Implications of blockchain in payment, clearing and settlement for central banks and regulators *

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* The views expressed are those of the author and do not necessarily reflect those of the ECB

Technological innovation as constant game changer

**Fintech:** innovation that could result in new business models or products with disruptive potential in the financial sector

![Diagram of blockchain and related technologies]
Distributed Ledger Technology

Distributed ledger technology (DLT) combines existing technologies (cryptography, distribution, consensus mechanisms) to enable shared use of a network and related processes with no technical need for a central entity.

Today

trusted parties operating centralised ledgers

Tomorrow?

distributed ledger with trust as a built-in feature

Terminology

- DLT
- Blockchain
- Bitcoin
- Consensus ledgers
- Smart contracts

<table>
<thead>
<tr>
<th>Restricted tiered networks</th>
<th>Restricted networks of equals</th>
<th>Unrestricted structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only identified and accountable entities use the DLT and can be assigned different roles (permissions)</td>
<td>Only identified and accountable entities use the DLT and can perform any role</td>
<td>Any (possibly unknown) entity uses the DLT and can perform any role</td>
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</table>
Impact on the financial sector

- **Virtual («crypto») currencies** were at the forefront of recent developments
  - Separation of **assets** (e.g. Bitcoin) and **technology** (e.g. Blockchain)
  - **Potential to induce change across the value chain**
    - Trading
    - Payments, clearing and settlement
    - Data and identity management as well as regulatory reporting
    - Holding of assets, record of ownership and asset services
  - **Monitoring by central banks and supervisory authorities**
    - Cf. recent reports of CPMI on innovations (2012), the role of non-banks (2014), and digital currencies (2015), as well as ECB on virtual currency schemes (2012, 2015) and distributed ledger technology in post-trading (2016)

Potential market adoption scenarios

- **Pressure on business models, risk management and supervision**
  - Challenges to the intermediary function of banks and financial market infrastructures
  - Market entry of new (unregulated) entities
  - **Possible scenarios:**
    (i) **individual market players** try to use DLT mainly to improve internal efficiency => happens already, limited impact
    (ii) blockchain based market solutions are offered by
      a) fintech startups **disintermediating** incumbents
      b) bigtech companies **crowding out** incumbents
      c) incumbent banks and infrastructures **cooperating** with fintech companies
      with whole market segments shifting to DLT
    (iii) a **peer-to-peer** world without intermediaries emerges => major impact, but unlikely to happen
Current key trends and observations

- Application of the technology mainly to **limited activities**, with recordkeeping and information sharing services more advanced than those involving asset transfers
- Experimenting with **tokenization** of assets is ongoing
- No use case in full production as **time is needed** to let the technology and its application to clearing and settlement processes mature
- Use cases based on **restricted, permissioned ledgers** with some use cases maintaining centralised control of the ledger
- Focused on **incremental improvements in post-trade processes** rather than substantial replacements of current market structures and practices
- Typically rely on existing infrastructures for settlement

Further evolution of DLT and blockchain

- **Re-intermediatisation**
  - Regulatory **compliance**
  - Control of access
- **Network effects**
  - Fragmentation vs. economies of scale
  - Technical standardisation, functional harmonisation of business rules and data sets
- **Process integration**
  - «Delivery vs. Payment»
  - Nexus to central bank money
- **Fundamental unresolved issues**
  - Legal basis
  - Regulatory compliance, governance
Selected governance, regulatory and legal aspects

- **Governance**
  - Setting or changing the rules/protocols
  - Control of access
  - Responsibility for the operational design and risk management

- **Regulatory compliance**
  - KYC duties, money laundering and terrorist financing
  - Consumer protection, data secrecy and privacy rules

- **Legal issues**
  - Nature of digitised assets, the legal status of the ledger and of its “rules”
  - Identification and authentication of users/parties to a transaction
  - Finality of the records/balances on a DLT/blockchain
  - Liability for operational vulnerabilities (cyber resilience, protocol control, etc.), losses, fraud or theft
  - Applicable law, jurisdiction and enforceability

Impact on regulatory authorities

⇒ **Existing legislation and regulation may be affected**
  - requirements to use specific types of FMs and access points (eg banks)
  - operational and prudential requirements for regulated entities

⇒ **Regulatory responses** are driven by a variety of motivations
  (eg consumer protection, prudential or market organisation rules), consequently the tools used vary:
  - information/moral suasion (eg warnings)
  - prohibition (for certain types of entities or instruments)
  - regulation of specific entities (eg wallet providers, exchange platforms)
  - interpretation of existing regulations (eg taxation)
  - accommodation (eg sandboxes)

⇒ **Regulators to adapt own frameworks** for data access and reporting («RegTech»)
Implications for central banks

Operational role
- assessing potential of digital innovations for efficient and safe central bank infrastructure services for payments and securities settlement
- assessing impact on monetary operations and central bank money issuance

Catalyst role
- facilitating private sector efforts to improve market efficiency
- promoting work on standardisation and interoperability, countering the risk of silos and proprietary solutions

Oversight, supervisory and financial stability role
- assessing possible impact of technology adoption on overseen/supervised entities and their business models and the financial markets at large
- adapting central bank frameworks for data collection and handling

Involvement of regulatory standard-setting bodies

- Global sectoral and cross-sectoral analysis and evaluation
  - monitoring developments and evolution of digital schemes
  - impact on services and financial institutions
  - security and operational (cyber) resilience of products and services
  - relevance for AML/TF
  - legal aspects
  - impact on financial intermediation
  - relevance for financial inclusion
  - wider impact on financial stability

- Assessment of need for global regulatory guidance (risk-based approach)

- Information sharing and coordination between global standard-setting bodies (BCBS, CGFS/MC, CPMI, FSB, IAIS and IOSCO)
CPMI analytical framework (February 2017)

- DLT and its **component parts**

  - Technical design elements
    - Maintaining information on the ledger (transaction history, account balances, tokens, other elements)
    - Updating the ledger (validation, consensus, roles of nodes)
    - Process flow

  - Institutional design elements
    - Governance of the ledger
    - Access to the arrangement (unrestricted or restricted)

- Potential configurations and trade-offs

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CPMI analytical framework (February 2017)

- Guidance on **understanding the arrangement**
  - Functionality and nature of the arrangement
  - Key factors for an effective implementation

- Potential implications for **efficiency, safety and the broader financial markets**

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<th>Safety</th>
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<td>Speed of end-to-end settlement</td>
<td>Operational and security risk</td>
</tr>
<tr>
<td>Costs of processing</td>
<td>Settlement issues</td>
</tr>
<tr>
<td>Reconciliation (speed, transparency)</td>
<td>Legal risk</td>
</tr>
<tr>
<td>Credit and liquidity management</td>
<td>Governance</td>
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<tr>
<td>Automated contract tools</td>
<td>Data management and protection</td>
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**Broader financial market implications**

- Connectivity issues and standards development
- Financial market architecture (actors, markets, regulators)
- Broader financial market risks (micro- and macro-level)