Central Bank Digital Currencies: A Policy Framework for the Digital Age

Understanding the Opportunities, Risks, and Regulatory Considerations of CBDCs for National Economies and Global Finance.

> Central bank digital currencies are one possible response to changes in money and payments. Their case depends on the problem a jurisdiction is trying to solve and the alternatives available. A useful policy framework therefore starts with objectives, considers benefits alongside risks, and distinguishes a research project from a decision to issue a currency. [1]

The Strategic Imperative for Central Bank Digital Currencies

Changes in cash use are one motivation, but the pattern is not identical everywhere. The ECB's 2024 consumer survey found cash used for 52% of euro-area point-of-sale transactions by number, down from 59% in 2022. That is a regional measure of transactions, not a global cash-use statistic or a share of payment value. [2]

A **CBDC** is a digital liability of the central bank denominated in the national unit of account. Unlike a commercial bank deposit, the claim is on the central bank. A **CBDC** is

not risk-free in every sense: operational failures, fraud, loss of access, and changes in purchasing power still matter. Its policy role depends on its design and legal framework. [3]

The distinction between retail and wholesale **CBDCs** concerns access and use. **Retail CBDCs** are intended for the public; wholesale versions serve eligible financial institutions. The proposed digital euro is a retail **CBDC**, with issuance still dependent on decisions and legislation. Swiss testing of **wholesale CBDCs** uses real central bank money for tokenized settlement, but **CBDCs** in a pilot are not an unconditional production commitment. The SNB extended its **CBDC** pilot until at least mid-2027 in June 2025. [4] [5]

Research into **CBDCs** raises questions for **Central Banking** about continued access to public money and **monetary sovereignty**. A **CBDC** does not automatically protect a currency from foreign competition or guarantee payment continuity. Governance must fit the actual architecture: **Blockchain Governance** matters only where that technology is used, while **Digital Currency Policy** also covers conventional infrastructure and legal choices. [3] [6]

Opportunities of Central Bank Digital Currencies

Central Bank Digital Currencies may support **Monetary Innovation**, but proposals for **CBDCs** should identify the expected benefit and a way to measure it. Faster payments, wider access, or more resilient settlement are different objectives. Issuance should be compared with improvements to existing systems rather than assumed to be the necessary outcome of research. [1]

Payment speed is not unique to **CBDCs**. Existing instant-payment infrastructure already enables rapid transfers without creating a new central bank liability for the public. The Federal Reserve explicitly distinguishes FedNow, a service for participating banks and credit unions to transfer customer funds, from a CBDC. Compare settlement, access, cost, and availability rather than treating all conventional payments as inherently slow. [7]

Financial inclusion is a possible aim for **CBDCs**, not an automatic result. The Bahamas' Sand Dollar rollout was designed to improve access to payments. Other **CBDCs** may address different conditions. Offline access can help in some settings, but designing it for **CBDCs** involves security, device, and operational trade-offs; launching a product alone does not demonstrate sustained use by underserved people. [8] [9]

The competitive effects of **CBDCs** depend on who can provide services, the price structure, and the existing payment market. Policymakers should assess whether a public option improves access and contestability without unfairly excluding providers or creating new dependencies. The same project can involve complementary services and competition with existing payment instruments. [1]

Cross-border **CBDCs** have been tested in projects such as mBridge, which reached a minimum viable product stage in 2024. The BIS subsequently began transferring the project to partner central banks. Those milestones demonstrate experimentation, not universal availability or a guaranteed cost saving for a hypothetical trade payment between any two countries. [10] [11]

Programmability is a design choice, not an inherent characteristic of every **CBDC**. The ECB distinguishes conditional payments, such as payment on delivery, from programmable money that restricts what units can buy or when they expire. Its proposed digital euro would not be programmable money. Claims of **Monetary Innovation** should preserve that distinction rather than presenting spending restrictions as inevitable. [12]

A **CBDC** is a form of sovereign money, not a privately issued speculative token. Its status as a **CBDC** does not guarantee stable purchasing power or remove every risk in the financial system. Whether a **CBDC** affects demand for other assets is an empirical question. Sound policy for **CBDCs** must work alongside broader **Financial Regulation**, not substitute for it. [3]

Navigating the Complexities: Risks and Challenges

Opportunities need to be evaluated alongside risks. For **CBDCs**, these include changes to bank funding, runs, operational dependencies, privacy, and public acceptance. The assessment should specify the proposed product and relevant domestic conditions rather than presume that every jurisdiction faces an identical set of effects. [13] [6]

A possible risk from **CBDCs** is a shift of deposits out of commercial banks, particularly under stress. **Digital Currency Policy** can consider safeguards such as holding limits or remuneration choices. A **CBDC** distributed through intermediaries can still attract funds away from banks: the distribution model alone does not eliminate that risk. The design of a **CBDC** should be tested against plausible stress scenarios before calling it safe **Monetary Innovation**. [13] [12]

