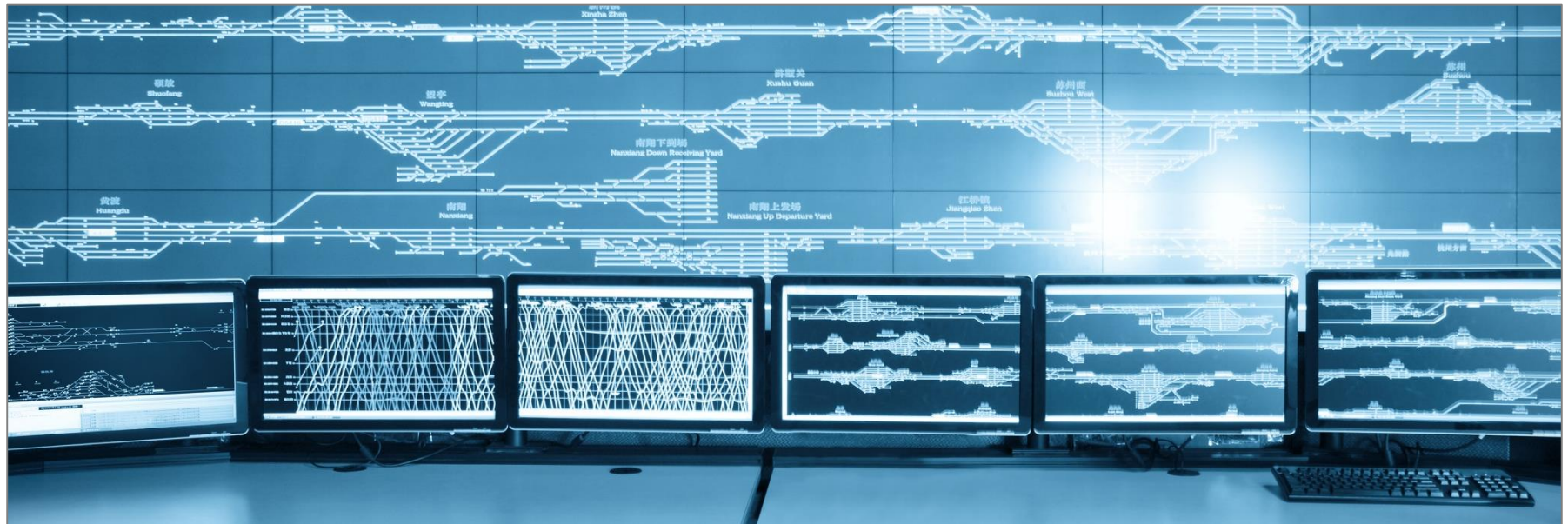


The future of financial infrastructure

An ambitious look at how blockchain can reshape financial services



An Industry Project of the Financial Services Community | Prepared in collaboration with Deloitte

Part of the Future of Financial Services Series • August 2016

Foreword

Consistent with the World Economic Forum’s mission of applying a multistakeholder approach to address issues of global impact, creating this report involved extensive outreach and dialogue with the Financial Services Community, Innovation Community, Technology Community, academia and the public sector. The dialogue included numerous interviews and interactive sessions to discuss the insights and opportunities for collaborative action.

Sincere thanks to the industry and subject matter experts who contributed unique insights to this report. In particular, the members of this Financial Services Community project’s Steering Committee and Working Group, who are introduced in the Acknowledgements section, played an invaluable role as experts and patient mentors.

We are also very grateful to Deloitte Consulting LLP in the US, an entity within the Deloitte¹ network, for its generous commitment and support in its capacity as the official professional services adviser to the World Economic Forum for this project.

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The Distributed Ledger Technology project is the most recent phase of the Forum's ongoing Disruptive Innovation in Financial Services work

2015

THE FUTURE OF FINANCIAL SERVICES

The Future of Financial Services project explored the landscape of disruptive innovations in financial services, provided the first consolidated taxonomy for these disruptions, and explored their potential impacts on the structure of the industry



2016

BEYOND THE FUTURE OF FINANCIAL SERVICES

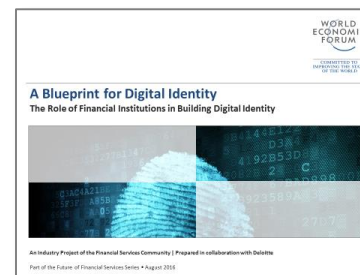
This phase of the disruptive innovation work explores two topics with key potential as foundational enablers of future disruption

The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services



This project explores the potential for distributed ledger technology to transform the infrastructure of the financial services industry

A Blueprint for Digital Identity: The Role of Financial Institutions in building Digital Identity



This project explores the potential for digital identity in financial services and beyond and lays out a blueprint for the implementation of effective digital identity systems

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Section 1

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Project team and core team

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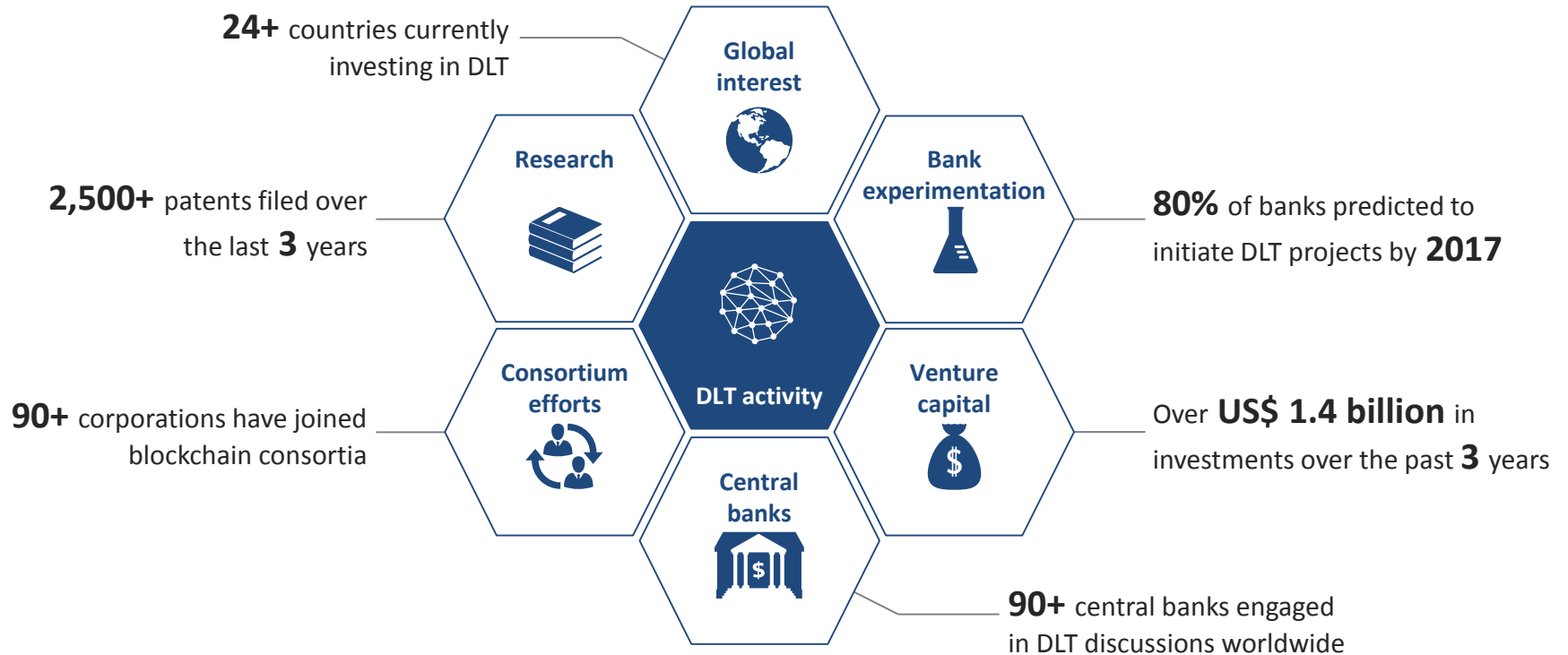
Section 2

Executive Summary

Section 2.1

Context and Approach

Distributed ledger technology (DLT), more commonly called “blockchain”, has captured the imaginations, and wallets, of the financial services ecosystem



Awareness of DLT has grown rapidly, but significant hurdles remain to large-scale implementation



An uncertain and unharmonized regulatory environment

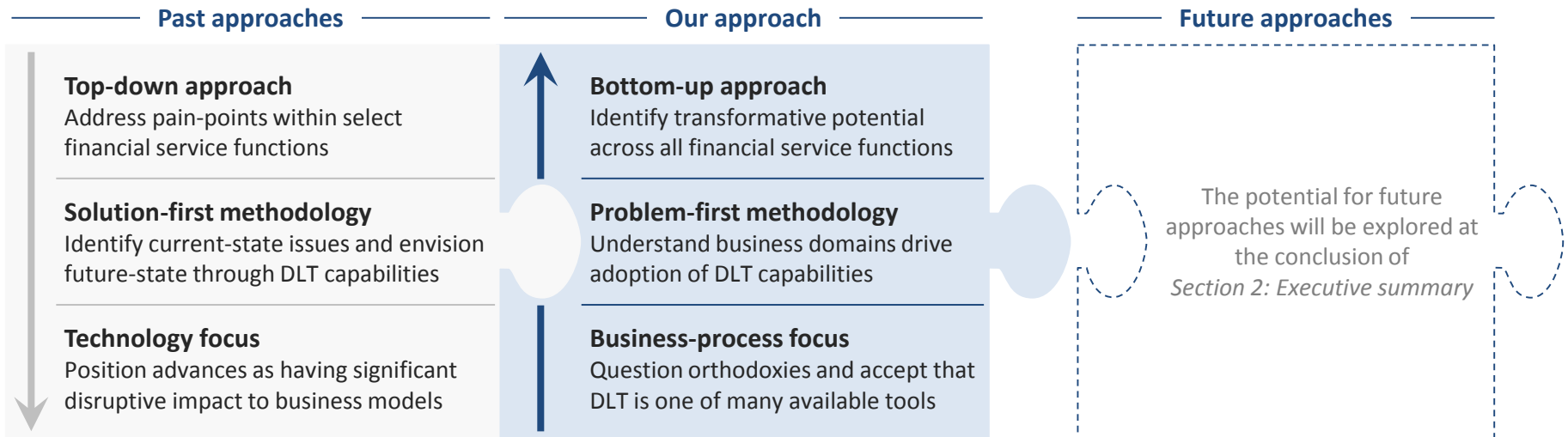


Nascent collective standardization efforts



An absence of formal legal frameworks

This report aims to complement existing distributed ledger technology research by providing a clear view into how financial service functions can be reimagined



Important elements covered within this report

- This report presents nine use cases that highlight potential applications, which participants can utilize to assess feasibility
- This business process-level analyses articulate how to:
 - Overcome current-state pain points through DLT
 - Drive dialogue around key critical conditions
 - Provide basis for quantitative analyses to be conducted
- This report identifies financial service orthodoxies that may be called into question through distributed ledger technology

Important elements *not* covered within this report

- This report does not cover real-economy applications
- This report does not explore applications outside of financial economies and their potential to foster financial inclusion
- This report does not evaluate the setup and transition costs associated with a distributed ledger technology implementation
- This report does not predict implementation and technical considerations

NOTE: Please reference *Section 3: Use case deep-dive approach* to learn more about our underlying focus and assumptions across our analysis.

This analysis was based on over 12 months of research, engaging industry leaders and subject matter experts through interviews and multistakeholder workshops

Received guidance from thought leaders across global financial institutions



Conducted interviews and solicited input from subject matter experts



Engaged leaders in academia, government and regulation



Global workshops

Five multistakeholder workshops at global financial hubs, with 200+ total participants, including industry leaders, innovators, subject matter experts and regulators



Singapore
Oct. 2015



New York, USA
Nov. 2015



London, UK
Dec. 2015



Davos, Switzerland
Jan. 2016



Sydney, Australia
Apr. 2016



Section 2.2

Key Findings

The World Economic Forum's analysis has yielded six key findings regarding the implications of distributed ledger technology (DLT) on the future of financial services

Key findings

- 1 DLT has **great potential to drive simplicity and efficiency** through the establishment of new financial services infrastructure and processes
- 2 DLT is **not a panacea**; instead it should be viewed as **one of many technologies** that will form the foundation of **next-generation** financial services **infrastructure**
- 3 Applications of DLT will **differ by use case**, each **leveraging the technology in different ways** for a diverse range of benefits
- 4 **Digital Identity** is a **critical enabler** to broaden applications to new verticals; **Digital Fiat (legal tender)**, along with other emerging capabilities, has the ability to **amplify benefits**
- 5 The most impactful DLT applications will require **deep collaboration between incumbents, innovators and regulators**, adding complexity and **delaying implementation**
- 6 New financial services infrastructure built on DLT will **redraw processes** and **call into question orthodoxies** that are foundational to today's business models

These key findings are explored in depth in the following pages, based on the use case deep-dives conducted across financial services.

