>> AGENTIC-CBDC <<

[A CONCEPT PAPER]

Extending Euro CBDC to Public Blockchains
+ Autonomous Agents

> CBDC INTEROPERABILITY

Digital money system with multi-infrastructure.
How to make it interoperable with public blockchains?

[BIS FRAMEWORKS]

> Compatible CBDC systems

> Interlinked CBDC systems (hub-and-spoke, e.g. Project Icebreaker)

> Single multi-CBDC system (common platform, e.g. mBridge)

[REAL-WORLD PROJECTS]

> mBridge (BIS + China, Hong Kong, Thailand, UAE, Saudi Arabia)
Dedicated DLT platform for instant cross-border settlement

> Project Mariana (BIS + France, Singapore, Switzerland
Public blockchain + AMM for wCBDC exchange

> Project Dunbar (BIS + Australia, Malaysia, Singapore, South Africa)
Multi-CBDC platform prototypes

[KEY ENABLER] = common token standard + compliance bridge

> THE CORE CHALLENGES

> ECB Digital Euro (2029) = No permissionless blockchain
> But demand for Euro on-chain is increasing significantly:
> EURC market cap: $28M -> $350M (2024-2026)
> Autonomous economy with agents (ERC-8004) are coming.

[GAP] = A set of legal and technical orchestration lacks.

>>> THIS PAPER ASKS:

Can we pass through all stages in a compliant way?

From beginning (Euro CBDC issuance),
to the end (On-chain agentic economy).

> EXTENDED CONCEPT WITH MY RESEARCH

MY PhD RESEARCH: INTEROPERABILITY (cross-chain → efficient DeFi ecosystem)

▼

BLOCKCHAINS ↔ OFF-CHAIN SYSTEMS
(bridging the gap between DLTs and central bank infrastructure)

▼

THE EURO CBDC INTEGRATION PROBLEM

[STEP 1]
How to integrate Euro CBDC with public ledger (compliant + secure)

[STEP 2]
How to deploy it to on-chain autonomous agents (ERC-8004 etc.)

[STEP 3]
How agents interact in the on-chain agentic economy (Payments, DeFi protocols, etc.)

▼

FINAL STACK: Orchestrated, Compliant, Technically Capable Euro CBDC

[WRAPPED AGENTIC CBDC]

```
[ STAGE 1 ] ECB Infrastructure
      |
      v
[ STAGE 2 ] Compliance Bridge (eIDAS 2.0 + ZK-KYC)
      |
      v
[ STAGE 3 ] ZK-Validity Bridge -> wrapped Euro CBDC (wEUR) on EVM
      |
      v
[ STAGE 4 ] ERC-8004 Agent uses wEUR in DeFi
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GOAL: Euro value moves where agents live.

>> EVERY STAGE RELATED TO A LAW <<

> Issuance -> TFEU 128 (ECB sole issuer)
> On-ramp -> PSD2 + eIDAS 2.0
> Wrapping -> MiCA (wEUR = e-money token)
> Agent -> EU AI Act (high-risk AI if autonomous)
> ZK-KYC -> GDPR Art. 25 (data minimization via ZKP)

[CONCEPT CHECK] No orchestrated and unified legal and technical stack exists.

[PROBLEMS 1-3]

1. Compliance-preserving bridges
   - Most of the bridges transfer value, not regulatory state.
2. GDPR Art. 17 (right to erasure)
   - ZK proofs are permanent on-chain.
3. Agent liability
   - Who is accountable when an autonomous agent pays illegally?

[PROBLEMS 4-5]

4. ZK-ML feasibility
    - EU AI Act requires explainability.
    - Current zk-SNARKs for ML might be slow for the use case.

5. Monetary policy transmission
    - What happens when 1% of Euro supply lives in agent-run DeFi?
    - ECB cannot fully monitor dark liquidity.

[NO ORCHESTRATED SOLUTION YET,
TRYING FOR RESEARCH DIRECTIONS.]

>> CRITICISM <<

- ECB might not be cooperative to wrap the upcoming CBDC.

  Because the goal is to provide a direct link between the central bank and citizens.

  But private wrappers and concentrated collaterals might be in conflict with this goal.

- However, policies may change. We assumed a cooperative bridge (ECB provides hooks).

>> ROOM TO DEVELOP <<

- This is a concept discussion, not a solution.

- Value = framing the problem space +
  legal mapping + solution mapping

- Next step: Formalize bridge semantics with compliance invariants.

>> ROOM TO DEVELOP <<

[CURRENT STATE]

- This is a wrapped CBDC concept/pack/stack for agentic economy and agent usage.
- So, agentic dimension need to be specified more. Currently, underspecified.
- Missing: Threat models for on-chain agents operating for financial purposes, delegated agency, multi-agent collusion, AI unpredictability, etc.

[NEEDED]

- Investigating autonomous agent protocols, checking if they require a change in the technical and legal design.
- Supervision mechanism (human-in-the-loop for high-value txs).
- On-chain agent reputation slashing.

> PATH TO A REAL SOLUTION

Cryptographic:

- Post-quantum ZK proofs for KYC + ML

Legal:

- EU law guidance on agent liability under MiCA/AI Act

Economic:

- Modeling of CBDC leakage into agentic DeFi

Governance:

- Who runs the bridge? A consortium? ECB itself?

[ORCHESTRATED R&D REQUIRED - LAW, CRYPTOGRAPHY, FINANCE, COORDINATION]

[CONCLUSION]

DISCUSSED A CONCEPT - UNDERSPECIFIED

The euro stablecoin market proves demand.
On-chain agentic economy emerges.
Interoperability with multi-infra is required for fintech.

>> Next: Specify the underlined parts.
>> Next: Compete for funds, establish a team.
>> Next: Deploy a proactive concept.

[CONTRIBUTION] = A proactive map of where to dig.

>> KEY REFERENCES <<

1. ECB Digital Euro Closing Report (Oct 2025)
2. ERC-8004: Trustless Agents (Aug 2025)
3. MiCA Regulation (EU 2023/1114)
4. AEPD ZKP & GDPR Opinion (2020)
5. U. Bindseil, "Tiered CBDC and the financial system," ECB Working Paper Series, No. 2351, 2020.

Questions are welcome.

[THANK YOU]

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