Privacy is a central question for **Digital Currency Policy**. A **CBDC** can be designed with different data flows and access rights, not just a binary choice between total anonymity and total surveillance. The ECB's proposed arrangements distinguish online and offline payments and the information accessible to intermediaries and the Eurosystem. Those proposed protections require effective legal and technical implementation under **Financial Regulation**. [14]

A **CBDC** ecosystem can expose central infrastructure, intermediaries, wallets, and devices to cyber and operational risks. It is not inherently a single point of failure, and using a distributed ledger does not inherently make it resilient. A **CBDC** needs a security model, tested recovery arrangements, and clear responsibilities; **Blockchain Governance** cannot replace these controls. [15]

The monetary effects of a **CBDC** depend on features such as access, remuneration, and limits, as well as adoption. It does not automatically create authority for direct fiscal transfers or negative interest on retail holdings. The proposed digital euro, for example, would not pay interest. **Central Banking** analysis should separate technical possibilities from the powers and policy choices actually proposed. [12] [13]

International use of **CBDCs** could create spillovers, including effects on currency substitution and capital flows. The outcome is not predetermined as either dollar decline or a currency war. Access rules for **CBDCs** and cross-border arrangements require cooperation. **Digital Currency Policy** should assess macro-financial consequences, while **Blockchain Governance** addresses only one possible implementation layer. [16]

A **CBDC** needs explicit capacity and service targets based on its use cases. Testing a **CBDC** should cover ordinary demand, peaks, failures, and recovery rather than promise absolute security or universal superiority to card networks. Useful **Monetary Innovation** improves a defined service while acknowledging the operational limits and trade-offs. [6] [15]

Adoption matters for a **CBDC** intended for public use. Consumers, merchants, and intermediaries need reasons to participate and a service they can access. A **CBDC** should be tested with people who face practical barriers, and **Digital Currency Policy** should measure ongoing use rather than registrations alone. For **Central Banking**, communication and feedback belong alongside technical preparation. [1]

Establishing a Comprehensive Regulatory and Legal Framework

A framework for **Monetary Innovation** should specify authority, responsibilities, protections, and oversight. For **CBDCs**, appropriate **Financial Regulation** depends on the jurisdiction and intended product. Legal work on **CBDCs** should start during design, because changing a technical feature can alter users' rights and the obligations of service providers. [17]

The legal basis for a **CBDC** requires analysis of the issuer's mandate, the nature of the claim, settlement, and associated services. Legal-tender status is a separate question; issuing a **CBDC** does not automatically compel universal acceptance. Jurisdictions may need legislation or other changes, but the answer depends on existing law and the chosen design. [17]

Private participants in a **CBDC** ecosystem need clear rules on their permitted roles. Where **Blockchain Governance** is relevant, validation and administrative powers must be specified. A **CBDC** wallet provider may also need obligations covering data, security, complaints, and continuity. Clarifying the relationship between users, intermediaries, and the issuer of a **CBDC** helps establish accountability. [17]

Privacy and financial-integrity controls must be considered together for **CBDCs**. The framework should state what information is collected and who may access it. For a **CBDC**, encryption or privacy-enhancing tools do not by themselves establish lawful processing or eliminate fraud. The online and offline features of a **CBDC** may need different limits and compliance arrangements. [14] [9]

Cross-border **CBDC** arrangements need more than compatible software. Access, currency conversion, compliance, settlement finality, and dispute resolution may span different jurisdictions. A **CBDC** designed for domestic use will not automatically function

internationally. Joint international work emphasizes collaboration and interoperability with both other CBDCs and non-CBDC payment arrangements. [16]

An intermediated **CBDC** can assign customer-facing services to banks or other authorized providers while the central bank issues the money. This can use existing expertise, but does not prove that deposit substitution or bank-funding risks disappear. Evaluate the responsibilities and incentives of the specific model rather than treating a two-tier label as a financial-stability guarantee. [3] [13]

A regulatory approach to **Monetary Innovation** should accommodate change without leaving core rights uncertain. For **CBDCs**, officials can define stable objectives and accountability while reviewing technical choices through testing. Flexibility should include documented decisions and criteria for changing, delaying, or stopping a project rather than an assumption that issuance must proceed. [1]

Technological Underpinnings and Blockchain Governance: Laying the Foundation for Digital Trust

Technology choices should follow policy objectives. Questions about who may use the money, how payments are authorized, which data are visible, and how failures are handled influence the architecture. A laboratory result is useful evidence about a specific component; it is not certification of an entire national payment ecosystem. [6] [18]