Distributed ledger technology has great potential to drive simplicity and efficiency through the establishment of new financial services infrastructure and processes

The following six key value drivers for DLT were identified through the in-depth examination of nine use cases from across financial services.

Value drivers

1



Operational simplification

DLT reduces / eliminates manual efforts required to perform reconciliation and resolve disputes

2



Regulatory efficiency improvement

DLT enables real-time monitoring of financial activity between regulators and regulated entities

3



Counterparty risk reduction

DLT challenges the need to trust counterparties to fulfil obligations as agreements are codified and executed in a shared, immutable environment

4



Clearing and settlement time reduction

DLT disintermediates third parties that support transaction verification / validation and accelerates settlement

5



Liquidity and capital improvement

DLT reduces locked-in capital and provides transparency into sourcing liquidity for assets

6

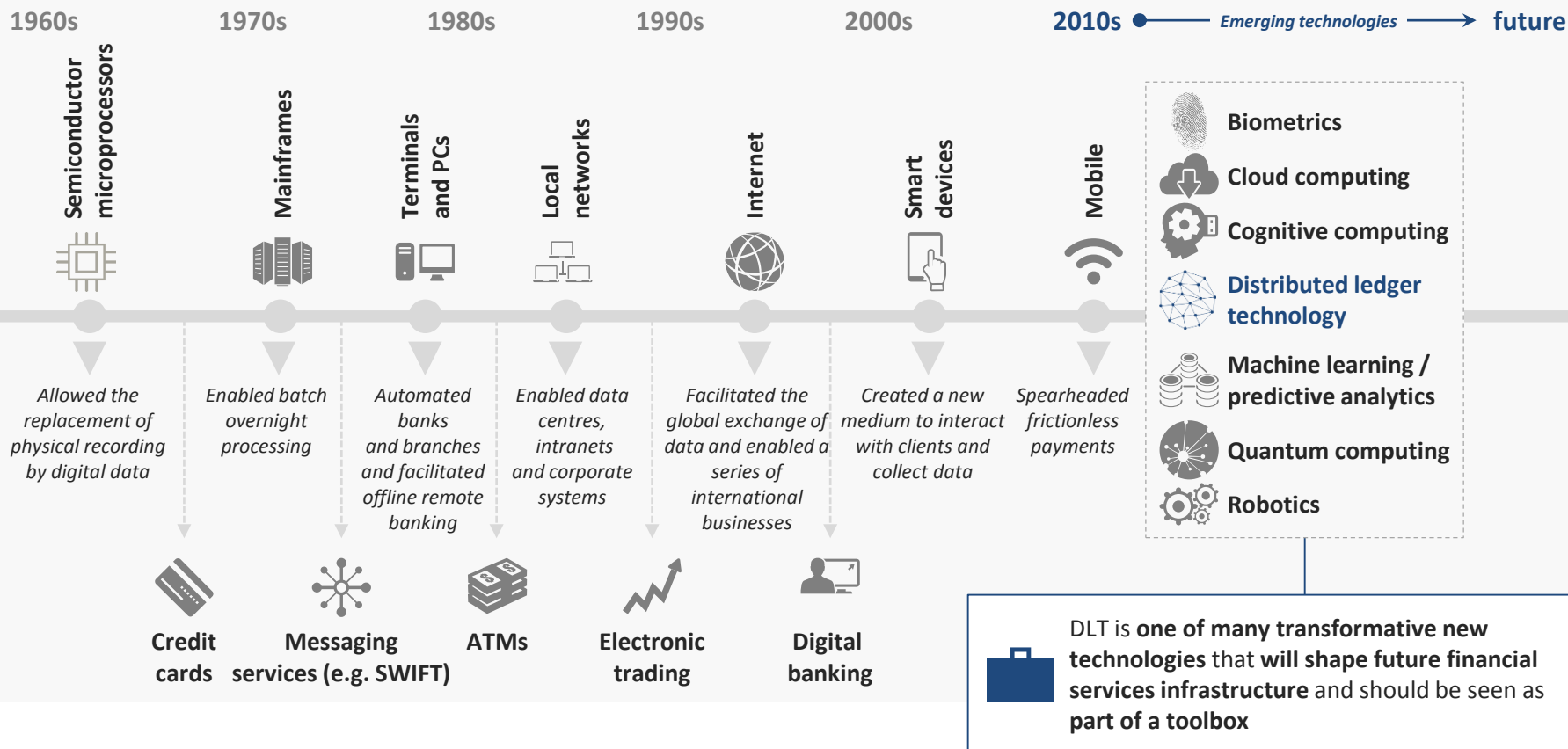


Fraud minimization

DLT enables asset provenance and full transaction history to be established within a single source of truth





Distributed ledger technology is not a panacea; instead it should be viewed as one of many technologies that will form the foundation of next-generation financial services infrastructure

Over the last 50 years, technology innovation has been fundamental to financial services industry transformation. Today, multiple technologies poised to drive the next wave of financial services innovation are converging in maturity.






Applications of distributed ledger technology will differ by use case, each leveraging the technology in different ways for a diverse range of benefits

Examples of DLT value drivers and benefits

| Use case | Value driver | Benefits |
|-----------------------|--|---|
| Trade finance |  Operational simplification | Enables real-time multi-party tracking and management of letters of credit, and enables faster automated settlement |
| Automated compliance |  Regulatory efficiency improvement | Provides faster and more accurate reporting by automating compliance processes that draw on immutable data sources |
| Global payments |  Settlement time reduction | Enables the near real-time point-to-point transfer of funds between financial institutions (FIs), removing friction and accelerating settlement |
| Asset rehypothecation |  Liquidity and capital improvement | Provides market participants with an improved line of sight into assets, enabling improved risk evaluation and decision-making |

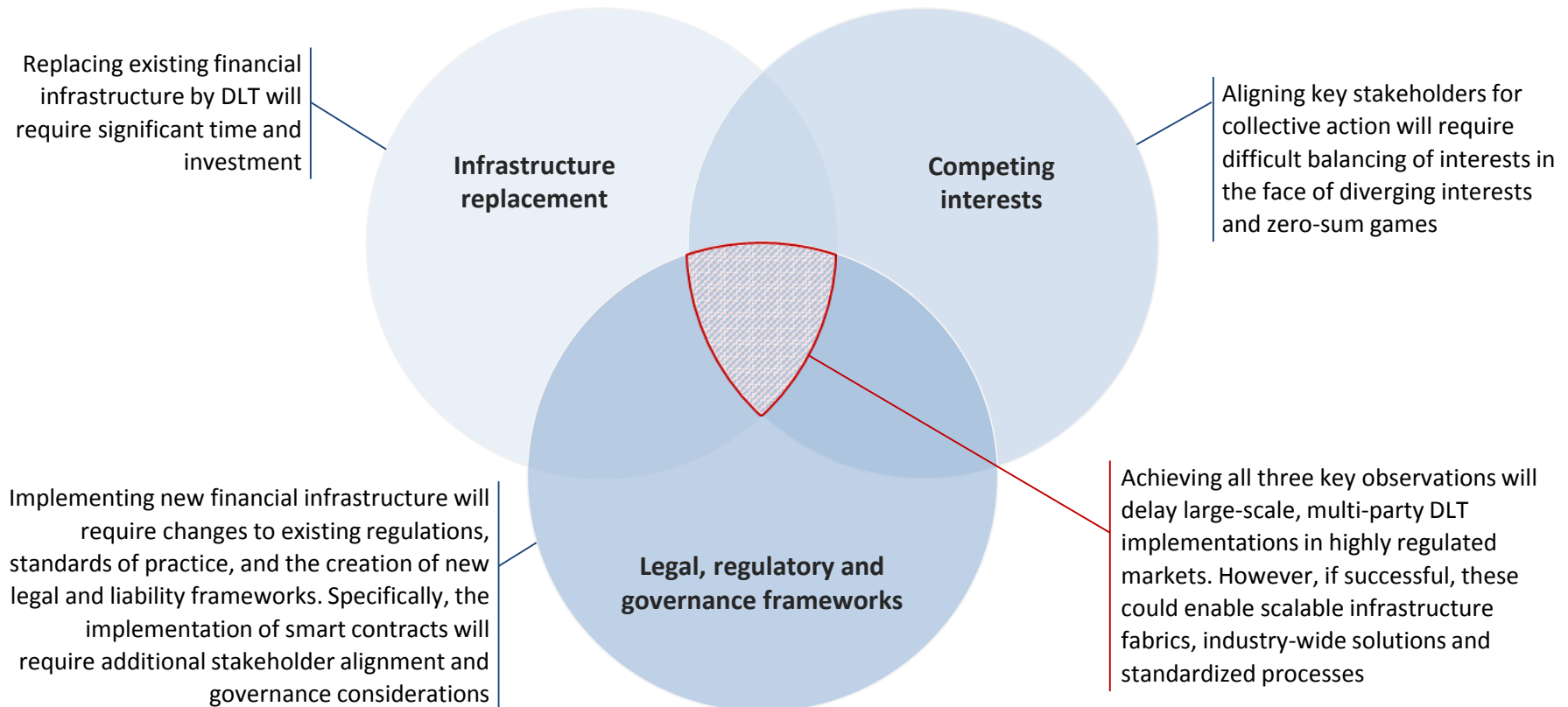
Digital Identity is a critical enabler to broaden applications to new verticals; Digital Fiat (legal tender), along with other emerging capabilities, has the ability to amplify benefits

| |  Digital identity |  Digital fiat |  Future innovations |
|--------------------|--|---|--|
| Current state | Correct identity information is critical to ensuring financial transactions are accurate and compliant – but integrating physical identity protocols with DLT creates frictions and increases the potential for errors | DLT systems are frequently denominated with tokens that are native to the system – but users of formal financial infrastructure will demand high levels of liquidity between assets on the system and fiat currency | The advent of the fourth industrial revolution is rapidly altering the financial system and broader economy through the exponential acceleration of innovation |
| Capability enabler | A fully digital system for storing and transferring identity attributes could be directly integrated into distributed financial infrastructure | Distributed fiat currencies issued by central banks could be employed within distributed financial infrastructure, ensuring the availability of liquidity even in the event of systemic instability | Opportunities for integration may emerge between distributed financial infrastructure and a range of innovations, such as artificial intelligence or the rapidly evolving internet of things |
| Future benefits | <ul style="list-style-type: none"> • Faster and accurate anti-money laundering (AML) and know-your-client (KYC) processes • Seamless customer onboarding • Improved counterparty matching | <ul style="list-style-type: none"> • Settlement to liquid cash-equivalent tokens issued by a central bank • Elimination of the need for an inefficient bridge between cash and new financial infrastructure | <p style="text-align: center;">?</p> <p style="text-align: center;"><i>The potential benefits of these integrations are highly uncertain</i></p> |

The most impactful DLT applications will require deep collaboration between incumbents, innovators and regulators, adding complexity and delaying implementation







Updating financial infrastructure through DLT will require significant time and investment. Three key observations must be taken into consideration for this implementation to be successful.

Key observations and insights



New financial services infrastructure built on DLT will redraw processes and call into question orthodoxies that are foundational to today's business models

Assumptions that are central to today's financial business models will be impacted both intentionally and unintentionally by the shift to distributed financial infrastructure, requiring incumbents to adjust their business practices in response.

| Current-state assumptions | Transformative characteristics of distributed infrastructure | Implications for market participants within financial services | |
|---|--|--|--|
| <p>Information silos drive the need for detailed reconciliation activities</p> <p>Lack of a single version of the truth and audit trails creates arbitrage concerns</p> | <p>a) immutability</p> |  <p>Eliminates need for reconciliation</p> |  <p>Provides historical single version of the truth</p> |
| <p>Asymmetric information between market participants drives the proliferation of central authorities</p> <p>Lack of transparency increases regulations on FIs</p> | <p>b) transparency</p> |  <p>Eliminates imbalance of information among market participants</p> |  <p>Increases cooperation between regulators and regulated entities</p> |
| <p>Lack of trust between counterparties creates the need for central authority oversight in contract execution</p> | <p>c) autonomy</p> |  <p>Ensures agreements are executed to agreed upon business outcomes</p> |  <p>Disintermediates supporting entities established to resolve disputes</p> |

Distributed ledger technology will question the need for individual books of record through immutable and distributed record-keeping

DLT provides transaction immutability, which is a key requirement for eliminating the need for an enforcer of trust in the ecosystem. Tamper-proof distributed data enables an environment in which trust is not an issue and allows counterparties to operate with a single version of the truth.

