclear value of DT vis-à-vis reserves for some use cases Increased spillover risks of crypto assets through increased interconnectedness
	Transforming DT platform into multi-asset platform	Issuing vouchers / "colored monies"	✓ ? ? ? ?	New services unlocked to address priority use cases Concentration risk on platform Potential governance challenges for different assets – need for strong rulebook with other stakeholders Readiness of external systems (e.g., reference data) needed for payments business logic implementation Performance challenges
	Interlinking with other platforms across borders	Swift pilot participation	✓ ✓ ? ? ?	Supports cross-platform PvP, DvP with DT directly Relatively low technical impact on DT platform Governance and operational difficulties Difficult to scale in absence of standards Still in R&D, not production-grade maturity
Cross-Border	DT issuance on multi-currency platforms	mBridge participation	✓ ? ?	Access to integrated services (settlement, FX) in many currencies Platform governance challenges New technologies, new implementation for DT – complex technical and policy choices

Source: Mission Team's elaboration.

Note: 1/ "ü" indicates a positive consideration; "?" indicates a consideration with potential adverse effects.

36. Other existing systems could be leveraged to provide direct interoperability with traditional Tenge. The NBK and NPCK should evaluate the links between DT and existing NPCK-operated payments platforms. CBDC systems will generally require links to the RTGSS. However, depending on the use cases pursued and state of the existing RTGSS, it may be desirable to have alternative connections, such as instant payment system.

37. The instant payment system in development could provide one alternative connection and allow for greater complementarity between the ongoing initiatives. Fast / instant payment systems are often seen as potential competitors to CBDC given both could enable (near) immediate transfers between users. However, many central banks are exploring having both systems, noting each may bring

specific benefits.²⁹ Whilst new systems may substitute payment volumes from each other to some extent, fast payment systems are infrastructures which support interoperability between private issuers for the processing of payments, whereas CBDCs support direct access and settlement to central bank money (see Patel and others, 2024). Both could therefore have a place in supporting the wider efficiency and robustness of the payment landscape. Kazakhstan's instant payment system would settle via the RTGSS (ISMT) on a deferred net settlement basis. In this way, funding and defunding activities for the DT could be processed through the instant payment system on a 24/7 basis if the NBK acts as a participant to the instant payment system, therefore allowing users to access DT at all times. The respective teams at the NPCK have not yet discussed such a link between the two systems.

38. Whilst both projects have distinct operational timelines, there are still opportunities for collaboration within development and production phases. For example, given the shared benefits for some of the objectives around efficiency and competition, it may be a more efficient use of resources to combine an early discussion of DT's role into the merchant and end-user level engagement into the work of the instant payment initiative – especially given this is more likely a long-term objective the NBK wishes to fulfill. Equally given the interest in incentives around operations, it could be important to ensure the instant payment system and DT have distinct but coherent rulebooks which reflect the different nature of risks and challenges of both systems operationally.

39. At the acceptance level, the unified QR code standard adds an additional mechanism for interoperability. A standardized QR code which can be used to initiate payments of different issuers is being developed to support the instant payment initiative. At present this standard has not accounted for the data formats of the DT, however this is an area for active refinement, as minimizing changes at the acceptance level (for merchants and businesses) could ease adoption challenges for DT in future.

C. Recommendations

Observations on Existing Payment Landscape

40. The NBK should evaluate the efficacy of current supervisory and regulatory powers around payments. The existing payments strategy covers an ambitious range of initiatives. However, the success of each may rely on a coherent and comprehensive regulatory, supervisory and oversight framework. As the NBK reviews the payments strategy beyond 2025, taking stock of the existing powers would help i) identify whether gaps now exist in the context of the existing landscape – especially between remits of the central bank and regulator, ii) what is viable for the central bank to determine in terms of regulation, oversight and scheme rules. The NBK may want to understand and assess (accounting for the desired objectives for DT and other systems in development), whether further powers need to be acquired, and evaluate their appetite to pursue such updates. Furthermore, considering the important roles schemes / service level agreements play in the operation and success of payment systems, some capacity should be dedicated to considering the rulebook for DT. To support these recommendations, the NBK could request a further TA focused on payments regulation and supervision.

Interoperability of DT with Existing Payment Systems

41. The NBK and NPCK should evaluate the benefits of linking DT and the instant payment system as a core mechanism for retail DT interoperability. Interoperability with the new instant payment system could provide an efficient route for direct funding and defunding of individual accounts. Through closer alignment of projects, synergies could be found in development and production. An important factor may be acceptance of both instant payments and DT through the QR code standard.

²⁹ Over 80 percent of central banks surveyed saw these systems as complementary (BIS 2023).

III. Expanding and Developing Use Cases

42. This section summarizes considerations on expanding DT’s use beyond retail use cases, in particular macro-financial implications. Clarifying the vision for DT could support prioritization of the use case analysis and engagement in the future phases. A stock take of wholesale and cross-border use cases is outlined and a review/“pilot analysis” of the 2023 experimentation by the mission is summarized.

A. Expanding Use Cases: Potential Macro-Financial Implications

43. The DT project to-date has focused on building production capability for retail transactions. Retail transactions are commonly defined as payments between consumers, businesses and public authorities. They can be everyday consumer transactions, but also include, for example, salary and tax payments made by businesses and individual-to-individual transfers.

44. However, the DT’s design, particularly in the absence of limits, could be used for a broader set of use cases. The DT can be used for large value payments between businesses, and even between banks. Hence, the DT can be used for both what is typically considered retail payments and wholesale payments, although it is not clear how it will be used in the current design. The use of DT for cross-border payments would further widen functionality. The mission discussed general considerations for wholesale and cross-border use cases during the first phase and then reflected on considerations specific for DT during interviews with stakeholders in the second phase. This subsection considers the macro-financial implications of widening use cases and reflects on the wholesale and cross-border discussions. The following subsection then reflects on the pilot experimentation and outcomes of a pilot analysis.

45. Other countries have taken approaches to clearly define the potential use cases. For example, many countries targeting traditional retail payments deploy limits and access criteria to avoid large value payments, while countries targeting wholesale use cases restrict access by individuals and businesses.³⁰ Often in discussions on wholesale CBDC, access to central bank money remains the same as in existing systems, and the technology is the primary change.

46. Increased access to central bank money could lead to substantial funds being moved away from commercial banks into central bank accounts or digital wallets. Such bank disintermediation is often raised in retail CBDC scenarios, but the same would apply in any case of expanded access to central bank money. In fact, with universal access to the DT, the risks are larger since not only individuals might move their bank deposits, but also merchants and large firms (including non-bank financial institutions) might move their funds.

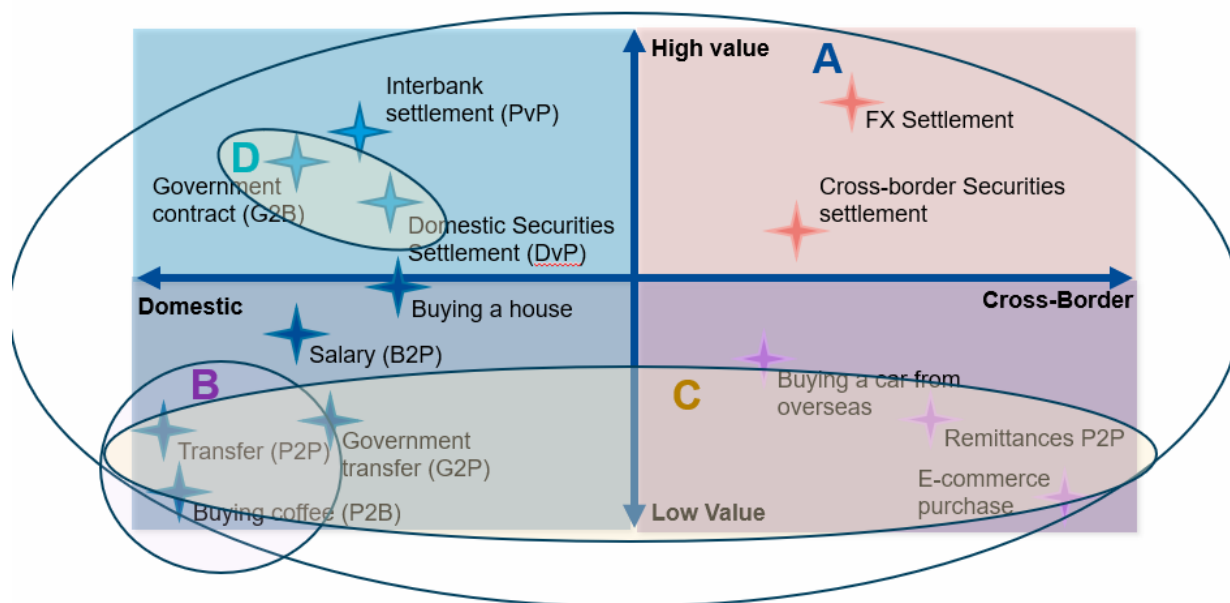
47. Such a shift could significantly reduce the deposits commercial banks rely on for lending activities. Particularly for Kazakhstan, a large share of banks’ funding sources comes from deposits. Reduced lending capacity could hamper the ability of commercial banks to support economic growth. Additionally, it could increase the cost of borrowing and potentially destabilize the financial system. The design decision of zero interest reduces the attractiveness of DT compared to commercial bank money with high yield, especially in normal times.³¹ However, in times of financial uncertainty or crisis,

³⁰ Please consider the discussion in Group of Central Banks (2023) on price versus quantity limits.

³¹ Citizens in Kazakhstan access from deposit account rates at around 14 percent.

individuals, businesses and even non-bank financial institutions might rapidly convert their commercial bank deposits into DT, perceiving it as safer. This could lead to digital bank runs, intensifying instability.³²

Figure 1. Payment Use Case Mapping



Source: Mission team's elaboration.

48. Analysis commissioned by the NBK had suggested DT's use for retail payments would likely minimize adverse financial stability implications in steady state, however both internal and external stakeholders have yet to make their own analysis on the current design. The NBK commissioned an economic assessment of the DT in 2022 which implemented a DGSE model based on a survey of willingness to use DT.³³ This considered the use of DT for retail uses and concluded DT would have little impact on financial stability. The 2023 FSAP noted that further scenarios could stress test this analysis and particularly identify if certain banks may be more vulnerable than others. The mission noted that commercial banks themselves (even those involved in the pilot) had neither conducted any sensitivity tests of their own balance sheets from DT, nor intend to in future. Equally ARDFM supervisory teams and NBK analytical teams (financial stability and economic research, monetary policy and monetary operations) had not conducted any own internal assessments of the impact of DT for retail use cases or otherwise.³⁴ Most stakeholders considered the analysis would only be needed following production, however the mission emphasized the need for analysis ex-ante to help inform design choices and pilot experimentation. For example, in the context of high value transfer use cases, an economic analysis might help to sensitize potential limit thresholds.

49. Future use cases and ultimate demand for DT could alter the macro-financial implications of DT and warrant separate and iterative economic assessments. Figure 1 indicates a (non-exhaustive) range of potential use cases or payment types that could be undertaken with DT. At present the design allows for use across borders and without limits (*Range A*). Whilst small retail transfers were

³² A decrease in bank profitability itself is not directly a financial stability concern, however if banks are not able to adjust, or are hit with an immediate /sizeable shock, this can have destabilizing effects.

³³ The mission was not able to directly meet with colleagues who undertook the 2022 economic assessment.

³⁴ Relevant colleagues noted the primary strategic discussion occurred in 2021 in line with some of the first analysis and publications on DT design but has not been conducted regularly.

the initial focus of the 2022 economic assessment (*Range B*), the limited production model of the DT has currently tested a broader range of both domestic and cross-border DT transactions (*Range C*) – though the majority of these were initiated in DT and not carried out end-to-end in DT. Experimental testing includes government to business payments and domestic securities settlement (*Range D*).