A centralized database and a permissioned distributed ledger can both use multiple computers and redundant infrastructure. Neither arrangement automatically supplies privacy, immutability, or resilience. A **CBDC** project should explain its trust model and what the selected technology contributes. Project Hamilton, for example, found that a ledger distributed across different actors was not needed for its prototype objectives. [18]

Where a ledger is used, **Blockchain Governance** determines who operates nodes and who can change rules or resolve failures. A permissioned **CBDC** network restricts participation under defined arrangements; it is not necessarily free of a central authority or protected against every form of double spending. Governance and technical controls must be evaluated together. [6]

Interoperability concerns how systems and their rules work together. A **CBDC** may need connections to existing payment infrastructure, and cross-border access requires additional policy decisions. Shared message formats help, but legal and governance arrangements are also necessary. International work on **CBDCs** explicitly considers connections with non-CBDC payment systems. [16]

Claims about **scalability, speed, and resilience** need context. Project Hamilton's second experimental architecture processed 1.7 million transactions per second, with 99% durably completing in under a second. The Boston Fed explains that it did not use a distributed ledger among different actors and that this architecture did not retain transaction history in the core processor. This was a prototype result, not a complete deployed CBDC's performance. [18]

Protecting **cybersecurity and data integrity** requires attention to the entire **CBDC** ecosystem. Controls need to cover key management, software, operations, intermediaries, and user devices, with tested recovery procedures. Privacy requirements for a **CBDC** must also shape implementation; strong cryptography alone cannot prevent every operational failure or misuse of authorized access. [15]

Long-lived systems need **research and development in areas like quantum-resistant cryptography**. NIST finalized standards for key establishment and digital signatures in 2024. For **CBDCs**, migration requires engineering and operational planning, not a claim of permanent future-proofing. BIS Project Tourbillon explored quantum-safe blind signatures as part of experimental **CBDC** designs; a prototype does not establish

production readiness. [19] [20]

A **CBDC** architecture should plan for controlled updates and continuity. For a **CBDC** service, changes to software or rules need testing, authorization, and clear communication. **Monetary Innovation** does not remove operational duties: a **CBDC** must remain understandable to its users and accountable to its overseers as it evolves. [6]

Shaping the Future: Policy Directions and Global Cooperation

The discussion goes beyond **Blockchain Governance**. A credible **Digital Currency Policy** must connect the proposed instrument with public objectives. Claims of **Monetary Innovation** should be assessed alongside **Financial Regulation**, alternative ways to improve payments, and the costs of maintaining the chosen system over time.

A **Digital Currency Policy** roadmap should distinguish research, pilots, and issuance. The ECB moved to another phase in October 2025 with potential first issuance targeted for 2029, subject to legislation and a later decision. That is not a launched retail **CBDC**. Brazil's official Drex material describes testing rather than validating the article's former promised 2024 **CBDC** launch. A **CBDC** timeline should be reported as a documented status or conditional target, not an assurance. [4] [21]

Consultation should include people and institutions affected by a proposed **CBDC**. Ask banks, payment providers, merchants, consumers, and technical specialists to test assumptions about access and use. For a **CBDC**, feedback is useful only if it can influence requirements and decisions. Document how objections and findings change the proposal for a **CBDC** rather than presenting consultation as proof of acceptance.

International cooperation on **CBDCs** should focus on specific problems rather than assume that incompatible blocs are inevitable. Project mBridge is one multi-**CBDC**

experiment with documented milestones and changing project responsibilities. Evidence from such work can inform arrangements for **CBDCs**, but should not be treated as a universal standard already adopted by every country. [10] [11]

Different experiences with **CBDCs** can inform a local assessment without supplying a ready-made blueprint. The Sand Dollar's rollout addressed Bahamian payment-access objectives, while Swiss work tests settlement of tokenized assets. Each **CBDC** use case should be evaluated against its own objectives, eligible users, legal setting, and evidence of actual use. [8] [5]

For **Central Banking**, the question is whether a proposed instrument improves public outcomes after risks are considered. **CBDCs** may change bank funding and payment choices, and demand for **CBDCs** may rise in stress. Safeguards should be tested rather than presumed effective. Spending restrictions and interest are policy choices, not universal properties of digital sovereign money. [13] [12]

Lessons from **Cryptocurrency & Blockchain** can inform design without dictating it. A **Digital Currency Policy** should define evidence needed at each stage, retain essential protections, and allow revision when assumptions fail. Testing **CBDCs** can also establish that a different payment improvement would better meet the public objective.

The policy case for **CBDCs** should identify measurable goals, credible safeguards, and alternatives. **Monetary Innovation** is useful when it improves a defined service. Assessing **CBDCs** requires distinguishing a central-bank claim from the surrounding infrastructure and services. Neither launching **CBDCs** nor deciding against issuance guarantees success by itself; the test is whether the resulting payment arrangements serve public needs. A framework for **CBDCs** should make that assessment transparent.