Current state



Traditionally, asset and transaction information was stored within physical books to independently reference previous actions internally and externally. As technologies advanced, physical books were translated into digital ledgers



Today, every FI maintains its own digital “book of record” repository



As a result, central intermediaries proliferate in the industry, providing unbiased reconciliation services to facilitate transactions between counterparties without requiring them to trust each other. For transactions executed internal to the organization, reconciliation is performed within lines of businesses

DLT transformative potential



At its core, DLT is a growing repository of transactions organized in chronological blocks where the technology intrinsically makes changes to previous transactions functionally impossible



DLT has been designed to replicate data among participating nodes in real time, ensuring all parties operate off of a single version of the truth at all times

Financial services implications



Challenges **information silos** between market participants and eliminates the need for **inter-firm reconciliation**



Disintermediates **central intermediaries** and reduces the fear of **arbitrage** within the ecosystem



Enables **audit trails** to be established for assets and transactions with a significant **reduction in disputes**

Distributed ledger technology will significantly increase transparency between market participants

Infrastructure must be capable of sharing information among all market participants. DLT builds upon a single version of the truth to provide transparency for historical and real-time transactions.

Current state



The age and fragmentation of large parts of existing financial infrastructure have placed limits on the degree of transparency these systems are able to offer, creating opportunities for information asymmetry



As a result, some actors within the ecosystem have gained competitive advantages through the imbalance of information



While some entities profit from this state of information, others experience suboptimal performance and spend excessive resources on risk hedging and liquidity guarantees

DLT transformative potential



The “default setting” of DLT is to provide full transparency into transactions



DLT has the potential to transform existing notions of private records, in which transaction details are only known to counterparties



DLT can promote the creation of a public record of activity in the ecosystem to which all market participants have access in real time

Financial services implications



Challenges existing **competitive advantage models** that leverage information asymmetry



Reduces the role of supporting entities (e.g. insurers) that profit from opacity within the ecosystem



Promotes discourse in the ecosystem where transparency best serves market participants vs where opacity is needed (e.g. secure personally identifiable information data)

Distributed ledger technology will have implications for the cost of leverage by reducing information asymmetry between borrowers and lenders

DLT enables improved visibility into the ways in which assets are being employed through the tokenization of assets and a public record of transactions.

Current state



In a wide variety of transactions types, FIs may loan or pledge assets to provide or receive access to credit; however, limited visibility exists into how many times an asset has been loaned or pledged



This limited line-of-sight into liens against an asset enables that asset to be used to secure multiple debts by the borrowers, often in excess of nominal asset value



This opacity causes lenders to rely upon reputational factors and assessments by supporting entities such as rating agencies

DLT transformative potential



DLT can tokenize individual assets (e.g. property and bonds) on a shared and trusted ledger to establish provenance



DLT can provide visibility into assets and associated liabilities based on transactional history while increasing the efficiency of credit transactions

Financial services implications



Promotes visibility of assets and associated liens/ownerships to **quantify risk** and **increase pricing accuracy**



Reduces access to capital for borrowers by limiting the ability to use the same asset to secure leverage from multiple parties





Challenges the role of rating entities in quantifying risks


Distributed ledger technology will transform the relationship between regulators and regulated entities, reducing frictions and improving outcomes

Transactional data must provide granularity and accuracy to regulators in order to monitor and comply with regulatory obligations. DLT facilitates transparency between regulators and regulated entities through a shared repository with real-time access to data.


Current state


 Regulated entities and regulators are increasingly challenged to support information requirements to certify compliance


 While regulated entities are committed to enable transparency, significant costs and risks are associated with current systems and business processes

 As complexity within the ecosystem and financial instruments increases, the trade-off between transparency and cost becomes a balancing act

DLT transformative potential

 DLT can become a shared data repository between regulators and regulated entities, breaking down organizational silos

 DLT has the potential to allow subsets of transactional data to be effortlessly shared with regulators in real-time

 DLT can facilitate 'regulatory-inclusive' business models, in which regulators utilize smart contracts to verify transactions / deals in real-time

Financial services implications

Transforms compliance from post-transaction monitoring to **on-demand and immediate monitoring**



Improves **capability of regulators** to fulfil their mandate of ensuring the legality, security and stability of financial markets

Improves efficiency for regulators to monitor trading venues such as **over-the-counter markets and dark pools**



Reduces regulatory compliance costs significantly

Distributed ledger technology will reduce the need for intermediaries by providing autonomous execution capabilities

Financial agreements are enforced via a complex set of business rules and processes to ensure obligations are fulfilled by counterparties. DLT provides the ability to autonomously execute these conditions in a shared and trusted environment.

Current state



All transactions involving at least two market participants are governed by agreements that highlight business outcomes based on obligations that must be met by each counterparty



The responsibility for ensuring these agreements are enforcements dependent on legal and regulatory frameworks



As a result, the complexity of these agreements has given rise to intermediaries that mediate disputes between parties and resolve deviations within agreed upon outcomes

DLT transformative potential



DLT can codify financial agreements in a shared platform and guarantee execution based on mutually agreed conditions, limiting unilateral counterparty actions



DLT can eliminate the manual effort required to support the execution of financial agreements and can accelerate business outcomes

Financial services implications

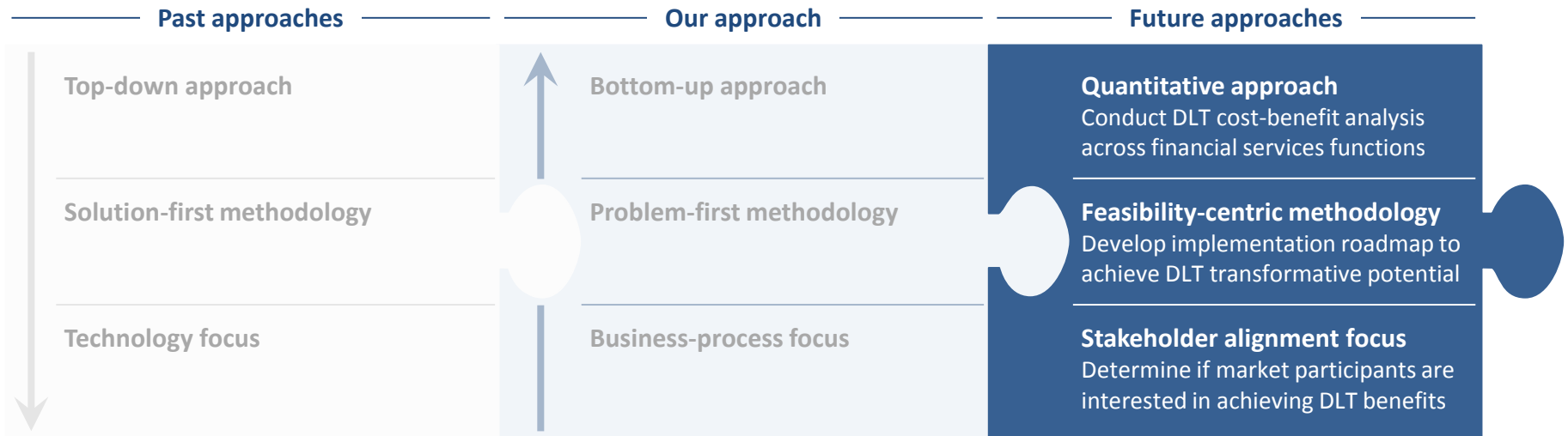


Reduces counterparty risk due to the reduced need to trust counterparties' willingness or ability to fulfil obligations



Disintermediates entities that currently mediate disputes and resolve business outcomes

Additional research remains to assess distributed ledger technology feasibility, quantify benefits and analyze implementation details



Important questions to be answered moving forward

- Cost-benefit analyses need to be conducted to determine the financial viability of distributed ledger technology
- Roadmaps need to be developed to achieve market participant collaboration and establish standards
- Governance models, backed by societal-level discussions, need to be envisioned to support technology accountability
- Regulatory, legal and jurisdictional-specific tax frameworks need to be established and well-understood

To conclude our executive summary, the following page will expand on our approach and help navigate across our use case deep-dives.

NOTE: Please reference *Section 3: Use case deep-dive approach* to learn more about our underlying focus and assumptions across our analysis.

This report provides comprehensive, business-process-level views of distributed ledger technology implementations within each financial services function

This report's detailed findings are designed to be consumed according to business affinity and interest. The table below shows the location of each use case, which can be read independently of each other.

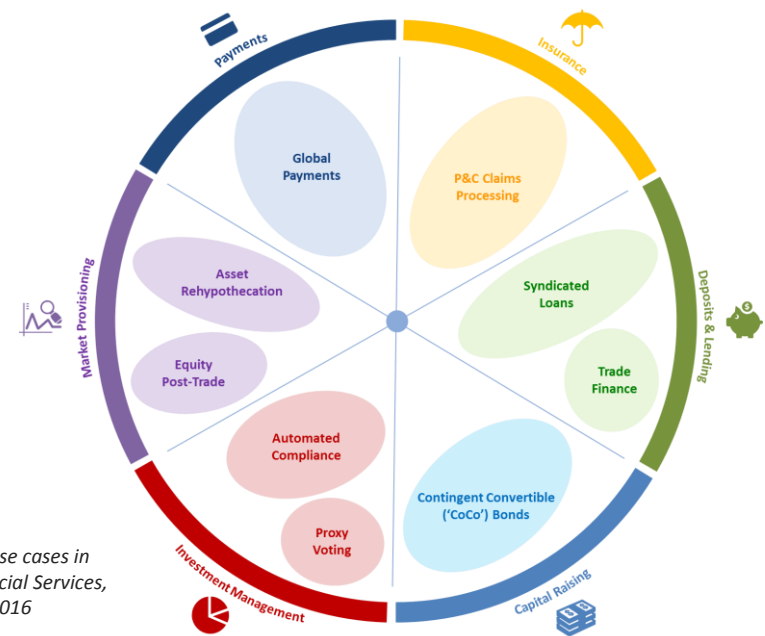
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|-----------------|--|------------------------------|-----|-----------------------|-----|------------------|----|---------------|----|------------------------------|----|----------------------|----|--------------|-----|-----------------------|-----|-------------------|-----|
| 1 | <p>Context and Approach</p> <p>An overview of current global DLT activity and the analysis methodology</p> | | | | | | | | | | | | | | | | | | |
| 2 | <p>Executive Summary</p> <p>A summary of the use case deep-dives through six key findings</p> | | | | | | | | | | | | | | | | | | |
| 3 | <p>Use Case Deep-Dive Approach</p> <p>An introduction of selected use cases, the analysis structure and high-potential use case characteristics</p> | | | | | | | | | | | | | | | | | | |
| 4 | <p>Use Case Deep-Dive Summaries</p> <p>A summary of the key findings of each use case organized by financial services function</p> | | | | | | | | | | | | | | | | | | |
| 5 | <p>Use Case Deep-Dive Modules</p> <p>Nine business-process-level analyses of a use case's current state and transformed future state enabled by DLT Each use case can be read individually according to the table below:</p> <table border="1"> <tr> <td>Global Payments</td> <td>46</td> <td>P&C Claims Processing</td> <td>56</td> <td>Syndicated Loans</td> <td>65</td> </tr> <tr> <td>Trade Finance</td> <td>74</td> <td>Contingent Convertible Bonds</td> <td>83</td> <td>Automated Compliance</td> <td>92</td> </tr> <tr> <td>Proxy Voting</td> <td>101</td> <td>Asset Rehypothecation</td> <td>110</td> <td>Equity Post-Trade</td> <td>119</td> </tr> </table> | Global Payments | 46 | P&C Claims Processing | 56 | Syndicated Loans | 65 | Trade Finance | 74 | Contingent Convertible Bonds | 83 | Automated Compliance | 92 | Proxy Voting | 101 | Asset Rehypothecation | 110 | Equity Post-Trade | 119 |
| Global Payments | 46 | P&C Claims Processing | 56 | Syndicated Loans | 65 | | | | | | | | | | | | | | |
| Trade Finance | 74 | Contingent Convertible Bonds | 83 | Automated Compliance | 92 | | | | | | | | | | | | | | |
| Proxy Voting | 101 | Asset Rehypothecation | 110 | Equity Post-Trade | 119 | | | | | | | | | | | | | | |

Section 3

Use Case Deep-Dive Approach

Use cases for this report were identified across each function within financial services

Leveraging the financial services innovation taxonomy within the World Economic Forum's *The Future of Financial Services* 2015 report, the implementation of DLT is considered across each function of financial services.