Considerations on Wholesale Use Cases

50. “Wholesale CBDC” is not a well-defined term in literature and could cover interbank payments, but also large or high value payments between even non-financial institutions. Taking a narrow definition of interbank payments, wholesale CBDC can be seen to already exist in the form of central banks reserves in central bank RTGS systems. To distinguish wholesale CBDC from reserves, a technology-based definition is often introduced where reserves are thought of as using traditional centralized technologies, while wholesale CBDC is thought of using “new” decentralized technologies. Wholesale CBDC can in this regard be seen as a tool to either upgrade existing infrastructure, such as central bank RTGS systems, or as a complement to the existing infrastructure offering new use cases.

51. The mission discussed some common use cases for wholesale CBDC, although these uses have not been piloted and remain of lower priority to external stakeholders. Three common use cases for wholesale CBDC often mentioned internationally are: (i) domestic interbank securities transaction settlement; (ii) settlement asset to support tokenized financial innovation, for instance tokenized deposits; and (iii) interbank cross-border payments. The last will be discussed in the context of cross-border scenarios. Annex I summarizes a range of experimentation of other central banks and international organizations to date to provide some lessons learned.

52. The work by the Swiss National Bank (SNB) and the SIX Digital Exchange (SDX) serves as a good example of wholesale CBDC supporting domestic interbank securities settlement in an international context.³⁵ The SNB has issued a wholesale CBDC on the SDX platform where tokenized securities can be exchanged using central bank money as the money leg in a delivery versus payment transaction. The experiments in the DT project with KASE and Binance have some similarities. In these cases, KASE and Binance issue a DT-backed stablecoin to serve the money leg instead of NBK directly issuing money on the KASE and Binance platforms. During the scenario, KASE and Binance opened two accounts on the DT platform: a main account and a special (segregated) account designed to escrow DTs as backing for the stablecoins. Thus, a core difference between the SNB solution and the NBK experiments is the use of an intermediary asset – the stablecoin – compared to the central bank directly issuing money on the KASE platform.

53. In the second case of supporting tokenized financial innovation more broadly, a wholesale CBDC again serves as a settlement asset. Many forms of assets can be “tokenized,” and to facilitate the exchange of different assets money is needed. There are essentially two forms of money: private and public. In some countries, commercial banks are exploring the idea of tokenizing deposits. And just as central bank money today serves as a settlement asset bridging privately issued money, a wholesale CBDC would bridge tokenized deposits from different banks. By leveraging programmability functions of DLT and the trust and stability associated with central bank money, wholesale CBDCs can play a pivotal role in facilitating tokenized deposits.

54. Whilst experimentation has proven technical feasibility, the mission did not find an urgent demand from stakeholders for tokenization use cases at this stage. Based on feedback from banks and other stakeholders, tokenization opportunities did not seem to be a priority area or interest, except for KASE who are looking to further develop KASE Digital. The NBK and NPCK may wish to undertake

³⁵ See <https://www.bis.org/about/bisih/topics/cbdc/helvetia.htm> for more on the SNB’s work on wCBDC for securities settlement.

further work to understand the key drivers of demand for tokenization to evaluate the amount of time to further invest at this stage.

Considerations on Cross-border Use Cases

55. Cross-border DT payments can be achieved in many ways, with some simply enabling cross-border payments, whilst others may make improvements. Enabling cross-border functionality does not necessarily improve cross-border payments – which are known to be slow, expensive, opaque, and inaccessible (FSB 2020) – but the functionality can strengthen the value proposition for the users of the DT. In the second case, cross-border arrangements using the DT would need to be designed in ways that would address the current frictions in cross-border payments – fragmented and truncated data formats, complex processing of compliance checks, limited operating hours, legacy technology, long transaction chains, funding costs, and weak competition (CPMI 2020). In designing DT in this way, there may be potential trade-offs to manage with domestic design.

56. The current card scenario in the industrial loop enables cross-border functionality but would not enhance cross-border payments. The card scenario results in a DT transfer to the card-issuing bank and a trigger of a traditional card payment processed through international card networks; this allows for cross-border interoperability with card-accepting merchants around the world. While the card scenario is not a payment using DT “end-to-end,” it can still be considered a cross-border CBDC payment since at least one segment of the payment was conducted using DT. The mission notes that use cases considered at this stage have been limited to P2B and low value B2B payments, though any effective upper-bound limit will likely reflect the limits of the card scheme.

57. The SWIFT CBDC Connector scenario tested in the experimental loop presents one solution for how domestic CBDC systems might be connected in the future. Participation in such experiments is of high value for the DT project as it is likely that cross-border CBDC payments in the future will be conducted via many different arrangements. The SWIFT experiment highlights the importance of ISO 20022 implementation and harmonization. The SWIFT experiment and other projects such as Icebreaker also point towards a need to be able to implement payment-vs-payment functionality with “smart contracts.”³⁶

58. The NBK obtained observer status in the mBridge project during 2023. While the SWIFT CBDC Connector scenario is about interlinking systems, projects such as mBridge focus on a joint system for wholesale CBDC. Projects such as mBridge explore central banks issuing money on a joint platform where commercial banks are participating. By having multiple currencies issue on a single platform efficient cross-currency transactions can be made, and payment-vs-payment can easily be implemented.

59. Such projects reveal insights for the DT project on the potential options and requirements for connecting to cross-border systems. For example, in the case of mBridge, central banks may pursue a manual mode of integration or an automated one. Under the manual model, central banks can issue and redeem their CBDCs on the platform without needing to modify their existing payment arrangements. A commercial bank first submits an issuance request and conducts a manual off-platform transfer of funds to the issuing central bank through the domestic payment system, which can be either a traditional payment system such as RTGSS or a domestic CBDC system such as the DT. Upon receipt of the funds the central bank issues the equivalent amount of CBDC into the commercial bank’s wallet on the mBridge platform. The automated model directly integrates with the domestic RTGSS and/or CBDC network with the mBridge platform, allowing transactions between the two systems to be processed in a highly automated manner. The process involves a commercial bank sending money through the local

³⁶ See the [BIS IH website](#) for more on Project Icebreaker, and Swift (2024) for more on the Swift experimentation.

payment system to a designated account/wallet which would then automatically trigger a CBDC issuance on mBridge platform.

60. Non-resident holdings and use of DT is likely to be minimal and substantial risks may be unlikely with current eligibility criteria. Individuals can be categorized into four different groups: resident citizens, resident foreigners, non-resident citizens, non-resident foreigners. Additionally, geographic consideration can be given (i.e., when inside or outside Kazakhstan). The current eligibility criteria and KYC requires a Kazakhstan national ID number (or special resident id number) thus restricting access by non-resident foreigners in principle. This model may limit macro-financial implications and capital flow concerns. As highlighted in Reslow and others (2024), granting wide access to non-residents can be associated with larger macro-financial implications such as large and volatile capital flows.

61. With the current access policies suggested in the DT project, a currency exchange is likely needed for the large majority of cross-border payments. Thus, access policies for financial intermediaries become crucial to consider. These intermediaries can be domestic or foreign, and they would require the ability to transact a large volume on their accounts. While their actual holdings can be limited, by e.g., waterfall accounts, such functionalities must be well-integrated to offer a seamless experience for the end-user (especially if cross-border payments are envisioned to be close to instant).³⁷ The current access policies for financial entities suggest that DT will mostly be restricted to domestic financial institutions, and thus not result in large holdings outside of Kazakhstan. That said, this comes with a trade-off since expanded access to DT could bring benefits such as shortening transactions chains. Additionally, DT issuance should be in line with any existing exchange or capital control policies.

62. Since the future cross-border CBDC landscape is uncertain and likely fragmented across different models, central banks should strive for flexibility and ability to connect to the outside world via different channels. Such flexibility presents a challenge for central banks; the IMF's CBDC Handbook suggests that central banks should therefore view domestic design decisions through a cross-border lens (Reslow and others 2024). The chapter also highlights the need for adopting international standards such as ISO 20022, and for a careful assessment of access policies.

63. However, active participation in resource-intensive experimental projects should not crowd out a focus on refining key basic functionalities. CPMI-BIS/IMF-WBG (2022) and Reslow and others (2024) recommend that central banks factor in an international dimension into their CBDC design from an early stage. Participating in experimental projects can result in valuable lessons, but they can also be resource intensive. With the current roadmap, the NBK and NPCK should consider cross-border experimentation only if it does not crowd out urgent needs to ensure basic functionalities.

Considerations for Public Financing Scenarios

64. Through discussion the mission noted that G2B and G2P payments were likely to become a priority use case to further test over the next year, and potentially to implement by end-2025. Additionally, tax collection scenarios and tax transparency initiatives featured highly as objectives discussed by several stakeholders interviewed. This technical assistance, as noted earlier, did not comment on the appropriateness or context of fiscal transfers and for what means, but has reflected on the use of DT as the mode of conducting such transfers. Reflections on both the public procurement and VAT collection scenarios are included below. The mission highlighted that the potential to conduct high-value G2B contracts in DT through programmable means, which then incentivizes the holding of DT throughout the value chain may have the most material impact for the banking sector out of all use cases.

³⁷ See the Digital Euro progress report (ECB, 2023) for more on how the ECB is considering waterfall accounts.

65. The DT project team are exploring the idea of “coloring money” to understand the feasibility and benefits of utilizing the DT platform and programmable capabilities in public procurement processes. This directive to explore this scenario underscores the government's commitment to leverage digital currency technology to enhance transparency, reduce corruption, and improve the efficiency of budget fund utilization. Many stakeholders seem to prioritize this scenario as it showcases programmability as a differentiating capability of DT that can help restrict how government money is spent, and which also incurs relatively low-volume transaction load on the platform.³⁸

66. When considering this scenario, it is important to analyze the effects on the broader economy and financial system. The effects will depend on two core assumptions: (i) which government payments are conducted in DT, and (ii) an estimate of the duration for how long that money will stay in the DT system before being deposited into bank accounts. One, perhaps extreme scenario is that all government payments are made in DT. Taking a predicted government expenditure of around 24 trillion Tenge (\$54 billion) in 2025, one can consider how banks' funding costs will be affected by making assumption on how long this money will stay in the DT system. As a reference, as of May 1, 2024, current accounts and deposits in banks amounted to around thirty trillion Tenge of which individuals deposited around 60 percent.³⁹ Thus, the government expenditure is a sizable amount of money that banks would lose as deposit funding, and hence would need to adjust for.

67. The feasibility of the “colored money” scenario requires important external resources and commitment of other stakeholders. The oracle node that is envisioned would validate certain pre-defined conditions of such payments would need to be under the responsibility of a government entity that can build and maintain a list of authorized contractors for a specific project or sector. It would also entail building a portal to the DT platform for defining agreement terms, registering contracts, and managing reputational systems that update the restriction lists.

68. The current school voucher scenario already piloted would not have any material impacts for the broader economy and financial system. While a scenario where all government expenditures could have implications for the broader economy and financial system, the school voucher program does not involve large amounts of money and thus would have limited effects on banks' funding. An expansion of uses cases would warrant further careful analysis.

69. The VAT Deduction scenario tests the implementation of automated deduction of VAT (value-added-tax) from a purchase of goods transaction at a merchant using a smart contract. A special QR-code for payment is generated by the merchant, the user reads the QR-code and confirms the payment transaction. The VAT amount is automatically calculated, and two transactions are performed: the first one is the payment from the customer to the merchant and the second one is transfer of the VAT amount to the tax authority. Nevertheless, this type of use case cannot easily be extended beyond simple physical transactions, due to the often-complex nature of the fiscal rules and processes (for example, legal entities pay the tax after netting the collected and due VAT on a periodic basis).

70. Split payments could offer a multitude of benefits, including enhanced compliance and reduced tax evasion, as they directly channel the VAT portion of transactions to tax authorities, thereby increasing transparency. The mechanism can be automated within the payment processing system, reducing businesses' administrative workload in terms of VAT calculation, collection, and payment. Automation also helps minimize human errors in VAT calculations and payments, leading to

³⁸ See for example, [IN THE SPOTLIGHT: Kazakhstan's CBDC: Revolutionizing Government Fund Transfers | Visa Navigate](#)

³⁹ Based on publicly available statistics on NBK website.

more accurate tax collections. That said, the complexity of setting up the system and ensuring that goods and services are correctly taxed should not be underestimated.

71. Introducing a split-payment mechanism would trigger significant changes in cash flow from the perspective of both businesses and the tax authority. Tax authorities would benefit from a positive cash flow impact as VAT payment would happen in real-time per transaction rather than on a periodical basis. However, the opposite would be true for businesses whose cash flow would be negatively affected by the mechanism, directly impacting their working capital.

Additional Use Cases – Offline and Crypto Assets

72. Use cases such as offline and DeFi were considered longer term opportunities. Offline capabilities are often discussed as a use case that CBDC can offer to support in part both digitally and financially excluded populations, however existing solutions are immature for production (see Annex I for some considerations of offline use cases). With respect to the integration of DT with crypto assets via crypto cards this would need to be carefully considered in line with the broader regulatory approach around crypto assets in Kazakhstan (see Annex III).

B. Reviewing Experimentation – A Pilot Analysis

73. The mission proposed a pilot analysis to reflect on experimentation to date and support decisions on the next steps in testing, evaluation and engagement. Authorities have undertaken a wide range of experimentation since 2021 including several proofs of concepts, prototypes, and pilots (see NBK 2021, 2022a, 2022b, 2023). This analysis primarily focused on the limited production loop which represents the main piloting work. Considerations for the experimental loop are given with the view that authorities' future work may look to scale some of these into pilots. The rest of this section summarizes the mission's key findings and recommendations; Annex IV provides further detail.

74. Whilst experimentation often focuses on technical feasibility, the mission particularly focused on how the pilot could support policy evaluation. To this effect, the pilot analysis aimed to cover three elements: (i) an assessment of how the current pilot supports DT's overall objectives, (ii) considerations for a long-term evaluation and monitoring framework, and (iii) areas to develop stakeholder engagement. These three elements are linked together: a clear vision on how the pilot affirms the wider project objectives and a clear evaluation framework provides a solid foundation on which to communicate with a range of stakeholders the intention, vision, and progress of the DT. And link to observations of the wider mission, particularly on the macro-financial implications of expanding DT's use.

75. Technical feasibility was considered alongside this analysis to understand the potential challenges for the project stemming from technology choices. The IMF has not opined on what may be the best technical solution for the DT. Section II and III of this TA Report reflect on considerations around the architecture and technology choices and have informed recommendations within this section.

An Assessment of Objectives

76. The mission considered how core objectives for DT have been reflected and assessed so far within the pilot, and how that may be developed in future. Stated objectives for the DT include: (i) modernization of the national payments system, (ii) increasing the efficiency of state-related payments, and (iii) increasing innovation, efficiency, and competitiveness of the domestic financial market.⁴⁰ The NPCK has set out separate experiment objectives for their testing over 2023 including interoperability of

⁴⁰ The role for the DT in payments is further marked within the National Payments Strategy 2025.

DT with commercial bank or “non-cash” Tenge and tracking use of government spending – the mission recognizes these as distinct from the ultimate goals of DT.

77. The 2023 pilot was successful in terms of the near-term goals stated. However, these goals, and the corresponding metrics recorded, did not clearly map to the overall DT objectives. The mission noted that whilst experimental objectives were clear to participants, stakeholders could not clearly define how such a use case may support the overall vision for the DT and there were differing views about what the key objective for the DT is. For example, most stakeholders remarked that DT would support transparency in government payments, however they could not articulate how either the DT-linked cards or the digital school vouchers could meet such use cases or improve on the status quo. When discussing challenges with government transfers today, many external participants in fact noted that from an individual perspective, transfers work well with existing commercial bank account integration.

78. Further pilot projects could go further in informing the core objectives for DT, such as the goals around efficiency, innovation and competitiveness of the financial market. With the current conditions of the payments landscape in Kazakhstan the mission understood this objective, and a focus on efficiency and competitiveness would be a high priority for DT, however the focus of the experimentation does not test these aims at present. No significant efficiency gains (in terms of speed or cost of retail transactions) were made from the DT’s experimentation within the industrial loop, but the NPCK team noted better potential in government payments. Furthermore, some stakeholders did not even recognize efficiency and competitiveness as an objective for the DT.

79. Objectives around transparency and government spending were broad and ambitious. Use cases discussed varied from social payments to automated tax collection, agricultural lending, and programmable supply chain transactions for building infrastructure.⁴¹ DT as a form of money would be a vehicle for making such transfers. In this respect, further work needs to be undertaken to understand what properties of DT make it more attractive for such uses. For example, DT as a more direct and risk-free (or lower risk) form of money could improve the aggregate cost of such payments. No estimates were available as to how much is spent to disburse government funds, however as they form a large share of the State budget there are likely efficiencies to be made. The mission noted that the programmability and automation aspects were the focus, however these have not been a focus of experimentation to date⁴² and is at a much earlier stage (proof of concept or prototype).

80. Financial inclusion objectives have not been the focus of the 2023 work. Though authorities raised financial inclusion as an objective for DT, the 2023 pilot did not account for any specific financial inclusion considerations. Latest available statistics suggest around 19 percent of the population may still be reliant on cash so there may be a case to still reflect such objectives throughout different experiments to understand demand from different user groups. Financial inclusion considerations usually reflect either those without access to bank accounts, or those who struggle to be included in the digital financial system due to connectivity. Whilst the digital vouchers were accessible to all school children in the pilot, they had no direct interaction with DT balances so in principle such schemes could be implemented in rural regions if the school was connected. The DT-linked cards were only open to NPCK staff and a bank account was required. As the current pilots were limited to the Almaty region no testing of payments initiated in rural regions has yet been done; it is unclear if regional testing will be conducted on this use case in future, however the NPCK has intentions to continue exploring offline functionality in the long-term.

⁴¹ Government payments were also seen as a compelling use case in the 2023 BIS CBDC survey (Iorio and others, 2024).

⁴² The closest CB experimentation to these “programmable vouchers” is the *programmable bound money* (PBM) concept of the MAS, but much remains to be explored in this area, encompassing a large set of non-bank stakeholder interests and expertise.

An Evaluation and Monitoring Framework

81. Evaluation and monitoring frameworks provide a benchmark by which to measure long term progress of DT. Monitoring of both short, and long-term goals allows authorities to reassess and change their approach if a substantial divergence from goals occurs – “a CBDC is never ‘finished’” (Soderberg and others 2023). In the production phase, such frameworks also help monitor “success” and provide tangible data on progress, providing transparency to public and private stakeholders.

82. Clear prioritization of policy objectives helps to define the basis of an evaluation framework. Prioritization of policy objectives helps to define which use cases to pursue, and monitor. These use cases consequently drive the capabilities that need to be in place, and under what timeline. From this basis a broader evaluation framework can be built out. Table 3 outlines a set of building blocks for an evaluation framework as proposed by the mission. This includes defining the potential measures and criteria for success, mapping what tools can be used to monitor such criteria and developing a governance reporting approach to reflect on progress over time.

83. Whilst multiple objectives for DT could be pursued together, a clear prioritization with allocated or dedicated capacity could help the project progress. From discussions, the emerging priorities are considered as targeting government spending/transfer use cases (transparency and efficiency of government payments) and providing DT as an alternative means of payment (improving competitiveness and efficiency of domestic financial market). The functionality tested to date would make it difficult to evaluate such objectives as met, however future testing could plan to incorporate the suggested framework on an objective and use case basis to deliver targeted reflection. The mission noted that the current breadth of projects poses resourcing challenges going forward (if the intention will be to deliver an evaluation of each use case). Authorities could consider leveraging internal resources across the central bank further, or prioritizing one or two use cases at a time.

84. The pilot could consider being dynamic in its evaluation during a future stage. For example, the pilot could test and affirm the economic design and governance of the DT platform. Whilst technical metrics such as success and failure rates of payments have been tested and monitored, a benefit of a pilot is to understand how functionality as well as rules, governance and user behavior play into the operation of the DT. For example, the DT could consider testing incentives for users to understand what may work for adoption. The project team have already tried to consider some variations to user experience within the DT-linked card pilot, but the corresponding internal review of the pilot did not draw out learnings from different setups, perhaps as the sample size was relatively small. Further testing could look to expand sample size and systematically evaluate design deviations from a set baseline.

85. As part of their evaluation, the NPCK needs to manage trade-offs between the technical requirements for DT’s infrastructure. The NPCK’s core DT project team has a good understanding of the necessary principles regarding the technical requirements for introducing DT: reliability, availability 365/24/7, flexibility, interoperability, safety, scalability, confidentiality. Realizing these requirements is a continuous process towards / through the production phase; many design choices will directly impact performance, the ability to support some use cases, or alternately amplify operational risks (such as, loss of confidentiality or degraded performance). The pilots revealed that meeting foundational characteristics, such as security or confidentiality, has put pressure on the platform’s scalability, which the underlying technology has not yet fully solved.⁴³ In the classical trilemma of *Decentralization – Scalability – Security* for DLT, the NPCK needs to determine the right tradeoff, and proceed on a risk-based approach.

⁴³ While DLTs currently underperform compared to traditional technologies, the DT platform throughput is currently significantly lower than other test platforms based on the same technology and architecture. Besides the already planned testing of a new version of the underlying technology, the NPCK may seek user reviews of some non-functional aspects (for example, from other central banks that have tested it such as Sveriges Riksbank or Bank of Canada).

Table 3. Factors for an evaluation framework

Components	Aim
1. Objectives	What does DT hope to achieve and why?
2. Use Cases	How is DT then used to reach such objectives?
3. Platform capability	- What sub-functionality is needed from the platform to support the use cases? Includes considerations around access, limits, onboarding, participation and security and resilience requirements. - Set a baseline design and consider 'deviations' to test. - May also consider building in automated reporting requirements to support elements 4–7 below.
4. Potential measures of “success”	- What would DT need to demonstrate to say the objective is being supported? Consider both quantitative and qualitative measures and short-term and long-term measures. - What would be the practical benefits to stakeholders? - Should be closely tied to all elements of 1–3 above. At the piloting stage, measures of success may be different to production.
5. Evaluation and monitoring tools	- What reporting requirements and data pieces do I need to collect to monitor measures of success? - Which can I measure immediately or continuously; which are periodic? - In production can authorities directly collect data? Are external parties required?
6. Governance reporting	- Who should review the evaluation data: Central bank only? Plus, regulator? - Outline government's role and consider industry interaction and engagement. - For transparency the central bank may commit to periodic reporting in production.
7. Evaluation timeline	Under what timeline are measures of success reviewed? Should foreshadow the rollout timeline
8. Forecast rollout timeline	What are the target launch dates for specific use cases?

Source: Mission team's elaboration.

Developing Stakeholder Engagement

86. The NBK and NPCK have published several papers on the DT, however stakeholder awareness and engagement remain relatively low and could be improved. No responses were received to the last public call for feedback. The mission's interviews brought together a picture of the state of understanding between various stakeholders. The mission noted that external stakeholders were relatively focused on the near-term implementation of the pilot or on public spending use cases. Most stakeholders, including those involved in the pilot, still have more to understand about both the objectives and the implications of DT for their own businesses; for example, on the latter, how the pilot arrangements might differ from the full implementation. E-money firms have not been engaged as part of the project. Businesses, merchants, and citizens have also been less of a focus in engagement.