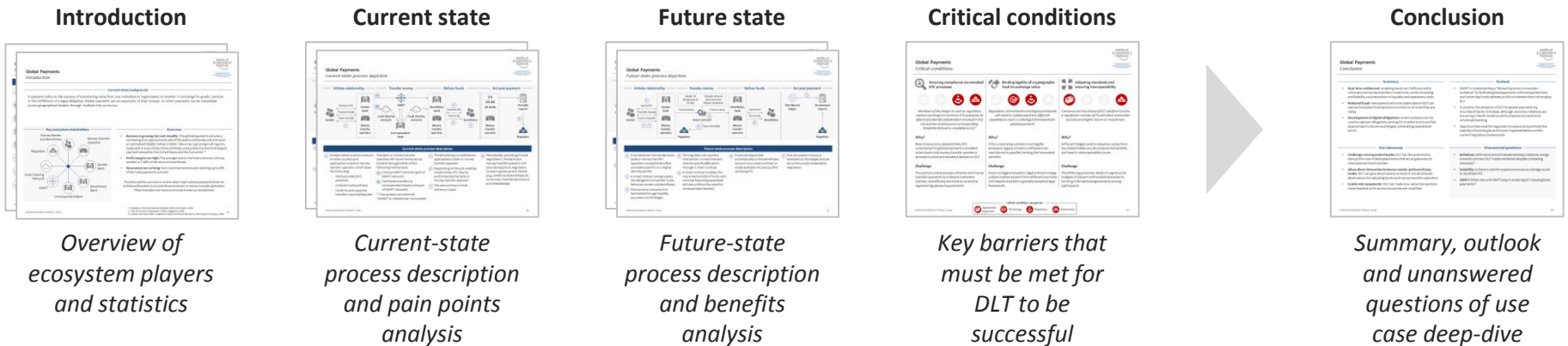
Use case portfolio selection criteria

1. Representation of DLT implementations across various asset classes across multiple subsectors
2. Demonstration of scenarios where DLT must be implemented in a networked or single entity environment
3. Consideration of implementations that could be justified both on financial and non-financial/strategic grounds

Use case deep-dives were conducted and summarized in a standardized format

Use case deep-dives that follow a standardized format were conducted to strike a balance between the possible and practical in order to consider how the structure of financial services might be transformed by DLT.

Use case deep-dive structure







The goals

- 1 Educate the community on the key DLT value drivers through business-process-level use cases
- 2 Highlight key conditions that must be met to implement new, distributed financial services infrastructure
- 3 Support existing conversations to implement DLT and initiate new discussions elsewhere

Throughout the use case deep-dives, a **broad set of assumptions regarding DLT had to be developed.**

Each use case deep-dive maintained a consistent focus and set of assumptions

Our focus

- Understanding the direct impacts that DLT can have at the business-process level on FIs and other market participants
- Analysing use cases that are broadly applicable in global financial markets, occasionally utilizing US regulations as reference points
- Identifying critical conditions for the successful implementation of DLT across the following four categories:
 -  **Stakeholder alignment:** achievement of shared benefits
 -  **Regulatory:** compliance-related requirements
 -  **Technology:** implementation dependencies
 -  **Governance:** administration and liability oversight

Our assumptions

1. We assume that enabling capabilities (e.g. digital identity) are available to be incorporated, in conjunction with distributed ledger technology, to meet each use case's goals securely and effectively
2. We assume that distributed ledger solutions implemented in the near future will be scalable to meet volume requirements (including, in some cases, billions of transactions)
3. We assume data sources that are accessible by distributed ledgers and/or facilitate autonomy cannot be compromised
4. We understand that benefits realized will be contingent on specific business models for each FI and jurisdictional uniqueness

A note on security considerations

Similar to any technological innovation, DLT comes with a set of risks that must be considered:

1. Ensuring that distributed ledgers are secure and safeguarded against errors is paramount to the long-term success of the technology and should not be treated the same as fundamentally questioning the strength of the protocol
2. While smart contracts enable autonomous agreement execution between parties, they rely on architects and security experts to build business rules that prevent malicious behaviour, complete thorough end-to-end testing and verify all code
3. Meticulous IT controls must be in place to detect potential gaps in security across all the inputs, components and outputs of DLT

Through the deep-dives, a number of characteristics were discovered that should be utilized to identify other high-potential use cases in financial services

Through the examination of nine use cases, a set of common characteristics were identified that appeared to be shared by high-potential applications of DLT

Characteristics of high-potential use cases

Example


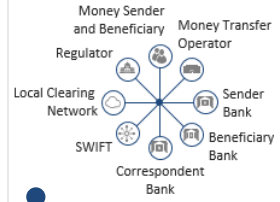
| | | |
|--|---|--|
| | Shared repository A shared repository of information is used by multiple parties | <i>Ledger that stores financial assets in which an owner and owned assets are tracked and shared with other internal/external parties (e.g. regulators and other geographical units)</i> |
| | Multiple writers More than one entity generates transactions that require modifications to the shared repository | <i>Payments system collectively managed and maintained by a small group of banks, but each bank has millions of end users transacting with their bank</i> |
| | Minimal trust A level of mistrust exists between entities that generate transactions | <i>Multiple parties within a trade finance arrangement (e.g. importer, exporter, issuing bank, receiving bank, correspondent banks and customs) that do not “trust” each other and, therefore, institute layers of verification and impose collateral requirements</i> |
| | Intermediaries One (or multiple) intermediary or a central gatekeeper is present to enforce trust | <i>Removing and/or reducing the importance of a central intermediary, whose primary role is to provide “trust” to the post-trade ecosystem</i> |
| | Transaction dependencies Interaction or dependency between transactions is created by different entities | <i>A situation in which Alice needs to send funds to Bob, then Bob needs to send funds to Charlie. Bob’s transaction is dependent on Alice’s transaction, and one cannot verify Bob’s transaction without checking Alice’s first</i> |

Section 4

Use Case Deep-Dive Summaries

Reading guide

This section provides a summary of the findings, divided by function and DLT use cases within the function. For each use case, the key players and impact are summarized, the critical conditions to be successful are identified and the possible outcomes are examined.

| | |
|---|--|
| <p><i>Function grouping</i></p> |  <p>Use cases Payments</p> |
| <p><i>DLT use case name</i></p> | <p>Global Payments</p> |
| <p><i>High-level summary of potential DLT benefits</i></p> | <p>Summary</p> <p>Conducting international money transfers through DLT could provide real-time settlement and reduce costs, enabling new business models (e.g. micropayments), and institute newer models of regulatory oversight</p>  |
| <p><i>Key stakeholders involved within use case</i></p> | <p>Implications for FIs</p> <ul style="list-style-type: none"> • Real-time settlement of international money transfers can increase profitability by reducing liquidity and operational costs • Utilizing DLT will enable direct interaction between sender and beneficiary banks, and eliminate the role of correspondents • Smart contracts can capture obligations and drive reporting, minimizing operational errors and accelerating outcomes |
| <p><i>Predicted financial services outcomes if DLT is successfully implemented</i></p> | <p>Critical conditions for implementation</p> <ul style="list-style-type: none"> • Ensuring compliance via standard KYC processes • Binding legality of cryptographic hash to exchange value • Adopting standards and ensuring interoperability |
| <p><i>Identified conditions that must be met for DLT to achieve determined benefits</i></p> | <p>WORLD ECONOMIC FORUM 2016</p> <p>39</p> |

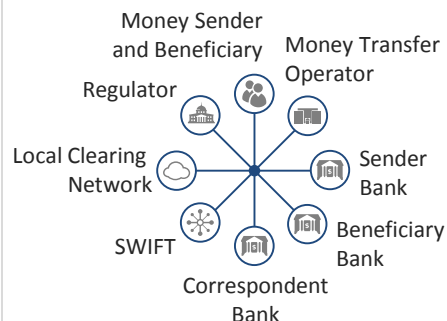


Use cases | Payments

Global Payments

Summary

Conducting international money transfers through DLT could provide real-time settlement and reduce costs, enabling new business models (e.g. micropayments), and institute newer models of regulatory oversight



Implications for FIs

- Real-time settlement of international money transfers can increase profitability by reducing liquidity and operational costs
- Utilizing DLT will enable direct interaction between sender and beneficiary banks, and eliminate the role of correspondents
- Smart contracts can capture obligations and drive reporting, minimizing operational errors and accelerating outcomes

Critical conditions for implementation

- Ensuring compliance via standard KYC processes
- Binding legality of cryptographic hash to exchange value
- Adopting standards and ensuring interoperability

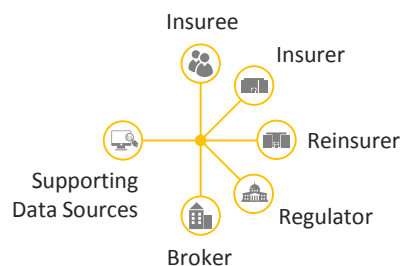


Use cases | Insurance

P&C Claims Processing

Summary

Facilitating claims management for property and casualty (P&C) insurers on DLT can automate processing through smart contracts, improve assessment through historical claims information and reduce potential for fraudulent claims



Implications for FIs

- Smart contracts can automate claims processing through third-party data sources and codification of business rules
- DLT can drive reductions in operating costs through process simplification
- Storing historical claims information on the ledger will enable insurers to identify suspicious behaviour and improve assessment

Critical conditions for implementation

- Building a comprehensive set of asset profiles and history
- Adopting standards for relevant claims data
- Providing a legal and regulatory framework

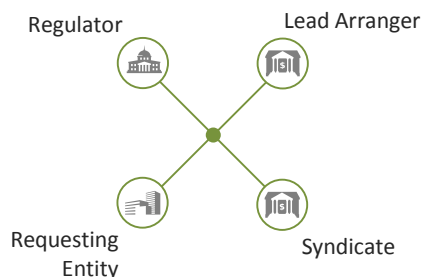


Use cases | Deposits and Lending

Syndicated Loans

Summary

Utilizing DLT to automate syndicate formation, underwriting and the disbursement of funds (e.g. principal and interest payments) can reduce loan issuance time and operational risk



Implications for FIs

- Forming syndicates through smart contracts can increase speed and provide regulators with a real-time view to facilitate AML/KYC
- Performing risk underwriting through DLT can substantially reduce the number of resources required to perform these activities
- Smart contracts can facilitate real-time loan funding and automated servicing activities without the need for intermediaries

Critical conditions for implementation

- Building risk rating framework for syndicate selection
- Standardizing diligence and underwriting templates
- Providing access to financial details on the distributed ledger

Trade Finance

Summary

Utilizing DLT to store financial details can facilitate the real-time approval of financial documents, create new financing structures, reduce counterparty risk and enable faster settlement



Implications for FIs

- Storing financial details on the ledger can automate the creation and management of credit facilities through smart contracts
- DLT can improve real-time visibility to the transaction to better institute regulatory and customs oversight
- Utilizing DLT will enable direct interaction between import and export banks, and eliminate the role of correspondent banks

Critical conditions for implementation

- Providing transparency into trade finance agreements
- Enabling interoperability with legacy platforms
- Rewriting regulatory guidance and legal frameworks

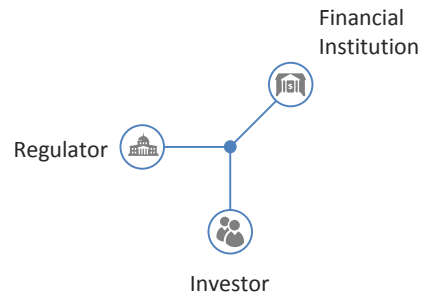


Use cases | Capital Raising

Contingent Convertible (“CoCo”) Bonds

Summary

Utilizing smart contracts to automate regulator reporting can minimize the need for point-in-time stress tests, reduce market volatility and, ultimately, increase “CoCo” bond issuance



Implications for FIs

- Tokenizing bond instruments when soliciting capital from investors can enable them to make informed, data-driven decisions
- Smart contracts can alert regulators when loan absorption needs to be activated, minimizing need for point-in-time stress tests
- Providing investors with transparency into loan absorption can reduce uncertainty currently associated with “CoCo” bonds

Critical conditions for implementation

- Standardizing attributes for soliciting investments
- Streamlining trigger calculations across FIs
- Developing processes to act on real-time trigger notifications

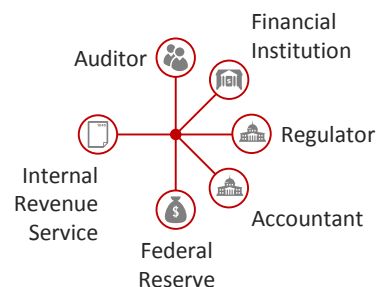


Use cases | Investment Management

Automated Compliance

Summary

Utilizing DLT to store financial information can eliminate errors associated with manual audit activities, improve efficiency, reduce reporting costs and, potentially, support deeper regulatory oversight in the future



Implications for FIs

- Storing financial information on the ledger provides immutable, real-time updates and facilitates automated review
- Executing reporting activities through smart contracts can facilitate the automated creation of quarterly and annual findings
- In the future, DLT can seamlessly execute and automate compliance activities (e.g. Comprehensive Capital Assessment Review)