87. Engagement on DT internally across the central bank and regulator is also low. At present, the current governance structure of the DT project involves the NBK Payment Systems Department, NPCK teams and executive level of the NBK. Whilst this has allowed for agile decision making, many important departments, including currency management, monetary operations, monetary policy and

financial stability have little formal opportunity to reflect and analyze design decisions.⁴⁴ Equally with the increasing demands placed on STBs from being distributors of DT, regulators had not considered any impacts (operational, or prudential) on the relevant STBs from DT. This will likely be a critical area for cooperation going forward to the production phase to ensure there are no gaps in oversight and supervision. Furthermore, if DT will support asset or securities tokenization, or connect with crypto assets, again this would require a coherent approach from all regulatory agencies involved.

88. Despite prioritization of public procurement use cases, government departments seem to be disengaged. The mission noted government departments were unable to comment on DT, or the potential benefit for government spending use cases.⁴⁵ DT would only be a mechanism for the transfer for such use cases; determining the fiscal policies would be out of scope for a central bank. As such, the public procurement cases being explored would require a substantive commitment from the relevant government departments in terms of operational input such as digitalization of existing registries.

89. Pre-production, regular and structured interaction with stakeholders on DT needs to be in place to build public and institutional awareness. User needs and expectations are important when evaluating design features of the infrastructure, strategies for launch, schemes and business models. It also contributes to creating a positive environment that will incentivize participation and adoption. Interaction should also happen in different forms, for example, focus groups / forums and bilateral engagement. In the former, the needs and expectations of different groups of stakeholders may need to be balanced. The latter could increase the change of a franker conversation with each stakeholder.

C. Recommendations

Institutional Capacity and Technology Considerations

90. The NBK should establish a Taskforce, Committee or strategic forum representing all NBK departments and NPCK. A taskforce could have many roles, but importantly would act as a central coordinating point in which to gather different perspectives across the central bank to refine a common vision of DT and oversee economic and operational assessment as DT moves to production. Such governance frameworks sit in the middle of many central bank CBDC projects given the potential breadth of implications from a CBDC. In the context of the DT given the wide use case set possible with the DT it will be important to reflect a coherent analysis across departments as design decisions are taken going forward and to ensure no gaps arise in the monitoring of private sector participation there would be a role for ARDFM to support analyses and discussion on a regular basis.

91. The NPCK could establish a technical board with STBs to support the operational and technical management aspects of the DT platform. In complement to the policy-focused engagement, a joint forum for STBs involved in node management will be important to ensure standards are being upheld, as well as updates are made as necessary to the platform in a coordinated manner. The Board would also provide a forum for core participants and distributors to raise challenges and provide feedback that could feed into strategic design discussions of the NBK and NPCK.

92. The NPCK should assess which use cases are feasible relative to the existing and forecasted technical capacity of the platform. The DT platform needs to support suitable use cases which balance policy objectives with practical capacity constraints. The current DT platform, based on Corda DLT delivers tokenization, programmability, and transaction confidentiality (if some performance-degrading fixes are put in place). However, more stress tests are needed before adopting a newer

⁴⁴ Some departments noted they had been consulted for the 2021 publications, but no formal discussions have occurred thereafter.

⁴⁵ The mission did not meet with any stakeholders directly linked to the school voucher pilot and understand that in this instance a successful working relationship is in place.

version of this technology, as well as long term operation simulations, to confirm its medium/peak throughput and the overall scalability of the architecture over time. If more demanding use cases are targeted during the production phase, the NPCK should understand their risk tolerance for potentially exceeding capacity. Targeting appropriate low volume use cases or managing the adoption rate may be a strategic decision in the short and medium term and be acknowledged as such in the product roadmap. However, durable solutions need to be found for addressing more demanding scenarios that align with the key objectives; failure to meet such scenarios could transform into reputational risks for the DT in the long run.

93. The NBK and NPCK need to consider how to maintain flexibility in design of DT platform and ensure there is a clear decision-making process for such changes. A core principle to allow for operational upgrades but also policy-focused changes will be flexibility or extensibility. For example, ensuring ISO20022 compliance should help DT platform interoperate with other systems, particularly those across borders given the global push towards this messaging standard. Equally from a policy perspective, though no limits and access criteria are in place, understanding if those are feasible to implement post-production, or what would be needed within the platform pre-production, would be important. The governance structures such as a cross-Bank taskforce and a technical board should play core roles in the decision-making process of any changes.

Exploring Use Cases and Macro-Financial Implications

94. NBK departments, supported by regulators, should conduct a baseline assessment of DT impacts from the use cases targeted for end-2025 and undertake further periodic economic assessments as use cases materialize. The uncertainty around the most viable use cases and potential DT demand complicates the ability to ascertain macro-financial implications at this stage. necessitates that the NBK's analytical and operational teams, along with other relevant stakeholders, examine the demand and implications for banks—both in aggregate and individually—across various scenarios. If G2P, cross-border, and wholesale payments remain a focal point for experimentation and piloting in 2025, it will be essential to conduct an ex-ante economic assessment of demand for these scenarios. This assessment will help understand potential operational impacts and stability considerations. In addition, the analysis must be periodically updated as further use cases materialize to ensure a wider spectrum of participant behaviors (beyond just citizens and financial institutions) are covered. The impacts on commercial bank credit may be pertinent given wider objectives to increase the availability of borrowing in the domestic market. In the short term, steps could be undertaken to raise capacity and awareness in the relevant departments in line with preparing for these assessments and the wider taskforce. The NBK should consider plans for extending an analysis of stress scenarios and the impact of different design choices around holding and transaction limits. In addition, the NBK should undertake further work on monetary policy implementation as design is revised.

95. For stakeholders to make proper estimations and scenario analysis, it would be beneficial to clarify the scope and ambition of government transfers with DT. The current uncertainty, and view of limited adoption prospects, has prompted many stakeholders taking a “wait and see” approach rather than assessing different scenarios. Whilst other central banks' experience show that retail end-user adoption can be slow, government use cases could be implemented and scaled quickly (if using DT in this way make sense to relevant parties). Therefore, the macroeconomic impacts should be carefully considered in the near term so the NBK and NPCK can factor these effects into their use case assessment. Equally government stakeholders would need to increase their engagement and input into use case ideation to identify the value-added feasible use cases for DT.

96. The NBK and NPCK should continue to reflect on cross-border implications of CBDC through future design revisions. Whilst the current DT design may minimize macro-financial impacts from cross-border use cases, widening participation or an expansion of viable use cases may change this assessment. The NPCK could continue to engage proportionately with ongoing cross-border

experimentation to understand emerging practices of other central banks and what may be required of the DT system for cross-border interoperability. As improving cross-border payments is a secondary objective, authorities may prioritize other objectives and use cases in the near term to production.

Developing the Pilot Experimentation (Pilot Analysis)

97. The forthcoming status report should update stakeholders on the roadmap for DT and the key use cases being prioritized for end-2025. Providing clarity of the key use cases could better allow industry to engage on the upcoming priority projects for the NBK and NPCK, and focus research and engagement around such use cases. The NBK and NPCK could consider engaging industry on the prioritization of use cases into short- and long-term goals and build a joint roadmap. For example, efforts around tokenization which are at a more experimental stage, could still be explored at a lower intensity and a roadmap put forward for a multi-year timeline to experiment around and implement this use case.

98. The NBK and NPCK should consider placing further emphasis and resource on the use cases centered around core objectives. These include efficiency, innovation and competitiveness of the domestic market and possibly financial inclusion. To support goals of innovation and competition, interoperability and choice, further emphasis should be given to refining testing DT to DT payments in real-world settings as well as two-way interoperability on demand (into DT). Goals around financial inclusion and accessibility should be factored in throughout different use cases, however it is understood core financial inclusion considerations such as providing offline use are challenging to test at this stage. The NPCK should engage with other central banks on emerging practices around providing offline services to support financial inclusion, whilst maintaining a strong security posture around the DT.

99. The NBK and NPCK should incorporate the monitoring of DT's progress towards its broad objectives within their evaluation and monitoring framework. With a wide set of experimentation, the NPCK's pilot reports provide a comprehensive overview of the work accomplished to date, however this could be more closely tied to how overall objectives are met. An evaluation framework tied to the broad objectives of DT will help support an evidence base of both positive and adverse effects of DT. The mission has proposed some building blocks for an evaluation framework. A clear set of criteria and identification of suitable tools to measure criteria will help authorities reflect on the value-added of DT.

100. User education strategies could be designed and identified to avoid misinformation risks. Testing of such strategies could be implemented and surveyed through future pilots (NBK and NPCK). Ahead of production, a multi-faceted stakeholder engagement strategy is required with of regular interaction with both sides of the market – merchants and consumers. Different strategies could be put in place depending on the use cases prioritized, however most central banks with a live CBDC note with hindsight, that consumer engagement should have started much earlier. An information campaign towards the population in general could be considered. This may mitigate concerns or provide a forum to discuss perceptions around privacy and monitoring with DT.

101. The NBK and NPCK should account for less vocal voices in their stakeholder engagement plan to understand the wider implications and also opportunities for DT in the long term. The current set of stakeholders engaged in DT broadly reflect larger players in the payments industry who will play an important role in DT but may not be the only ones who could support and benefit from the platform. Smaller banks and also underrepresented (and typically less-vocal) user groups will be important to seek out in engagement to understand how their perspectives differ. Both consumer and business groups should be engaged in the future discussions of DT, and regional engagement should be considered.

IV. Cybersecurity and Operational Resilience of Payment Systems

102. This section analyses the cybersecurity and resilience posture of payment systems in Kazakhstan with a view to the entry of DT in this landscape. It first reviews cybersecurity policies, laws, procedures, and guidelines, in alignment with standards and best practices. It also reviews how these standards and practices apply to key security practices in payment systems within Kazakhstan. The section then considers the cybersecurity and operational resilience measures applied in the DT pilot to ensure key threats and risks to DT have been identified and mitigated. This is paramount for establishing public confidence during the pilot and future production phases. Finally, given the cyber threat posed by emerging technologies such as AI and quantum computing, financial sector readiness is considered.

A. Observations

Cybersecurity and Digital Risk Management in the Financial Sector Today

103. The NBK and NPCK align their security practices to industry standards such as ISO 27001, NIST, and CIS to guide security activities and management. The NBK IT security team is responsible for providing security services through two approaches: (i) horizontally through the NBK internal security, and (ii) vertically to the NPCK. It also takes into consideration stipulated requirements by the Ministry of Digital Development in its Legislation 832.⁴⁶ Prior to last year, the NPCK had been ISO 27001-certified for four years; a recertification is planned for next year. The NPCK also explored OWASP, MITRE ATT&CK, and Corda Security Controls for DT cyber threat modelling.

104. Information sharing and incident response activities for financial services is fairly covered through the ARDFRM FINCERT. FINCERT does this by processing cyber events from commercial banks' security tools (e.g., SIEMs), except for payment services, which are not covered by FINCERT. It is a requirement for financial services participants to report security incidents to FINCERT regardless of the incident's severity. Key challenges noted included scarce cyber expertise and consequently ARDFRM recruits cyber talents from neighboring countries. Additionally, though FINCERT is a member of FIRST, it does not have external sources of cyber intel/feeds from global cybersecurity industries/vendors. To enhance risk-based supervision, FINCERT is planning to enhance their system and processes through automation, in two years' time.

105. While cyber and privacy awareness levels are improving in Kazakhstan, digital financial fraud remains a concern. A recent survey on cybersecurity and privacy awareness of the citizens noted the population knowledge about using electronic digital signatures and protection of personal data practices online has increased from 77.4 percent (2022) to 80.4 percent (2023).⁴⁷ Commercial banks however proposed that financial sector fraud happens due to a lack of customer awareness, especially when scammers pressure them to commit some transactions. Additional factors increasing these risks included staff turnover and internal fraud (unethical staff behavior to conduct fraudulent transactions). Some commercial banks (e.g., BCC) do not have cyber awareness sessions, during, or after onboarding customers, and otherwise rely on their data analytics tools to detect fraudulent transactions and employ

⁴⁶ Decree of the Government of the Republic of Kazakhstan on approval of uniform requirements in the field of information and communication technologies and information security (<https://adilet.zan.kz/eng/docs/P1600000832>).

⁴⁷ Results of a study conducted by Ministry of Digital Development, Innovation and Aerospace Industry (2023) show the majority of respondents: gained knowledge about protecting personal information when using social networks (91 percent); are aware when using their electronic digital signature (85 percent), and know about the potential risks of children using the internet (77 percent).

multi-factor verification (e.g., text and face ID) for authorizing transactions, especially when certain thresholds/limits are exceeded. The mission noted that there are no separated resources for digital fraud within the regulator – the responsibilities are currently mixed with the information security team which is a less common practice.

106. The concentration of payments services within one or two closed systems renders them as potential targets to cyber threat actors, posing systemic risks to the financial sector. Nation state hackers and criminal groups are among the threat sources identified in the Kazakhstan's financial sector. Given the dominance of networks such as those built by Kaspi for payments, they are likely a lucrative target or entry point for malicious actors with a motive to destabilize financial stability or broader economic activity. Such networks therefore could be considered as critical or single points of failure in the financial system. Any successful cyber-attack or operational failure, (e.g., that can result in an outage or wide scale fraud), may subsequently pose material reputational risk for the NBK and regulators. While firms such as Kaspi hold systemically important status as a financial institution (and are regulated by ARDFM), the mission did not find exceptional or additional mechanisms in place at present to ensure they have a more stringent oversight with respect to cyber resilience of payment services and activities.⁴⁸

DT and Digital/Cyber Risks

107. The NBK and NPCK both have an important role in the DT architecture and security environment. The platform and its accompanying rules and governance are critical in securing DT. The NBK developed a DT security architecture and high-level security objectives (such as confidentiality, privacy, scalability, and reliability) that the implementation of the DT must meet. The NBK utilized its internal staff and internal control team to review the initial source code of the DT and provided recommendations to the NPCK to apply corrective actions for the vulnerabilities identified. The NPCK developed the DT system and is responsible for implementing security measures and operations of the DT pilot. Though an open-source platform has been chosen for the DT implementation (Corda) the NPCK or NBK has not commissioned any thorough, independent security assessment (such as penetration test of the DT) before “go-live” in the pilot phase.⁴⁹ Even in a limited production environment, a security assurance promotes trust of the users, regulators and stakeholders in the security and reliability of the DT from an early stage. Trust in the security and privacy aspects of DT was an area that commercial banks highlighted as a perceived area of focus for end-users in considering whether to adopt or engage with DT.

108. The information security threat and intruder modeling conducted by the NPCK is a commendable first step. This exercise helps to inform security decisions on identified threats from the beginning of the DT project life cycle. It also increases confidence of DT stakeholders (i.e., users) by demonstrating the integration of security through threat modelling at the project's early stages.

109. While some security requirements are in place, the development of the minimum-security requirements for DT is still underway. Without specific and approved security standards and requirements there is a high risk of overlooking application of critical security measures in the DT. In principle, these requirements would guide the design, development, and implementation of the DT. Ideally security requirements are factored into the earlier stage of system development, i.e., design and development phase so that trade-offs with functionality can also be considered. Even if these requirements will be developed and approved in due course, often, it is very costly or ineffective in wholly fixing vulnerabilities in the later stages of the system development life cycle, such as production phase.

110. The four commercial banks within the DT pilot were not subjected to a cybersecurity posture assessment to determine their readiness to participate in the DT pilot. Market participants

⁴⁸ Based on information available. Kaspi declined to comment, and regulators did not note any special measures.

⁴⁹ Box 2 provides some further reflections on open-source platforms.

who are operating substantive parts of the DT platform (in this case, individual nodes for verifying and validating DT transaction) should undergo a security assessment of their IT environment to establish their technical and non-technical cyber capabilities for DT operations; the mission did note that some market participants are expecting to change their IT and cyber security practices to accommodate DT implementation, such as hosting DT nodes.

111. The NPCK acknowledge that some commercial banks could face technical and cyber challenges to migrate and securely operate the DT nodes in their IT environments. The NPCK is planning to introduce a fee-based access model for commercial banks who will not have the necessary resources to operate and manage their own DT nodes.

Box 2 Open-Source Platforms and CBDCs

The mission was asked to reflect on the considerations in utilizing open-source platforms.

Open-source software, which allows users to freely inspect, modify, and distribute the code, has rapidly become the norm for DLT-based ecosystems, with many vendors aligning their practices to those of the blockchain communities to harness the opportunities. Whilst the IMF does not comment on the viability of specific commercial solutions during technical assistance, the mission reflected on risks and opportunities of such platforms in general and considerations when applying them to CBDC systems.

The potential innovation and collaboration opportunities of utilizing open-source software must be balanced with the management of cybersecurity risks, such as vulnerability exposure and supply chain threats. Open-source platforms promote innovation, collaboration, and transparency, enabling developers to contribute to and enhance the software, often resulting in more robust and secure solutions. State-of-the-art cryptographic implementations gain accuracy and robustness through allowing open peer reviews from the community, thus largely benefiting DLTs to which these libraries are often incorporated. However, the open nature of the code can introduce risks such as vulnerabilities being more easily discovered and exploited by malicious actors. A typical DLT product may incorporate code from tens or hundreds of open-source projects, which may expose its users to supply chain-induced vulnerabilities (such as backdoor malwares), if not carefully audited.

Governance and accountability for the security of code must be defined. The lack of formal support and accountability for the code base (in some, though not all open-source platforms) can pose challenges in maintaining and securing these systems, and would require strong internal capacity or securing (preferably local) contractors that have such competencies. In maintaining the CBDC ecosystem, authorities may need to consider their risk tolerance in line with the potential for CBDC to become a critical national infrastructure (CNI).

Authorities may also want to weigh up proposed efficiency gains of such platforms. Often, open-source platforms market “lowering of costs” as a benefit in comparison to closed-source licensed software platforms. This may not be guaranteed, as support for the platform is usually reflected as an additional cost. Such costs may need to be considered within the overall business model for CBDC and balance of incentives for private sector participation.

Cyber Risk Management of Emerging Technologies

112. The NBK is proactively exploring different security solutions to mitigate the threats posed by emerging technologies such as AI and quantum computing. Generative AI could benefit the financial sector through improved credit risk monitoring, increasing productivity and efficiency, enhancing virtual assistance and customer relationship management, as well as improving crucial cybersecurity activities such as threat detection and incident response. On the other hand, generative AI can amplify

cyber risks, such as social engineering attacks, data leakage, misinformation/disinformation etc.⁵⁰ The NBK is already actively researching and acquiring knowledge and experiences of other neighboring countries in the regions on AI capabilities for detecting financial fraud and cybercrimes in the financial sector, including for the DT. Through the NBK Anti-Fraud center project based on AI, commercial banks will be required to share, exchange information and report suspicious transactions within the financial sector for prompt actions, i.e., investigation by respective parties.

113. Breakthroughs such as quantum computing are a double-edged sword, transforming computational capabilities but posing significant cybersecurity threats. Quantum computers can break current standard cryptographic algorithms that are currently hard to break using classical computer systems. Such standard cryptographic algorithms include Rivest–Shamir–Adleman (RSA) and Elliptic Curve Cryptography (ECC), which are widely used for securing online transactions, banking communications, and protecting sensitive financial data.⁵¹ These cryptographic standards also underpin the security of DLT such as Corda, including securing transactions, establishing digital identities, and creating digital signatures. Quantum computing could enable an attacker to decrypt encrypted data, forge digital signatures, or impersonate legitimate parties within the network.

B. Recommendations

Cybersecurity Risk Management

114. The ARDFRM FINCERT should enhance and expand its operations towards a proactive cyber incident detection and response. A proactive stance is likely important for future preparedness, with or without the establishment of DT. FINCERT should consider subscribing to industry intel feeds to enhance monitoring. FINCERT should extend its services and conduct regular cyber drills activities to build incident response capabilities and preparedness for cybersecurity experts in the financial services, thus tackling cyber incidents end-to-end as an ecosystem. In addition, ARDFRM can establish regular forums to raise cybersecurity and privacy awareness in the financial sector to combat digital fraud and discuss emerging threats. ARDFRM management should evaluate the organizational structure and role of FINCERT and provide resources to enhance financial services cyber incident management – capacity building, preparedness, monitoring, information sharing, and incident response activities. Furthermore, information security and digital fraud management should be separated, but should closely work together.

115. The ARDFM, NBK and NPCK should closely monitor the cybersecurity and operational resilience of critical payment infrastructure with potential systemic cyber risk. To mitigate these risks, the need for additional supervision and oversight for arrangements that may have systemic consequences, such as Kaspi and Halyk Bank, should be reviewed periodically. Further TA around systemic payment supervision as discussed in Section II may inform future actions.

116. The NBK/NPCK should collaborate with, and influence, stakeholders to develop a strategy to build, upskill, and retain various technology and cybersecurity expertise in Kazakhstan. This requires a coordinated approach amongst various players including those responsible for protection of CNI including critical financial systems, academia, research institutions and the cybersecurity industry.

⁵⁰ Generative artificial intelligence (gen AI) introduces novel opportunities to strengthen central banks' cyber security but also presents new risks, including AI-generated social engineering, zero-day attacks and malware attacks for data leakage (BIS 2024)

⁵¹ CBDC systems rely on cryptographic mechanisms to safeguard "in-motion" data being transmitted, like many systems, such as sensitive customer, transaction, and market data. Thus, CBDC and other national payment systems, such as RTGS systems, are vulnerable to the quantum threat (See World Economic Forum 2024).

DT Cyber and Operational Resilience Risk Management

117. The NBK/NPCK should assess, evaluate, and classify the DT against cyber and operational requirements for CNI. Reports demonstrate an increasing appetite from cyber attackers to target the financial sector given its importance to the economy.⁵² As potential CNI, DT would be no exception.

118. The NBK/NPCK should prioritize developing a set of minimum security and resilience requirements for the DT platform. This will guide the design, development, operationalization or review of the security and operational resilience of the DT platform. This can be expanded to breakdown or mapping these requirements with market participants roles in DT, at different levels. The mission recommended that an assessment against these requirements is considered during the handover of DT nodes to market participants. An assessment will help identify and monitor if there are potential weak points in the ecosystem where vulnerabilities may be exploited to disrupt DT operations.

119. A thorough security testing of the DT's security and resilience should be conducted by an independent firm before launch of an industrial-grade platform launch, and regularly in production. CBDC projects already in production or in pilot phase provide tangible lessons; for instance, the e-Naira wallets (Nigeria) suffered technical glitches (system bugs) soon after it was launch in October 2022. This event forced authorities to take e-Naira offline to fix the bugs. DCash (Eastern Caribbean Currency Union – ECCU) also went offline in Jan 2023 for two months following an expired digital SSL certificate in the Hyperledger Fabric software.⁵³ The two scenarios showcase that a cyber-related operational failure in a CBDC system can cause a security vulnerability, and vice versa. Either case can result in a cyber breach, undermine public trust, and may cause reputational damage for the central banks. Security and operational resilience testing using third-party firms can help identify overlooked DT vulnerabilities before a full production phase and provide corrective actions on an ongoing basis.