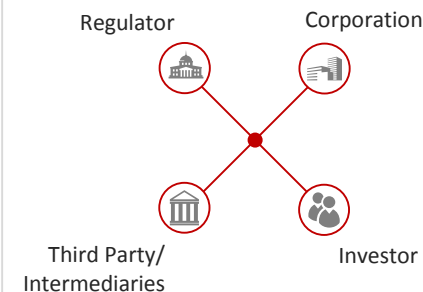
Critical conditions for implementation

- Providing compartmentalized access to data
- Automating faster and efficient enforcement of regulations
- Enabling interoperability with legacy platforms

Proxy Voting

Summary

Distributing proxy statements via DLT and counting votes via smart contracts may improve retail investor participation, automate the validation of votes and, potentially, enable personalized analyses in the future



Implications for FIs

- Distributing proxy statements via the distributed ledger can reduce costs associated with printing and mailing
- Smart contracts can automate the validation of votes and increase the transparency of counting votes (e.g. end-to-end confirmation)
- Storing proxy statements on the ledger may enable investors to conduct personalized, automated analyses in the future

Critical conditions for implementation

- Storing investment records on a distributed ledger
- Integrating legacy voting mechanisms into tokens
- Collaborating across actors to ensure success

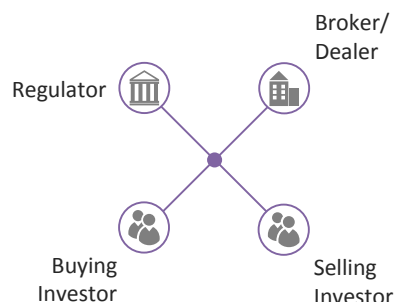


Use cases | Market Provisioning

Asset Rehypothecation

Summary

Utilizing DLT to track and manage asset rehypothecation via smart contracts can enable the real-time enforcement of regulatory control limits across the financial system and reduce settlement time



Implications for FIs

- Rating counterparties based on transaction history stored on DLT can enable investors to improve investment decisions
- Smart contracts enable the real-time reporting of asset history and the enforcement of regulatory constraints
- Facilitating clearing and settlement processes via smart contracts can eliminate need for intermediaries and reduce settlement time

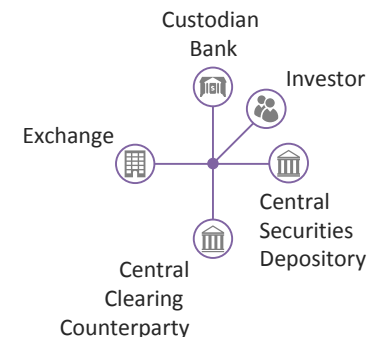
Critical conditions for implementation

- Tokenizing assets using a shared standard
- Fostering engagement among the financial ecosystem
- Architecting solution to manage over-the-counter (OTC) templates

Equity Post-Trade

Summary

Utilizing DLT and smart contracts to facilitate post-trade activities can disintermediate processes, reduce counterparty and operational risk and, potentially, pave the way for reduced settlement time



Implications for FIs

- Conducting clearing activities through the ledger can automate processes, reduce settlement time and lower counterparty risk
- Smart contracts can simultaneously transfer equity and cash in real time, reducing the likelihood of errors impacting settlement
- Disintermediating clearing, settlement and servicing processes can reduce costs and enable capital & liquidity management efficiencies

Critical conditions for implementation

- Incorporating “net transaction” benefits within settlement
- Achieving multistakeholder alignment across participants
- Standardizing reference data utilized to match trades

Section 5

Use Case Deep-Dive Modules

Section 5.1

Payments: Global Payments

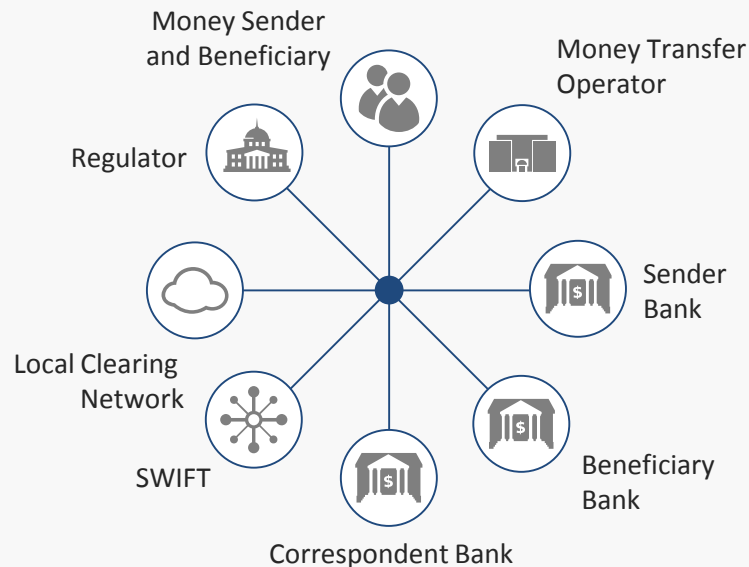
Global Payments

Introduction

Current-state background

A payment refers to the process of transferring value from one individual or organization to another in exchange for goods, services or the fulfillment of a legal obligation. Global payments are an expansion of that concept, in which payments can be completed across geographical borders through multiple fiat currencies.

Key ecosystem stakeholders



Overview

- **Business is growing fast and steadily :** The global payments volume is increasing at an approximate rate of 5% yearly worldwide and will reach an estimated US\$ 601 billion in 2016.¹ Revenue is growing in all regions, especially in Asia where China will likely surpass Brazil as the third largest payment area after the United States and the Eurozone^{2, 3}
- **Profit margins are high:** The average cost to the final customer (money sender) is 7.68% of the amount transferred
- **Newcomers are arriving:** Non-bank transactions are reaching up to 10% of the total payments volume²

The focus of this use case is on low value–high volume payments from an individual/business to an individual via banks or money transfer operators. These transfers are more commonly known as remittances









1. Migration and Remittances Factbook 2016, World Bank, 2016.

2. Top 10 Trends in Payments in 2016, Cag Gemini, 2016.

3. Global Payments 2015: A Healthy Industry Confronts Disruption, McKinsey & Company, 2015.

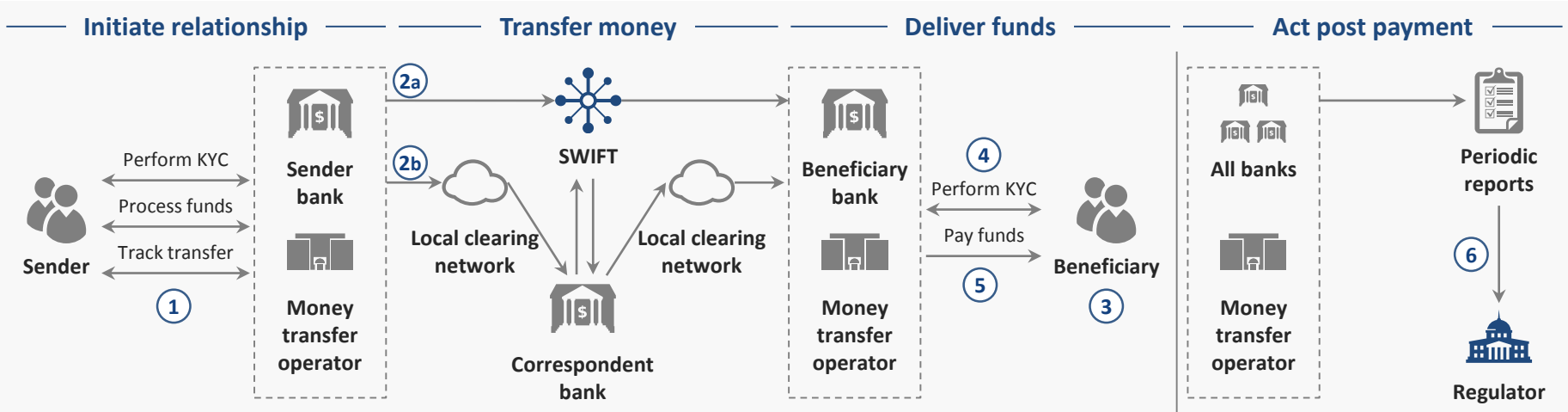
Global Payments

Key market participants

| Market participant | Role | Description |
|--|-------------------|--|
|  Money Sender and Beneficiary | <i>Core</i> | An individual or business wishing to transfer money (sender) to another individual or business (beneficiary) internationally |
|  Money Transfer Operator | <i>Core</i> | Non-bank companies specialized in international money transfer through a global network of agents |
|  Sender Bank | <i>Core</i> | A sender's preferred bank that offers international money transfer |
|  Beneficiary Bank | <i>Core</i> | A bank used by the beneficiary to receive funds |
|  Correspondent Bank | <i>Supporting</i> | A bank that has access to foreign exchange (FX) corridors and facilitates the transfer (via nostro accounts and SWIFT) |
|  SWIFT | <i>Supporting</i> | The global member-owned cooperative provider of secure financial messaging and settlement services |
|  Local Clearing Network | <i>Supporting</i> | The national interbank network that allow financial messaging/settlement (e.g. ACH, SPB and Zengin) |
|  Regulator | <i>Supporting</i> | Central banks and monetary authorities that determine and monitor adherence to KYC and AML standards |

Global Payments

Current-state process depiction



Current-state process description

1 Sender needs to send money to another country and approaches a bank or money transfer operator, which does the following:

- Performs AML/KYC activities
- Collects funds and fees
- Confirms and supports transfer inquiries/disputes

The bank or money transfer operator will move money across borders through either of the following mechanisms:

- 2a** Utilizes SWIFT network (part of SWIFT network)
- 2b** Facilitates transfer via correspondent banks (not part of SWIFT network)

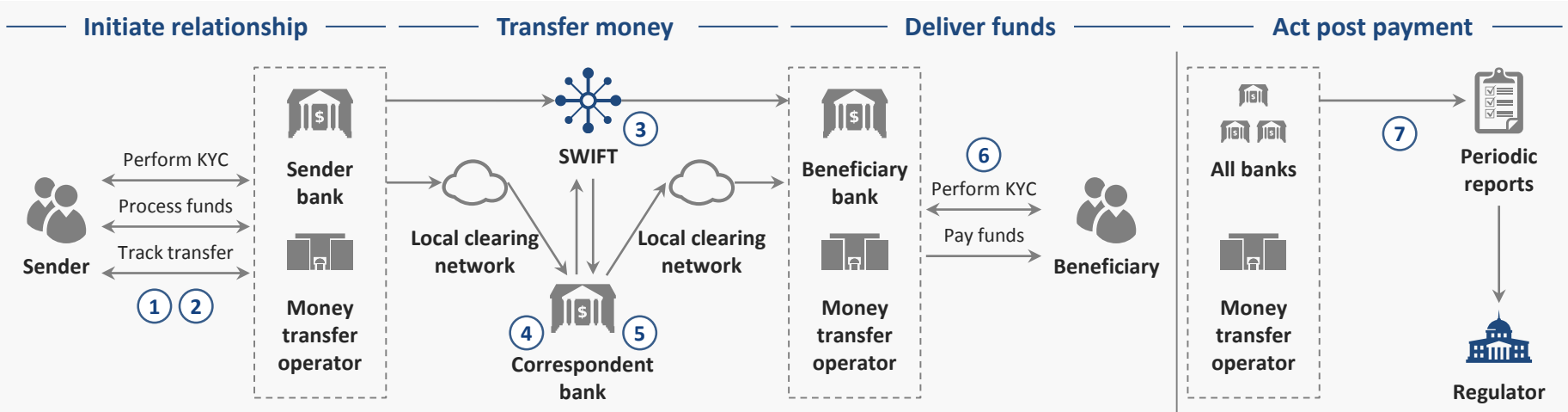
** Transactions can either be "netted" or initiated per-transaction*

- 3** The beneficiary is notified and approaches a bank or money transfer operator
- 4** Depending on the pre-existing relationship, KYC may be performed by the bank or money transfer operator
- 5** The amount due in local currency is paid

- 6** Periodically, according to local regulations, the bank and money transfer operator will provide reports to regulators containing transaction details (e.g. sender and beneficiary ID, currencies, transferred amount and timestamps)