Cyber Risk Management of Emerging Technologies

120. The NBK/NPCK should develop a strategy to ensure financial market participants safely and securely adopt emerging technologies, striking a balance between benefits and risks. With respect to utilizing AI, the strategy should prioritize building capacity and awareness on both opportunities and risks, oversight, and training of AI-driven activities, as well as regulation for safe, secure and ethical use of generative AI. The adoption strategy may consider restricted use and access of generative AI to staff to mitigate the risks related to their unpreparedness in using, operationalizing, and integrating their work with AI tools. Building expertise and talent in the fields of data science, AI security and AI supervision would also allow for a more proactive (versus reactive) approach to harness generative AI for cyber defense strategies, including integrating generative AI with existing security tools.

121. For quantum computing, the NBK/NPCK should develop plans to migrating cryptographically-vulnerable computer systems to quantum-resistant cryptography.⁵⁴ To secure the future financial system and DT platform the NBK and NPCK should actively identify and monitor quantum-vulnerable cryptography in use within the financial system today, to ensure a plan is created for their migration to new systems. This includes having an up-to-date inventory of digital assets alongside their cryptographic information. Further, the NBK/NPCK should closely monitor updates from experts in the cybersecurity and cryptographic industry.

⁵² 65 percent of cyber events in Kazakhstan were attributed to politically motivated attackers. (Mastercard 2023).

⁵³ The ECCB's DCash outage: An interruption was caused by an expired certificate on the Hyperledger Fabric software. This is the open-source software that provides the platform for the blockchain. (See Margulies 2022 for further information).

⁵⁴ From a security principle "you cannot protect what you don't know." An approach to quantum computing was proposed in a United States White House Memorandum (United States White House 2022).

Annex I. Lessons of wCBDC Experimentation

This annex considers typical uses for wholesale CBDC (wCBDC) and lessons from experimentation around the world for the DT.

Securities Settlement

Several projects have investigated how CBDC can be used to support securities settlement. Most projects are focused on how tokenized securities and tokenized wCBDC on the same platform can facilitate better delivery-versus-payment (DvP) settlement. Generally, the experiments demonstrate positive results for *technical feasibility*. However, less focus is placed on the overall merits compared with other options, including upgrading existing systems, and technical and cyber resilience. Many experiments also assume (and thus seek to be prepared for) an environment where DLT-based and tokenized financial transactions will be in high demand in the market; however, this has yet to materialize.

The Swiss National Bank (SNB) is one of the leading central banks to observe and learn from in this space. Project Helvetia is a collaborative experiment conducted by the BIS Innovation Hub (BISIH) Swiss Centre, the Swiss National Bank, and SIX (a Swiss financial infrastructure operator). The project aims to explore the settlement of tokenized assets in central bank money, focusing on the practicality and legal feasibility of using a wCBDC for such settlements. The project has undergone multiple phases: Phase I demonstrated the functional feasibility and legal robustness of settling tokenized assets with wCBDC. Phase II further explored these areas, showing that a wCBDC can be integrated with existing banking systems. Phase III is piloting real CHF wCBDC without the involvement of the BISIH.

The DT project can benefit from the insights gained through Project Helvetia's multiple phases:

- **Integration with Existing Systems:** Learning from Project Helvetia's experience in integrating wCBDC with existing core banking systems can offer valuable insights for the smooth integration of the DT with Kazakhstan's financial infrastructure.
- **Legal and Functional Feasibility:** The comprehensive exploration of legal frameworks and functional feasibility in Project Helvetia can serve as a guideline for addressing similar challenges in DT project.
- **PoC and Pilot Testing:** Kazakhstan can draw lessons from the structured phase-wise approach of Project Helvetia, applying similar methodologies for PoC, pilot testing and gradual realization of DT.

Other prominent and interesting experiments to learn from include:

The Reserve Bank of Australia (RBA): Project Atom involved the development of a proof-of-concept (PoC) for the issuance of a tokenized form of CBDC that wholesale market participants could use for the funding, settlement, and repayment of a tokenized syndicated loan on an Ethereum-based DLT platform. The PoC demonstrated that digitizing syndicated loans on a DLT platform could improve efficiency and reduce operational risk by replacing highly manual and paper-based processes. Integrating a wCBDC on the same platform enabled "atomic" DvP settlement of the drawdown, novation, and repayment of the tokenized syndicated loan (see RBA 2021).

South African Reserve Bank (SARB): Project Khokha 2 notes that the use of a single shared ledger with different levels of access, depending on the role of the participant, enabled greater oversight of what was happening across the network, making reconciliations easier and providing valuable real-time operational data. In addition, the project notes that having both the security and settlement tokens on DLT enabled DvP on a single network; however, the porting of the central bank's settlement token across two platforms also introduced some challenges, for instance, in the separation between operational and legal settlement introduced by porting the wCBDC token to the Khokha Hub. The project concluded that issuing

a token-based wCBDC on DLT created a riskless settlement asset on a platform that also serves as a payment settlement system and hosts settlement participants' accounts as a wallet on the DLT with the central bank. Participants have observed that the true benefit and challenge from DLT may not stem from the technology itself, but from the business process innovation it enables. Based on the PoC, although the number of operators could potentially be reduced, the roles and functions did not disappear and therefore existing regulatory frameworks would still apply. The design of the PoC did, however, result in the issuance of DLT-based tokens, which are not defined in law, and the modular design of platforms would require further consideration to determine whether and how frameworks may need to be updated (see SARB, 2022)

Bank of Canada (BoC): Phase 3 of Project Jasper embarked on a practical exploration of how payments and settlements could interact within a distributed ledger framework by developing and testing a prototype system integrated with current market infrastructures. This phase of the project saw the introduction of securities and cash onto the ledger through the creation of Digital Depository Receipts (DDRs) by the CDS and the Bank of Canada, respectively. This integration enabled participants of the PoC to execute securities settlements using central bank funds on the distributed ledger. The experiment highlighted several promising aspects of the DLT platform, including the successful integration with financial market infrastructures via a "loose coupling" approach, the enforcement of independent token issuers' rules on the ledger, which facilitated the free transfer of DDRs in a shared ledger scenario, and the implementation of participation restrictions through a private ledger and doorman service. The PoC also featured real-time ledger transparency for market infrastructure and regulatory observers as needed. Furthermore, the PoC introduced a mechanism for extending credit to broker participants who were not part of the payment system, enabling them to access cash DDR on the ledger – a reflection of the existing system's credit provision to brokers. However, this inclusion of a credit extension process reintroduced credit risk in a model that initially hoped to eliminate such risk. The project suggests that DLT models exploring more radical changes from the current settlement and market infrastructure could potentially offer operational cost savings and lessen reconciliation efforts in the back office. The conclusion is that while DLT continues to hold potential for enhancing efficiency, a broader expansion in the ledger's scope to encompass additional assets and the entire trade and post-trade lifecycle might be necessary to fully harness these benefits (see BoC, 2022).

Banque de France (BdF) has also launched an ambitious wCBDC program including an initiative where the BdF worked with the European Investment Bank (EIB) and Société Générale – Forge to settle a European Investment Bank (EIB)-issued digital bond with wCBDC (see BdF, 2021 and 2023).

The DT project stands to benefit from several key lessons from CBDC experiments from other central banks. Adopting atomic settlements could enhance the efficiency and security of financial transactions involving securities and other instruments, minimizing counterparty risks, and expediting settlement times. Additionally, investigating privacy-preserving technologies to ensure user privacy without sacrificing scalability or system performance is essential. Allowing seamless integration with existing financial infrastructure is also important. Finally, addressing regulatory and legal challenges from the outset is critical for compliance and widespread acceptance.

Tokenized Deposits

Two newly announced projects to observe outcomes from are Project Ensemble and Project Agorá. Both projects are focused on how wCBDC can interact with and support a tokenized market, including tokenized deposits. While stakeholders in Kazakhstan do not currently focus on tokenized deposits, observing and learning from the experimentation can be beneficial in the long run.

In March 2024, the HKMA launched **Project Ensemble**, a new wCBDC project, to support the development of the tokenization market in Hong Kong. Project Ensemble seeks to explore innovative financial market infrastructure (FMI) that will facilitate seamless interbank settlement of tokenized money

through wCBDC. The project will initially focus on tokenized deposits, which are digital representations of commercial bank deposits. With wCBDC as the foundation, tokenized deposits can be used for tokenized asset transactions.

In April 2024, the Bank for International Settlements (BIS), together with seven central banks, announced **Project Agorá** and the plans to join forces with the private sector to explore how tokenization can enhance the functioning of the monetary system while maintaining its two-tier structure. The project brings together Bank of France (representing the Eurosystem), Bank of Japan, Bank of Korea, Bank of Mexico, Swiss National Bank, Bank of England, and the Federal Reserve Bank of New York. The project will seek to partner with a large group of private financial firms convened by the Institute of International Finance (IIF). The project builds on the unified ledger concept proposed by the BIS and will investigate how tokenized commercial bank deposits can be seamlessly integrated with tokenized wholesale central bank money in a public-private programmable core financial platform.

Cross-Border (Wholesale)

Exploring wCBDCs in cross-border transactions has seen significant experimentation, focusing on addressing the challenges and identifying the benefits of such digital currencies in international finance. Key experiments include:

Project Jura, a collaboration by the Bank for International Settlements (BIS), Banque de France (BdF), and Swiss National Bank (SNB), focused on the cross-border settlement of wholesale Central Bank Digital Currencies (wCBDCs). Jura tested the feasibility of using DLT to secure and efficiently transact two distinct wCBDCs. Key innovations included the deployment of digital currencies on third-party platforms and the introduction of mechanisms like subnetworks and dual-notary signing to facilitate secure and policy-compliant transactions.⁵⁵

Project Jasper-Ubin was a cross-border collaboration between the Bank of Canada and the Monetary Authority of Singapore, designed to explore the use of blockchain technology for the clearance and settlement of payments and securities. Utilizing DLT, the project aimed to improve the efficiency of cross-border transactions by enabling direct currency exchanges without the need for intermediaries. The experiment successfully demonstrated how two different blockchain platforms could be linked to facilitate real-time, cost-effective, and secure cross-border payments, thereby showcasing the potential of DLT in enhancing global financial transactions (see BoC and MAS, 2019).

Project Dunbar was an international initiative led by the BIS Innovation Hub, collaborating with the Reserve Bank of Australia, Bank Negara Malaysia, the Monetary Authority of Singapore, and the South African Reserve Bank. This project aimed to develop prototypes for shared platforms that could enable banks in different countries to transact directly with each other using digital currencies issued by multiple central banks. The key achievement of Project Dunbar was the demonstration of the feasibility of a common platform for cross-border transactions using multiple CBDCs, which could significantly reduce reliance on intermediaries and improve the efficiency and security of international payments.⁵⁶

Project mBridge is a venture led by the BIS Innovation Hub, which collaborates with the central banks of China, Hong Kong, Thailand, and the United Arab Emirates. The project's goal is to create a cross-border corridor network that facilitates more efficient international trade and investment through wCBDCs. By leveraging DLT, mBridge aims to simplify the process, reduce costs, and increase the speed of cross-border payments and currency exchanges. The project has successfully demonstrated the potential of CBDCs to transform the landscape of international finance by enabling faster, cheaper, and more

⁵⁵ See <https://www.bis.org/about/bisih/topics/cbdc/jura.htm> for more on Project Jura.

⁵⁶ See <https://www.bis.org/about/bisih/topics/cbdc/dunbar.htm> for more on Project Dunbar.

transparent transactions. Project mBridge continues its development and has reached the minimum viable product (MVP) stage, while broadening its international reach.⁵⁷

For Kazakhstan’s DT project, the experiences from Projects Jura, Jasper-Ubin, Dunbar, and mBridge offer valuable insights into designing and implementing a successful CBDC system for cross-border payments. Key lessons include the potential benefits of establishing either direct connections between different CBDC platforms or by sharing platforms for streamlined cross-border payments and the necessity of international collaboration to address policy and regulatory challenges.