Global Payments

Current-state pain points

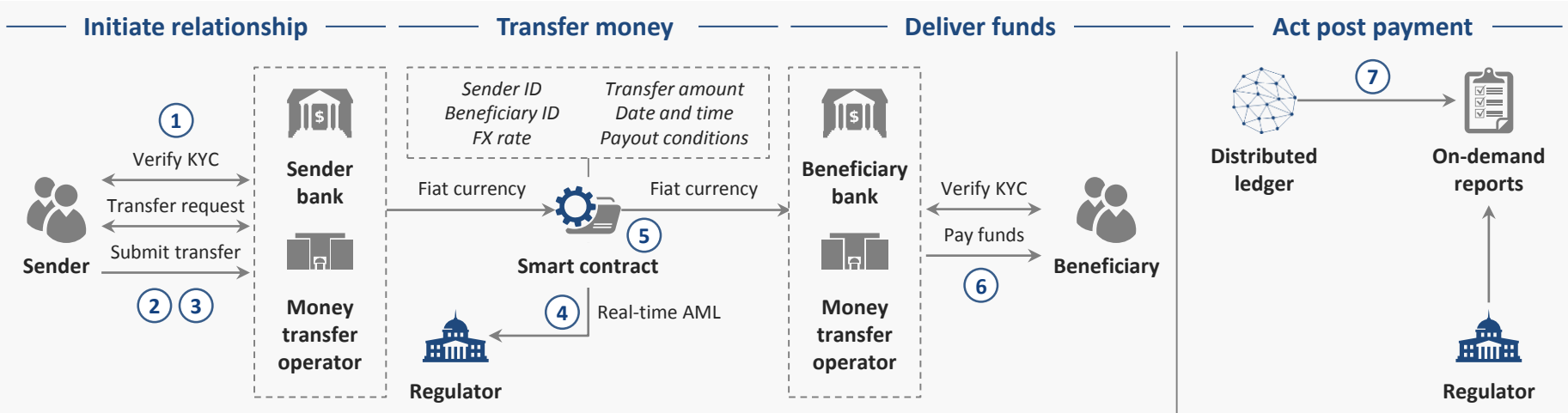


Current-state pain points

- 1 Inefficient onboarding:** information about the sender and beneficiary is collected via manual and repetitive business processes
- 2 Vulnerable KYC:** limited control exists over the veracity of information and supporting documentation, with various maturity levels across institutions
- 3 Cost and delay:** payments are costly and time consuming depending on route
- 4 Error prone:** information is validated per bank/transaction, resulting in high rejection rate
- 5 Liquidity requirement:** banks must hold funds in nostro accounts, resulting in opportunity and hedging costs
- 6 Vulnerable KYC:** similar to #2, limited control exists over the veracity of information and supporting documentation, with various maturity levels across institutions
- 7 Demanding regulatory compliance:** due to various data sources and channels or origination, regulatory reports can require costly technology capabilities in addition to complex business processes (often supported by multiple operation teams)

Global Payments

Future-state process depiction

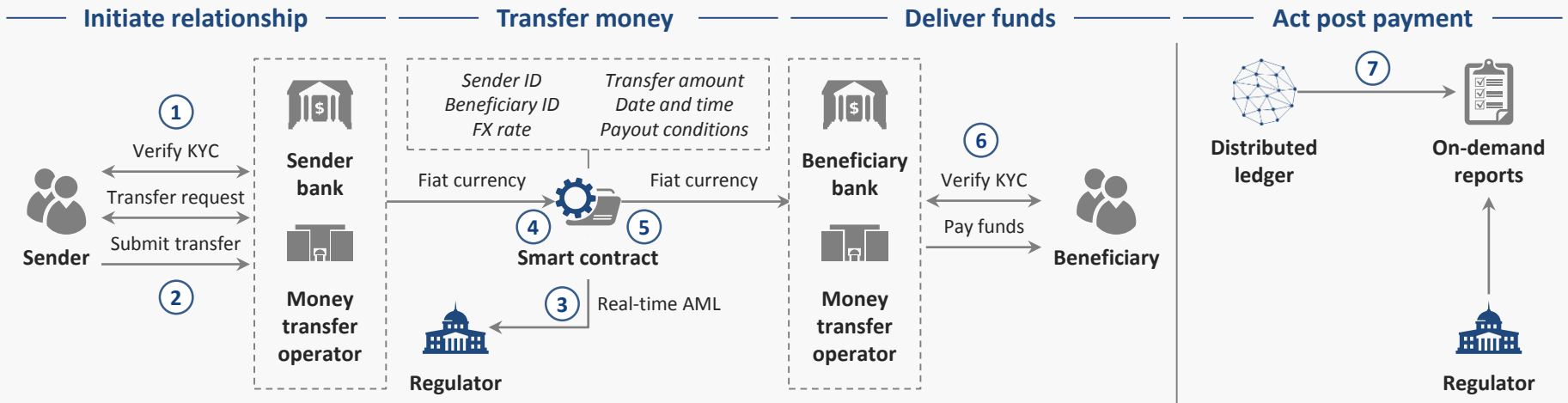


Future-state process description

- | | | | |
|--|--|---|--|
| <p>1 Trust between the sender and a bank or money transfer operator is established either via traditional KYC or a digital identity profile</p> <p>2 A smart contract encapsulates the obligation to transfer funds between sender and beneficiary</p> <p>3 The currency conversion is facilitated through liquidity providers on the ledger</p> | <p>4 The regulator can monitor transactions in real time and receive specific AML alerts through a smart contract</p> <p>5 A smart contract enables the real-time transfer of funds with minimal fees and guaranteed delivery without the need for correspondent bank(s)</p> | <p>6 Funds are deposited automatically to the beneficiary account via a smart contract or made available for pickup after verifying KYC</p> | <p>7 The transaction history is available on the ledger and can be continuously reviewed by regulators</p> |
|--|--|---|--|

Global Payments

Future-state benefits



Future-state benefits

- 1 **Seamless KYC:** leveraging the digital profile stored on DLT establishes trust and authenticates the sender
- 2 **FX liquidity capabilities:** through smart contracts, foreign exchange can be sourced from participants willing to facilitate the conversion of fiat currencies
- 3 **Real-time AML:** regulators will have access to transaction data and can receive specific alerts based on predefined conditions
- 4 **Reduced settlement time:** cross-border payments can be completed in real time
- 5 **Cost savings:** with fewer participants, the improved cost structure can generate value
- 6 **Seamless KYC:** leveraging the digital profile stored on DLT establishes trust and authenticates the beneficiary
- 7 **Automated compliance:** the regulator will have on-demand access to the complete transaction history over the ledger

Global Payments

Critical conditions

Ensuring compliance via standard KYC processes



Members of the ledger as well as regulators need to converge on common KYC processes to effectively identify stakeholders involved in the transaction and ensure a corresponding template data set is available on DLT

Why?
Real-time and on-demand AML/KYC compliance for global payments is enabled when banks and money transfer operators provide trusted and standard dataset on DLT

Challenge
The policies and processes of banks and money transfer operators to onboard customers (sender, beneficiary) are diverse, as are the regional regulatory requirements

Binding legality of cryptographic hash to exchange value



Regulators, central banks and legal participants will need to collaborate from different countries to reach a valid legal framework for global payments

Why?
If the underlying solution is not legally accepted, legacy solutions will have to be maintained in parallel, limiting the forecasted benefits

Challenge
Given no legal precedent, legal and technology subject matter experts from different countries will need to establish a globally accepted legal framework

Adopting standards and ensuring interoperability



Consensus on the choice of DLT platform across a significant number of FIs will allow economies of scale and higher return on investment

Why?
Different ledgers and/or adoption cycles from key stakeholders would compromise benefits and lead to interoperability issues

Challenge
The differing priorities, levels of urgency and budgets of players will create obstacles to forming international agreements among participants



Global Payments

Additional considerations



DLT enabled by global banks

Overview

Global correspondent banks can implement DLT to unlock benefits and increase efficiency in the value chain, while also enabling next-generation competitive services to local banks



Impact

- Non-members of the DLT platform would still be reliant on middlemen and their associated fees to offer global payments as a product



Embedded solution

Overview

The adoption of DLT may be driven by key information technology providers; as they integrate DLT into their core banking platforms, they might play a key role on setting standards



Impact

- Banks and information technology providers will need to collaborate on a shared strategy to converge on mutual interest
- The use of DLT may be driven by the choice of ledger implemented by the information technology provider



Cryptocurrency as the linking currency

Overview

Banks can leverage cryptocurrency on the DLT to facilitate global payments, eliminating supporting settlement platforms and foreign currency buffers in nostro accounts



Impact

- Additional gains will be made on liquidity management and transaction settlement time
- The use of cryptocurrency will add to additional volatility and will demand additional hedging instruments
- Banks would be required to hold cryptocurrency as assets on their books

Global Payments

Conclusion

Summary

- **Real-time settlement:** enabling banks can fulfil and settle international money transfers in real time, while increasing profitability via a reduction in liquidity and operations costs
- **Reduced fraud:** transparent and immutable data on DLT can reduce fraudulent transactions to a fraction of what they are today
- **Development of digital obligations:** smart contracts can be used to capture obligations among FIs in order to ensure that appropriate funds are exchanged, eliminating operational errors

Key takeaways

- **Challenge correspondent banks:** DLT has the potential to disrupt the role of dedicated banks that act as gateways to international fund transfers
- **Allow direct interaction between sender and beneficiary banks:** DLT can give direct access to most if not all relevant destinations for adopting banks and money transfer operators
- **Enable micropayments:** DLT can make low-value transactions more feasible to FIs as cost structures are modified

Outlook

- SWIFT is implementing a “Global Payments Innovation Initiative” to facilitate global payments with transparent fees and same-day funds delivery but this initiative does not employ DLT
- Currently, the adoption of DLT for global payments by incumbent banks is limited, although concrete initiatives are occurring in North America and Europe across retail and wholesale banking
- Opportunities exist for regulators to assess and promote the viability of prototypes and future implementations within current regulatory frameworks

Unanswered questions

- **Initiatives:** Will retail and wholesale banking initiatives merge towards common DLT implementation despite competing interests?
- **Volatility:** Is there a role for cryptocurrencies as a bridge asset to facilitate FX?
- **SWIFT:** What role will SWIFT play in enabling DLT-based global payments?

Section 5.2

Insurance: P&C Claims Processing

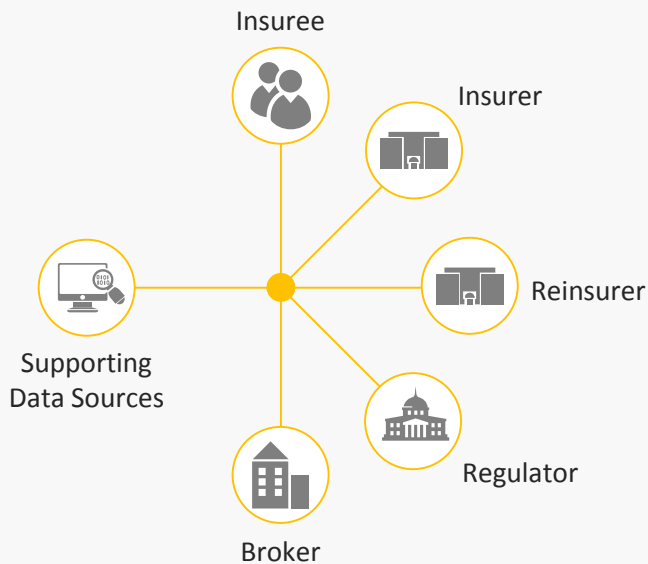
P&C Claims Processing

Introduction

Current-state background

Insurance is a financial risk management product in which an individual or entity receives protection against losses (e.g. property, asset, casualty and health) from the insurer. Commercial property and casualty (P&C) insurance (e.g. commercial motor, commercial property and commercial liability) protects businesses against risks that may result in loss of life or property.

Key ecosystem stakeholders









Overview

- **P&C is large:** P&C is the second largest segment of insurance worldwide (after life and health) with earned premiums in 2014 of US\$ 728.6 billion, growing at 5.1% since 2010, and is set to reach US\$ 895.1 billion by 2018¹
- **Claims processing is a key bottleneck:** For P&C insurance, the tasks associated with claim and loss processing are a major source of friction, accounting for an average of 11% of the overall written premium (revenue)²

DLT has the potential to optimize the back-office operational costs of property and casualty insurers. This use case highlights the key opportunities in claims processing for the P&C commercial insurance business

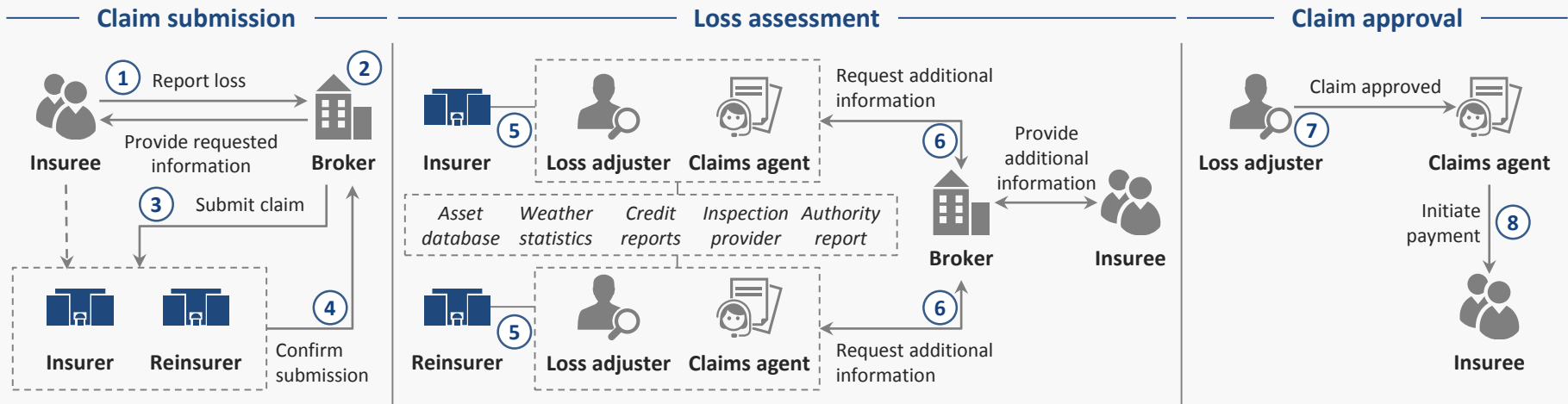
P&C Claims Processing

Key market participants

| Market participant | Role | Description |
|--|-------------------|---|
|  Insuree | <i>Core</i> | Companies looking for insurance to cover their underlying operational risks (properties and casualties) |
|  Insurer | <i>Core</i> | A company that, through a contractual agreement, undertakes to compensate specified losses, liability or damages incurred by another company |
|  Reinsurer | <i>Core</i> | A company that provides financial protection to insurance companies handling risks that are too large for insurance companies to handle on their own |
|  Regulator | <i>Supporting</i> | Insurance supervisory agency and central banks that determine and monitor adherence to KYC, AML, risk concentration, liquidity and solvency standards |
|  Broker | <i>Supporting</i> | A specialized company or registered professional that acts as an intermediary, advising and connecting insurees with insurers |
|  Supporting Data Sources | <i>Supporting</i> | Diversified sources of information used by insurers to assess underwriting risks and evaluate claims and losses; they can include authorities, experts and official data sources, among others (e.g. police report, weather database, official inspection reports, asset ownership records) |

P&C Claims Processing

Current-state process depiction

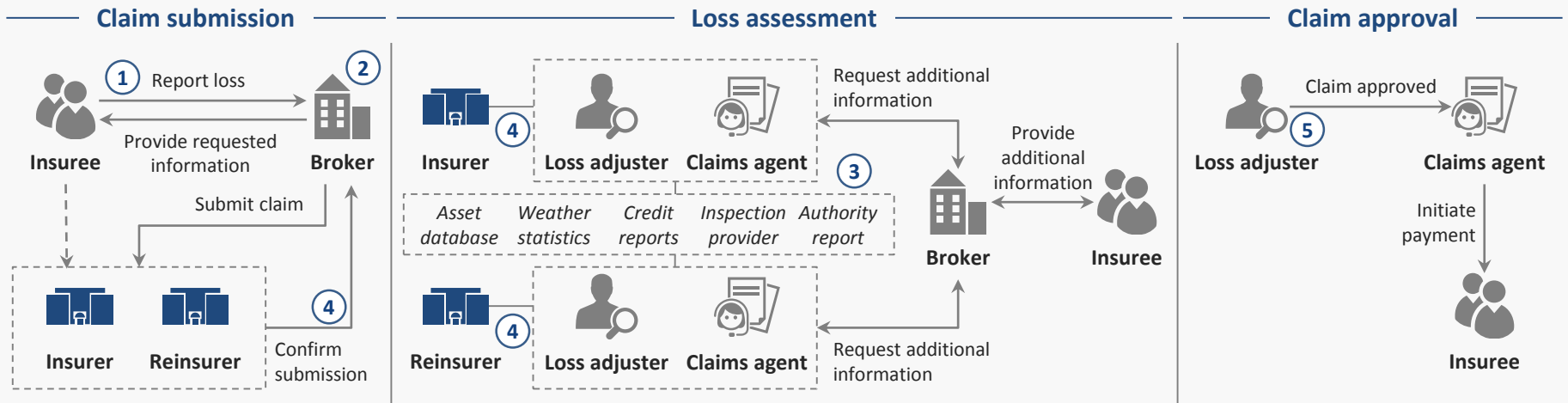


Current-state process description

- 1 Insuree reports loss and claims restitution from an insurer (and reinsurer, if applicable) via a broker (or independently)
- 2 Broker may request additional information from insuree to support the loss claim
- 3 Broker submits the claim to the insurer and reinsurer (in cases of syndicate insurance or reinsurance)
- 4 After verifying the documentation received, the insurer(s) confirm receipt of the claim submission
- 5 Loss adjusters perform claim assessments and verify the validity of the claims through client information, secondary data sources (e.g. weather statistics and authority reports) or additional inspection assessments/interviews
- 6 If additional information is required by the insurer, a new information request is made to the broker or insuree. In some situations, the insuree must collect supporting documentation directly from secondary data sources
- 7 After concluding claim assessments, the loss adjuster within each insurer reaches a conclusion about the claim
- 8 If the claim is approved, payment to the insuree is initiated via an insurer's claims agent

P&C Claims Processing

Current-state pain points

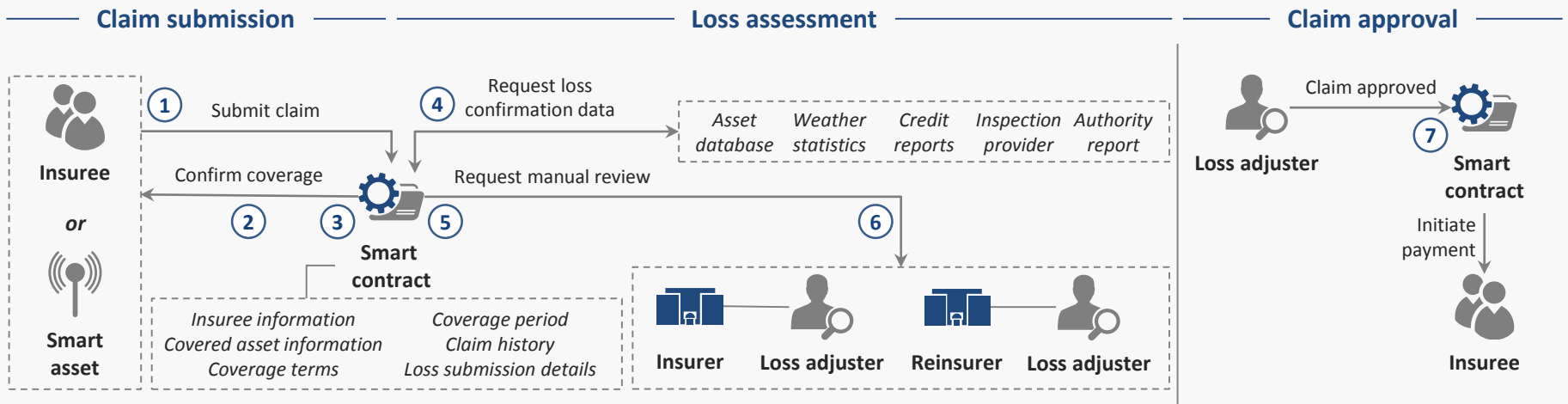


Current-state pain points

- 1 **Undesirable customer experience:** to initiate a claim, the insuree must complete a complex questionnaire and maintain physical receipts of the costs incurred by the loss
- 2 **Costly intermediaries:** brokers act as intermediaries during processing, adding delays and costs to the submission
- 3 **Fragmented data sources:** insurers must establish individual relationships with third-party data providers to get manual access to supporting asset, risk and loss data that may not be updated
- 4 **Fraud prone:** the loss assessment is completed on a per-insurer and per-loss basis with no information sharing between insurers, increasing the potential for fraud and manual rework
- 5 **Manual claim processing:** loss adjusters are required to review claims and to:
 - Ensure their completeness
 - Request additional information or use supporting data sources
 - Validate loss coverage
 - Identify the scope of the liability
 - Calculate the loss amount

P&C Claims Processing

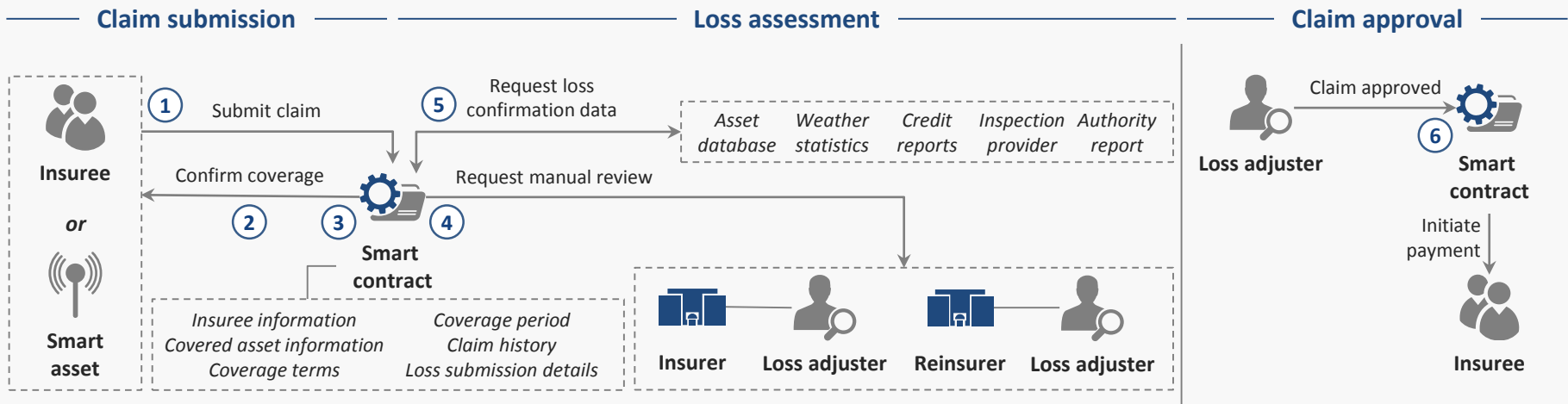
Future-state process depiction



Future-state process description

- ① Loss information is submitted by the insuree or smart asset (via sensors or external data sources if the asset is technologically capable), triggering an automated claim application
- ② For insurance policies issued via a smart contract, insurees receive feedback regarding initial coverage in real time
- ③ Claim due diligence is automated via codified business rules within the smart contract, using information submitted by the insuree
- ④ DLT automatically utilizes secondary data sources to assess the claim and calculate the loss amount
- ⑤ Depending on the insurance policy, a smart contract can automate the liability calculation for each carrier where a syndicate (or insurers or reinsurers) exists
- ⑥ In predetermined situations, the smart contract can trigger an additional assessment of the claim in order to reach a final decision/calculation
- ⑦ If the claim is approved, payment to the insuree is initiated **via a smart contract**

P&C Claims Processing *Future-state benefits*


















Future-state benefits

- 1 Simplified and/or automated claim submission:** through a smart contract, the claim submission process will be simplified and/or fully automated (in cases of smart assets)
- 2 Enhanced customer experience:** through the streamlined transfer of loss information from insuree to insurer, DLT eliminates the need for brokers and reduces claim processing times
- 3 Automated claim processing:** business rules encoded in a smart contract eliminate the need for loss adjusters to review every claim (functionality will enable the loss adjuster to review the claim and provide a decision, in specific risk situations)
- 4 Reduction in fraudulent claims:** the insurer will seamlessly have access to historical claims and asset provenance, enabling better identification of suspicious behaviour
- 5 Integrated data sources:** DLT facilitates the integration of various data sources from trusted providers with minimal required manual review
- 6 Streamlined payment process:** in most cases, the smart contract will facilitate the payment automatically without effort from the back office

P&C Claims Processing

Critical conditions

|  Building a comprehensive set of asset profiles and history |  Adopting standards for relevant claims data |  Providing a legal and regulatory framework |
|--|--|---|
|     |     |     |
| <p><i>Asset records must migrate to the DLT to allow smart contracts to consume reliable and updated asset information directly over the ledger in the case of a claim</i></p> | <p><i>Insurers and regulators will play a key role in setting data standards and facilitating the adoption by external data providers to ensure the effective flow of information among the participants</i></p> | <p><i>Regulators, insurers and other relevant stakeholders will have to establish a legal framework that regulates the validity of smart contracts as binding instruments for insurance policies</i></p> |
| <p>Why?</p> <p>If asset provenance and loss information are kept off the ledger among different players, smart contracts will lose their effectiveness to process claims automatically</p> | <p>Why?</p> <p>If the data is not standardized, additional manual work will still be required, resulting in cost inefficiencies and jeopardizing gains</p> | <p>Why?</p> <p>The absence of a legal precedent will expose the insurer and insuree to higher counterparty risk and disputes</p> |
| <p>Challenge</p> <p>Engaging the market and enforcing a specific DLT as the dominant mechanism for asset registry may be challenging to implement and will require stakeholders diligence</p> | <p>Challenge</p> <p>Changing current company-specific processes and data sets to a shared standard will require extensive discussion and converging interests</p> | <p>Challenge</p> <p>Careful and close collaboration would be required since stakeholders will likely have competing interests and senses of urgency to establish a shared framework</p> |



P&C Claims Processing

Conclusion

Summary

- **Claims automation:** Claims processing can be automated using trusted third-party data sources and the codification of business rules in smart contracts on the ledger
- **Reduced fraud:** Transparent and immutable data on the ledger can also reduce fraudulent claims to a fraction of what they are today

Key takeaways

- **Smart contracts will be key:** Insurance policies can be managed using smart contracts on DLT, capturing coverage conditions, and syndicate insurance agreements or insurer-reinsurer agreements
- **Loss adjustment expenses may become irrelevant:** DLT utilization will fundamentally disrupt the cost and profitability ratios that are currently in use across the insurance industry

Outlook

- The application of DLT within insurance is currently in its infancy, with a number of incumbents and new entrants providing early proof of concept, focusing on:
 - Creation of immutable insurance claim records
 - Development of asset provenance to assist in risk profiling and claims processing
 - P2P insurance
- Opportunities exist for regulators/FIs to:
 - Monitor and assess new DLT-based products (e.g. P2P insurance)
 - Guide the industry towards a lower-cost model via the common and shared implementation of DLT

Unanswered questions

- **Profitability:** Will the automated processing of claims have adverse effects on loss ratios?
- **Pricing:** What impact will changes in loss ratios have on insurance premiums?