The BISIH has also launched Project Rialto to explore how instant cross-border payments could be improved using a modular foreign exchange (FX) component combined with settlement in wCBDC. FX is a key component of cross-border payments. However, currently, the FX services facilitated by correspondent banks can be costly, slow, and complex, and they expose participants in the payment chain to liquidity, credit, and settlement risks. Project Rialto is a collaboration of the BIS Innovation Hub Eurosystem and Singapore Centers in partnership with several central banks. It explores a new automatic FX settlement layer solution using wCBDC as a safe settlement asset that could be deployed for interlinked instant payment systems or digital asset systems. Observing lessons from this project as it advances can provide valuable lessons for the design of the DT.⁵⁸

⁵⁷ See https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm for more on Project mBridge.

⁵⁸ See <https://www.bis.org/about/bisih/topics/cbdc/rialto.htm> for more about Project Rialto.

Annex II. Offline Use Cases

Offline CBDC functionality refers to the ability to transact with a CBDC without the need for an active internet connection at the time of the transaction. This feature is particularly important in enhancing the flexibility and inclusivity of CBDCs, making them a viable option for a wider range of scenarios and users. While offline functionality currently is not a priority within the DT project, some stakeholders raised benefits of such functionality.

Offline transactions can be a boon for people living in remote or rural areas where reliable internet service is not always available, ensuring that they are not excluded from the digital economy.

Kazakhstan's vast geography and varying levels of infrastructure development make offline transactions an instrumental feature for ensuring that all citizens, regardless of their location or internet access, can benefit from the DT.

Offline functionality can also increase resilience in the face of connectivity issues. It allows for transactions to continue even during internet outages or in scenarios where connectivity is compromised, ensuring the continuity of economic activities. In the event of natural disasters or emergencies that disrupt internet services, offline CBDCs can play a critical role in maintaining financial transactions and aid distribution.

However, offline CBDC transactions present unique challenges and risks, including technical hurdles such as ensuring security, preventing double-spending, and managing data synchronization when re-connecting to the network. Operational issues like user authentication and compliance with regulatory frameworks like AML pose additional difficulties. Proprietary access to secure elements prevents offline wallets becoming universally accessible, and attacks can go unnoticed for a long time. Risks include potential exploitation for illicit activities, systemic vulnerabilities, and operational failures. Mitigating these risks requires advanced techniques, strict transaction limits, robust authentication mechanisms, and regular audits. Addressing these concerns is essential for the secure and inclusive implementation of offline CBDC functionalities.

Instead, enhancing digital infrastructure is crucial for minimizing the reliance and need for offline functionalities. By expanding internet and mobile network coverage, leveraging new types of infrastructure (such as Low Earth Orbit satellites) especially in remote areas, and improving network reliability through technological upgrades and redundancy systems, governments and central banks can significantly enhance connectivity.

Annex III. DT and Crypto Assets

DT, as a representation of sovereign fiat currency, is distinct from privately-issued crypto assets.

The mission noted this was not always clear to all stakeholders with some confusing it as a public attempt to “buy into” crypto assets. The holding of crypto assets is currently prohibited in Kazakhstan’s domestic regulatory regime but can be held within some frameworks and sandboxes of the Astana International Financial Center (AIFC) which is regulated by the Astana Financial Services Authority (AFSA). Estimates provided by KASE suggested interest in crypto within the domestic population is growing, with holdings undertaken through the AIFC.

However, DT could become a bridging asset between traditional and crypto markets in future. The extent to which this is desirable will reflect the risk tolerance of authorities and the potential safeguards and regulatory regimes in place. The mission noted that encouraging such links may increase reputational risk elements for the NBK if clear communication about the differences between DT and private crypto assets are not well known.

Crypto assets do not currently pose financial stability risks to the domestic financial system, but this is an evolving area that requires proactive vigilance. While crypto markets in Kazakhstan remain small, the authorities should prepare for the possibility that they grow substantially and the current ban in the domestic market becomes untenable. This would require a change in the regulatory stance, entailing conduct, prudential regulation and supervision, and closer collaboration between authorities (IMF 2024).

The consideration to allow banks to issue crypto cards enabling clients to utilize their crypto asset holdings in everyday transactions through international card platforms represents a significant step towards integrating crypto assets into the mainstream financial ecosystem. This approach raises substantial concerns regarding the potential for increased contagion between the highly volatile crypto market and the traditional financial system. Furthermore, while it can provide some benefits in providing better visibility into the crypto market, it can also make it more legitimate, and increase the attractiveness of holding crypto.

The primary apprehension stems from the intrinsic volatility and speculative nature of the crypto market, which, when intertwined with the conventional financial system through mechanisms such as crypto cards, could transmit shocks and destabilize the broader financial ecosystem. This interconnection could lead to scenarios where fluctuations in crypto asset values directly affect the liquidity and solvency of banks, posing systemic risks. Furthermore, the integration of crypto into everyday transactions might accelerate the transmission of any crypto market distress to the real economy, affecting consumer spending, business investments, and ultimately, financial stability.

Moreover, the regulatory and oversight challenges associated with monitoring transactions involving cryptocurrencies could impede effective risk management and anti-money laundering (AML) efforts. Given the pseudo-anonymous nature of many crypto assets, ensuring compliance with AML and countering the financing of terrorism (CFT) standards could become increasingly complex, potentially exposing the financial system to illicit financial flows.

In light of these considerations, cautious deliberation of the potential implications of allowing banks to issue crypto cards as part of Kazakhstan’s DT project is needed. It is imperative to assess the risks to financial stability and implement comprehensive regulatory and supervisory frameworks capable of mitigating the potential contagion effects between the crypto market and the traditional financial system. This entails developing clear guidelines on the issuance and use of crypto cards, stringent AML/CFT controls, and mechanisms to monitor and manage systemic risks effectively.

Annex IV. Pilot Analysis: Further Detail

This annex outlines some further considerations and supporting points for the pilot analysis conducted by the mission team.

Background and Approach

The mission proposed a pilot analysis as a way of stock-taking work to date, reflecting on areas for further development and analysis with respect to the pilot, and with a focus on the policy aspects the pilot could help inform. The scope of the pilot analysis spanned three elements:

- 1) an assessment of how the pilot supports DT's objectives,
- 2) considerations for a long-term evaluation and monitoring framework, and
- 3) areas to develop stakeholder engagement

The mission used a mix of questionnaires, brainstorming, desk review and discussions with authorities to reflect on the internal aims of the pilot and the DT's objectives. A questionnaire sent ahead of the TA considered the status of the project, experimentation, capacity and motivation. Discussions within the first phase related to the pilot analysis focused on understanding objectives for the DT and also stakeholder mapping undertaken to date. In the second phase, further discussions happened on the 2023 experiments and external factors and demands influencing the project.

The mission also conducted several stakeholder interviews to understand perspectives of participants of the pilot. These including commercial banks within the pilot, payment and financial industry stakeholders including card schemes and the Kazakhstan Stock exchange, alongside pilot users and NPCK teams.⁵⁹

Experimentation to Date

Kazakhstan has undertaken a wide set of CBDC experimentation. The NBK (and now NPCK) have tested a range of DT use cases since 2021 with several proofs of concepts and pilots. The mission focused primarily on the industrial loop experimentation over 2023, but broader opportunities in the R&D circuit are discussed to inform work beyond the target of a "fully operational" platform in end-2025.

The NPCK's first real-world pilots launched in November 2023, with the deployment of a DT-platform's limited production (industrial loop) on Corda DLT. Two use cases were tested as part of the industrial loop: (i) a digital voucher for school meals and (ii) CBDC linked cards for payments in-store and online (See Box A.1). A second version of the platform was created to conduct research activities and to test hypotheses regarding different functionalities, cross-border payments, issuance of DT-backed stablecoins and tokenization of securities (R&D circuit or "experimental loop"). This platform also supported testing the ideas of market participants who won the DT Ideathon 2022 idea competition. Figure A.1 summarizes the 8 scenarios undertaken and their specific aim/objectives.

The pilot to date has validated the technological feasibility of transfers between many different stakeholders. Documentation has noted that P2P, P2B/B2P, G2P/P2G, G2B/B2G payments would be technologically feasible, however challenges remain around scaling these use cases which the project

⁵⁹ Unfortunately, the mission was not able to directly engage some key stakeholders for the government use case due to availability constraints.

team are aware of. Further analytical, design and testing work around each mode could be undertaken in determining a prioritization and feasibility for end-2025.

Box A.1 Industrial Loops Scenarios Overview

Digital School Vouchers

The NBK/NPCK conducted the pilot in collaboration with a bank (KazPost), a legal entity (the school), a PSP (Onay), a merchant (the school canteen), and users (school children). The school received government subsidies for the provision of free school meals for children in the form of card-based DT “vouchers.” The children could pay for their meals tapping their cards in special terminals that provided information to the school authority on how many meals were provided each day. There was in this sense good accountability in the system, however, no advanced programmability functionality was deployed at this stage of the pilot. Based on an invoice for the actual number of school meals served, the canteen supplier was paid by the school in DT which was immediately converted to fiat currency by their mutual custodian bank.

DT-linked Cards

The NBK/NPCK worked together with Visa, Mastercard and 4 commercial banks (Halyk Bank, Altyn Bank, Bank CenterCredit, Eurasian Bank). The pilot participants [– primarily employees of the NPCK –] received a certain amount of DT in their digital wallets that they could spend at Point-of-Sale (PoS) in Kazakhstan or abroad, use for e-commerce or to withdraw physical cash from ATMs. There was no conversion of physical cash into DT or direct conversion to bank accounts by individuals. The pilot period lasted around one month. Visa and Mastercard provided full integration to the card networks, with their objective being to minimize operational impact for all actors involved. Thus, when the payment was made, there was an immediate conversion to fiat currency and the transactions were processed through their systems. A few variations of the DT-linked card also tested true DT transactions and differing levels of integration with bank’s existing mobile applications, for example some users could not see their DT balance within their app.

The pilot reports indicated a relatively high degree of technical success. PoS transactions had a 100 percent rate of success. Online purchase and ATM withdrawal success was slightly lower rates: 87 and 82 percent, respectively. In the former case, technical difficulties consistent with full fiat payments were seen to be an issue. In the latter, withdrawals at other bank ATMs were a source of operational difficulty due to mixed efforts of integration from banks’ side, however another challenge of withdrawals was typically insufficient balances – where the user had not realized they had exhausted their DT balance.

Assessment of DT Objectives

Beyond publicly stated objectives, through mission questionnaires and brainstorm we understand the DT project aims to realize the following objectives:

- Improving the efficiency of payment infrastructure and competitiveness of the domestic financial market
- Improving payments with government participation
- Digitalization/modernization of payment infrastructure including enabling further innovation
- Better cross-border payments
- Enhance financial inclusion

Key motivations for authorities include the ability to drive efficiencies around cost and increase competitiveness and transparency in the market with DT. Through utilizing design-centered thinking techniques such as “abstraction ladder,” the mission understood a strong drive around the government payments was motivated by the drive to improve transparency of government funds and tackle corruption.

⁶⁰ No strong barriers exist to government transfers via bank accounts so the focus is around creating accountability. Equally with respect to efficiency and competitiveness, authorities indicated high cost of payments and concentration of payment services were key areas of focus that DT could mitigate. The mission explored such themes within the pilot experimentation and wider stakeholder engagement to understand and affirm these challenges within the existing market. Table A.1 summarizes the mission’s assessment of how the current experimentation mapped to the discussed objectives.

Figure A.1 Matrix of Scenarios and Completed Test Objectives

	OBJECTIVE/SCENARIO	Digital Vouchers	CBDC Card	R&D - Cross-border payments	R&D - Issuance of stablecoins (Binance)	R&D - Issuance of stablecoins (KASE)	R&D - Sale of tokenised assets	R&D - Pedometer	R&D - VAT Deduction
1	Ensuring efficient integration with the financial market participants’	✓	✓	✓	✓	✓	✓	✓	✓
2	Interoperability with the digital assets industry and DeFi			✓	✓	✓	✓		
3	Implementation of innovative services (including those based on programmability of the CBDC) to improve the efficiency of payments			✓	✓	✓	✓		✓
4	Integration of the DT platform with the existing payment infrastructure	✓	✓						
5	Conducting testing with real consumers and merchants in an open environment	✓	✓						
6	Conducting research on market participants’ scenarios, cross-border payments and integration with DLT networks			✓	✓	✓	✓	✓	✓

Source: NBK and NPCK, Digital Tenge: Results of the First Implementation Phase – White Paper 2023.

More work could be done to support many of the DT objectives more clearly. Whilst the current limited production pilot tests feasibility of integration DT to the existing system it does not provide sufficiently clear efficiency gains at this point as overall cost and speed of payments would remain

⁶⁰ Abstraction ladder is one of the design techniques noted within the IMF’s product development framework (See Tourpe and others 2023). For more on design-thinking techniques see Lewis and others (2020).

unaffected by DT. Equally for the digital voucher scenario, this experiment successfully tested an accounting of municipal funds for school meals. However, it was not clear that DT was necessary for its use in this scenario and so the potential may lie in extrapolating this arrangement into a different use case or bringing out DT-specific functionalities. On broader efficiency and modernization of markets, including asset and securities settlement, neither authorities nor external stakeholders seemed clear on the efficiency gains and regulators had not been engaged on the use of stablecoins for settlement. In the context of a tight timeline, the mission recommended this is kept as a longer-term priority as market interest and capacity increases – other central bank experimentation provides clear evidence of potential efficiency gains from a technical perspective.

Table A.1: Mapping Experiment Outcomes to DT Objectives 1/ 2/

Experiment Objectives	1. Efficiency & competitiveness	2. Government payments	3. Modernization & innovation	4. Cross-border payments	5. Financial inclusion
Industrial Loop					
Digital Vouchers	—			—	—
CBDC-linked Card		—	—	—	—
Experimental Loop					
R&D Issuance of Stablecoins (integration with crypto)	—	—		—	—
R&D Issuance of Stablecoins (tokenized asset settlement)		—		—	—
R&D VAT Deduction	—		—	—	—

Source: Mission team's assessment based on discussion as at June 2024.

Note: 1/ The cross-border and pedometer experiment were not discussed with stakeholders at length and are excluded from this table. 2/ Circles represent the strength of connection between an experiment and a DT objective. A full circle denotes a strong connection between the experiment and a DT objective. A "—" represents no clear match.

Evaluation and Monitoring

Evaluation and Monitoring can aid reflection of a project in both pre-production and production stages. During pre-production they can help identify critical changes and gaps, whereas in production they can be useful also in monitoring progress and providing transparency to stakeholders.

Very few central banks have reached production stage so experiences of applying evaluation frameworks are minimal.

Most central banks have relied on reports and white papers, in a similar style to the NBK. Some examples of alternative evaluation styles include the book by the research department of the Central Bank of Nigeria which reflected on the role of e-Naira across operations of the central bank and for key objectives.⁶¹ With this in mind, the mission has proposed a framework which draws from other publicly run projects beyond CBDC.

Within the report the mission proposes eight core elements of an evaluation framework (Table 3).

An evaluation first and foremost ties to the objectives being pursued for DT overall. They can then be broken down into use cases and capability and functionality to form the basis of “what” is being evaluated. The key evaluation elements are then clearly defining the criteria for success (success measures), how they will in fact be measured (tools), under what timeline (evaluation timeline) and to who/how (governance reporting). Evaluating a project has little meaning if there are not clear outcomes to report, or stakeholders to report them to. For CBDC projects, stakeholder engagement is multifaceted; when considering the evaluation framework, it is useful to consider who is the key decision-maker, who needs to be consulted and who should be informed and updated.

As an illustration of how such a framework could work, we focus on two DT objectives:

- In the context of *promoting transparency and traceability in government spending*, there are two use cases identified for experimentation and operation – procurement and social benefits. Then the G2B and G2P functionality must be in place as well as programmability. The forecast rollout timeline should indicate a target order for the use cases that will be deployed (e.g., start with G2B in phase 1 and continue with G2P in phase 2). Evaluation criteria might include “X percent” reduction in the cost of delivering government payments, and it could be measured directly by government agencies’ finance divisions. Equally another criterium might be to raise trust and confidence in government procurement processes by citizens – this might be measured through qualitative survey work on attitudes.
- *Improving efficiency and competitiveness* would likely require a different approach and experimentation focus, which includes further testing of retail DT-to-DT payments. For example, the use cases may be allowing for everyday payments by individuals and businesses. They require P2P, P2B and B2P types of payment functionalities as well as interoperability between DT, commercial bank money and physical cash (eventually even to other innovative forms of money). Once again, a forecast rollout timeline should be estimated for different use cases, starting for example with P2P in this instance. Evaluation criteria in this instance may focus on the share of end-users paying with DT in different scenarios at six months, one year, two years etc. This would require some considerations around existing payments data collection to ensure an accurate accounting of DT’s role. Equally some criteria might focus on the costs incurred by merchants for accepting different payment types. This could warrant a survey commissioned on cost of in-payments. Feedback from such studies may help provide an evidence base for further design and policy changes if no improvements are found. In the case of providing DT as an alternative means of payment, DT to DT transfers would also be important to monitor in a way that assesses if the DT platform operates at the same or improved level to existing payments, and if it allows for interoperability between users who struggled to undertake transfers before.

Interoperability with existing systems may be a key metric to monitor across different use cases as the DT is operationalized.

There is an opportunity to leverage and extend the existing card pilot to collect further data. From an operational perspective, understanding flows into and out CBDC and which types of users will result in a better-informed analysis of the economic implications of DT. Alongside the volume of such transactions, motivations and attitudes could be collected via surveys to provide a deeper

⁶¹ This also covered wider research and theories around CBDC. See Central Bank of Nigeria (2023).

understanding of what is incentivizing or encouraging platform adoption. Equally the extension into testing two-way interoperability would be useful to understand if any dynamics are different when moving into CBDC. Table A.2 maps the current testing of interoperability to benchmark gaps.

Table A.2 Interoperability Between DT and Other Forms of Tenge

Into → From ↓	DT	Commercial Bank Tenge	Cash
DT	DT platform; or intra-bank node. Only latter tested in 2023 pilot	Tested via Card payment (redemption to commercial bank node and then sent over card rails)	Tested via card use at ATM (redemption to commercial bank node and then withdrawn)
Commercial Bank Tenge	Not tested in 2023 pilot	Existing intrabank (internal "on-us"), interbank systems and card transfers	Withdrawal at bank branch or ATM
Cash	Not tested in 2023 pilot	Deposit at bank branch or ATM	P2P physical transfer or post

Source: Mission Team's elaboration based on pilot as at June 2024.

Reflections on Stakeholder Engagement – Perspectives from Other Central Banks' Experience

At an early stage trying to engage with end-consumers directly on CBDC can be challenging. Key issues for central banks in the pre-production phases are low awareness, but also misinformation. Authorities sometimes struggle to get much out of general consultations that explicitly ask citizens for their views on the need for CBDC. To get more useful information, it is better to engage with a smaller sample of the population in the form of focus groups and case studies. Table A.3 summarizes potential engagement formats authorities could consider going forward.

A focus on pain points in payments and the financial landscape can help inform and prioritize objectives and use cases. Understanding consumer views does not necessarily require going into the specifics of the need or not for a CBDC. Consumers may be better able to provide feedback on the pain points they face in the context of payments and what features could be added to improve this situation. Equally a survey of consumer habits, i.e. a payments diary undertaken at regular intervals to build a time series of changing trends. Such exercises can be undertaken by the central bank directly, or commissioned on their behalf, depending on resources to hand.

Merchants and businesses are better prepared to discuss payments' challenges and ways to improve the landscape. General surveys are more informative, however, bilateral engagement with a smaller sample of the merchant population is advisable in order to get in-depth understanding of their needs. There may be differences in needs between businesses who are entirely consumer facing, versus those who are purely business-facing in terms of need for speed of processing and settlement, cash flow management and integrations with different systems.

Table A.3: Considerations of Formats for External Stakeholder Engagement

Different Formats	Considerations
Open Questionnaire / Call for Feedback (Quantitative and Qualitative -Mixed)	- Conducted by the central bank usually in line with an update. - Content could be broad or focused (i.e., covering a specific use case, or multiple) - Most commonly open to online or postal replies. - Open questionnaires tend to self-selection bias. - Less informative past early-stage ideation unless very focused
Targeted Questionnaires (Mixed)	- Could be outsourced but should be designed with central bank; bespoke question design and sample selection (building representative samples where appropriate) - Could be undertaken in a range of formats (phone, in person or online).
Payment Diaries (Mixed)	- Common way of gauging actual behaviors and subconscious preferences. Useful at an early stage to understand baseline habits. - High intensity for participants so typically recruited with smaller samples. - Representation of population needed to make any inferences. - Could be outsourced (though central bank should consider bias and sample selection if relying on existing studies);
Interviews (Qualitative)	- Able to cover different user groups and stakeholders including platform participants. Best for engaging on commercially sensitive information. - Best done in person; end-users (merchants and citizens) could be engaged over phone, online and in-person. - For firms, ensuring the right person is engaged in the interview is critical. - Central bank could leverage their local branch network to ensure representation of views across geography. - Could be outsourced if an independent view / assessment is sought.
Focus Groups (Qualitative)	- Could be conducted directly by the central bank or convened by a business association or research firm on the central bank's behalf. - Could be conducted periodically to assess progress and development of perspectives as use cases are evaluated. - Useful for understanding how participants react and engage to others' views. - Consider segmentation of different users when creating focus groups - Firms may be less vocal if they have commercially sensitive views to share
Forums (Qualitative)	- Moderate central bank involvement; Run directly on a periodic basis. - Could target citizens, businesses, academics, or government, respectively. - Can be formalized and publicized for transparency and accountability – especially for firms, academic, governments. Summaries can be published.
Behavioral Experiments or Trials (Mixed)	- High central bank involvement. - Target specific research gaps or assesses viability of a specific feature / use case. - Requires clear evaluation goals from outset.

Source: Mission team's elaboration based on experiences of other central banks.

Central banks can benefit from formalizing governance arrangements internally, but also with government stakeholders. CBDCs as a form of money has wide implications on the operation of the central bank including accounting of the balance sheet, monetary operations, communications. If such departments are not included, or at least well informed on CBDC's vision, design, and operation, this can lead to gaps in analysis and unmanaged trade-offs in operational objectives, therefore a governance structure within the central bank should account for a wider set of stakeholders. The mission has made a key recommendation of the report for a cross-Bank taskforce to be established with the view of preparing for holistic monitoring of DT in production. Equally some central banks have formalized their engagement with government stakeholders through memorandums of understanding and joint taskforce, importantly with a view to creating transparency around how decisions on DT are made, and to distinguish issues relating to central bank independence. Such structures may also improve cross-government engagement if presently low due to the public nature of the commitment (Ministries of Finance, but also ministries covering digital issues, and maybe tax authorities or authorities in charge of other fiscal transfers). Equally a joint taskforce may have great powers to leverage and convene stakeholders.

Further governance structures do come at some costs to agility. However, if roles and responsibilities are outlined clearly from the outset this can be beneficial in the long-term operations. In the context of Kazakhstan, the emerging prioritization of government use cases increases the case for a formalized government engagement.

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