Section 5.3

Deposits and Lending: Syndicated Loans

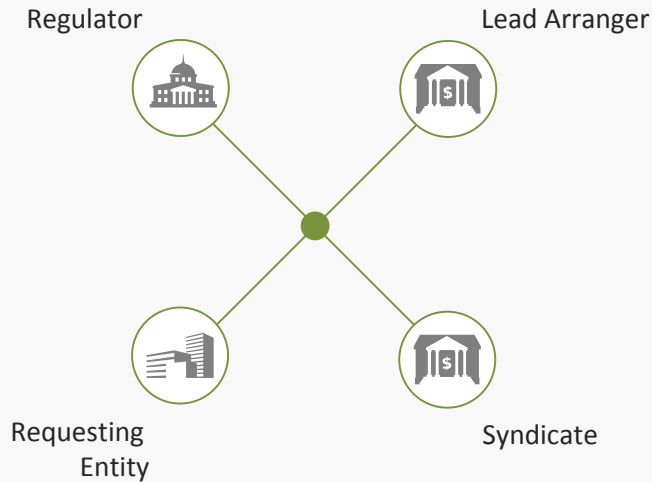
Syndicated Loans

Introduction

Current-state background

Syndicated loans provide clients with the ability to secure large-scale diversified financing at the current market rate. These loans are funded by a group of investors (e.g. syndicate), where one investor serves as the lead arranger. The lead arranger serves as the underwriter for the loan and performs all administrative tasks throughout the loan life cycle, charging a fee based on the complexity and risk factors associated with the loan.

Key ecosystem stakeholders



Overview





- **The US market is dominated by incumbents:** Four US FIs accounted for more than 50% of the market share (US\$ 1,917 billion total volume) in 2014¹
- **The EMEA market is large:** The total EMEA syndicated loan volume in 2014 amounted to US\$ 1,214.5 billion¹
- **The Asia-Pacific market is growing:** The Asia-Pacific (ex-Japan) syndicated loan volume increased by 22% in 2014, bringing total volume to US\$ 524.2 billion¹
- **The Latin American market is immature:** The total Latin American syndicated loan volume in 2014 amounted to US\$ 42.2 billion¹

DLT has the potential to optimize syndicated loan back-office operations. This use case highlights key opportunities in the end-to-end syndicated loan process

1. Global Syndicated Loans: League Tables 2014, Bloomberg, 2014.

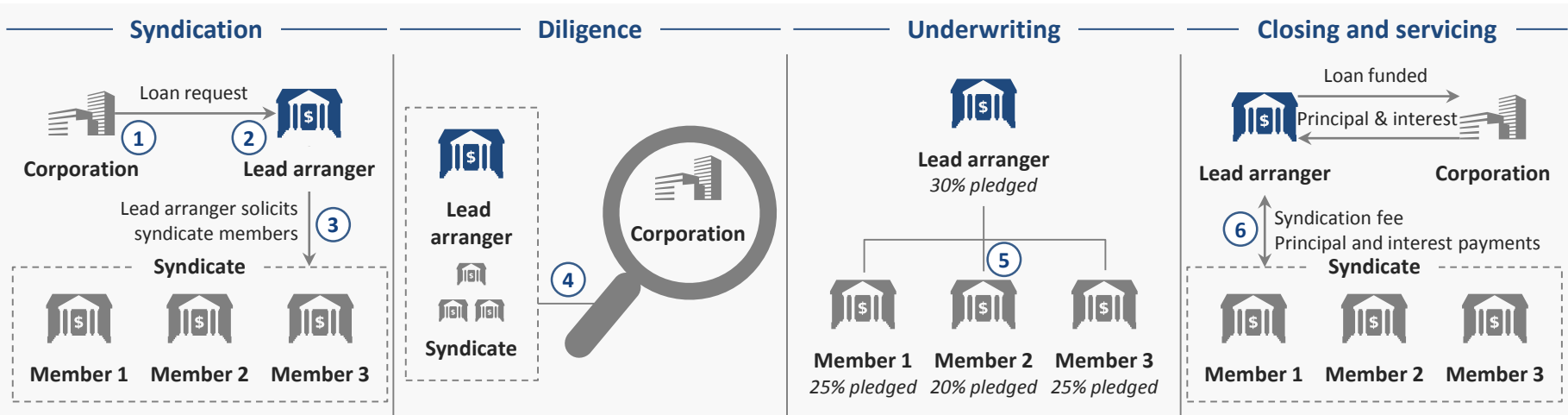
Syndicated Loans

Key market participants

| Market participant | Role | Description |
|---|-------------------|---|
|  Lead Arranger | <i>Core</i> | An FI that leads a group of investors through the underwriting and financing of a large loan |
|  Syndicate | <i>Core</i> | A group of investors formed into one entity for the purpose of distributing risk across institutions for large transactions |
|  Requesting Entity | <i>Core</i> | An organization requesting a large loan from an FI |
|  Regulator | <i>Supporting</i> | A monitor that verifies adherence to AML compliance activities |

Syndicated Loans

Current-state process depiction

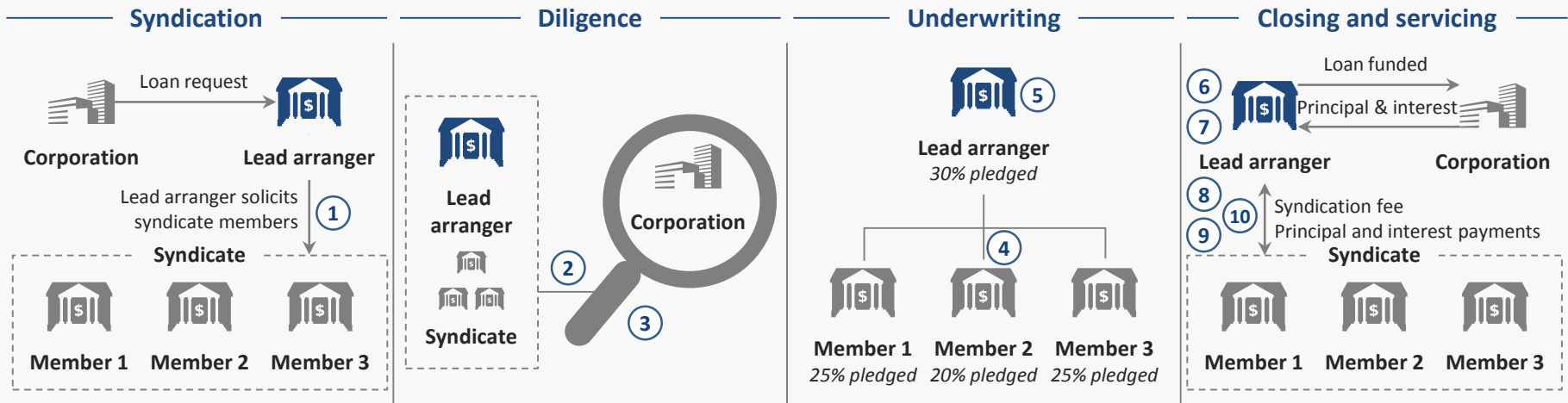


Current-state process description

- 1 A corporation requests a loan from an FI (referred to as the lead arranger within the syndicated loan market)
The lead arranger performs KYC procedures in accordance with regulatory requirements
- 2 To reduce risk, the lead arranger sources prospective members to fund the loan
- 3
- 4 The lead arranger facilitates the investigation of the corporation's financial health to determine credit worthiness and the level of risk associated with the loan
- 5 Syndicate members pledge a percentage of the overall risk based on their respective tolerance levels
- 6 The lead arranger takes on the administrative responsibility for servicing throughout the agreed upon contract life cycle (e.g. funding the loan and dispersing principal and interest payments to syndicate members)

Syndicated Loans

Current-state pain points

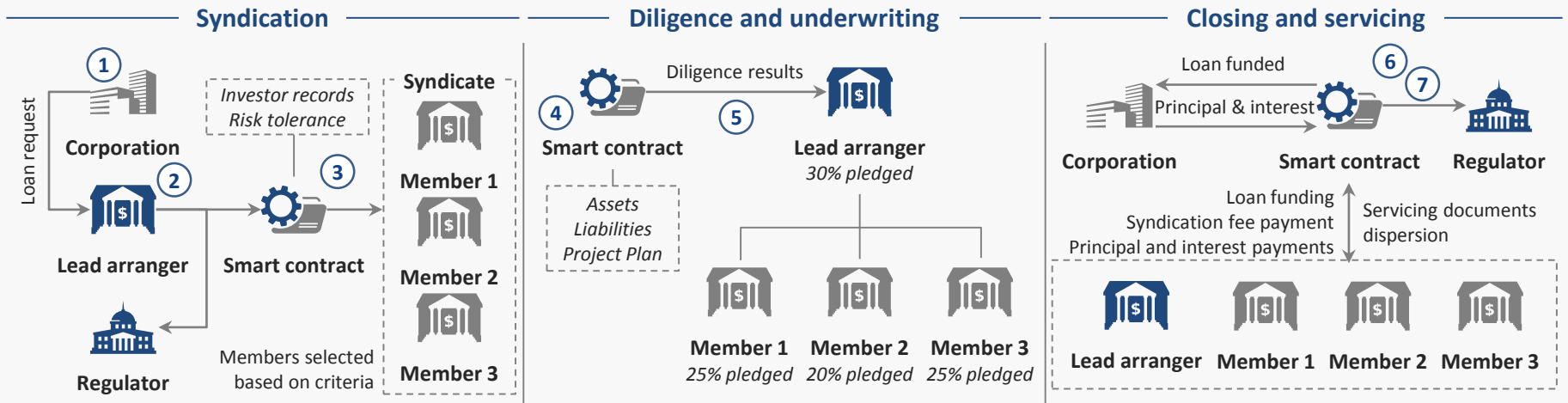


Current-state pain points

- | | | | |
|---|--|---|--|
| <p>1 Time-intensive process: selecting syndicate members based on financial health and industry expertise is time-intensive and inefficient due to manual review processes</p> | <p>3 Lack of technology integration: due diligence team members reference various applications and data sources, resulting in additional time required and a potential for errors</p> | <p>5 Lack of technology integration: underwriting systems do not communicate with diligence systems, duplicating efforts</p> | <p>8 Delayed settlement time: while verifying funds, payments settle t+3 (trade date plus three days), delaying investors from obtaining funds</p> |
| <p>2 Time-intensive review: analysing a corporation's financial information is time-intensive and inefficient due to manual review processes</p> | <p>4 Labour-intensive process: the documentation of syndicate member pledging is labour-intensive and inefficient due to reliance on manual activities</p> | <p>6 Inefficient fund disbursal: the lead arranger facilitates principal and interest disbursal, resulting in additional costs to investors</p> <p>7 Default risk: the lead arranger poses a risk in the disbursement of funds throughout the loan life cycle</p> | <p>9 Costly intermediaries: third-party organizations facilitate servicing operations, resulting in additional costs to investors</p> <p>10 Siloed systems: activities are duplicative since systems do not communicate with one another</p> |

Syndicated Loans

Future-state process depiction

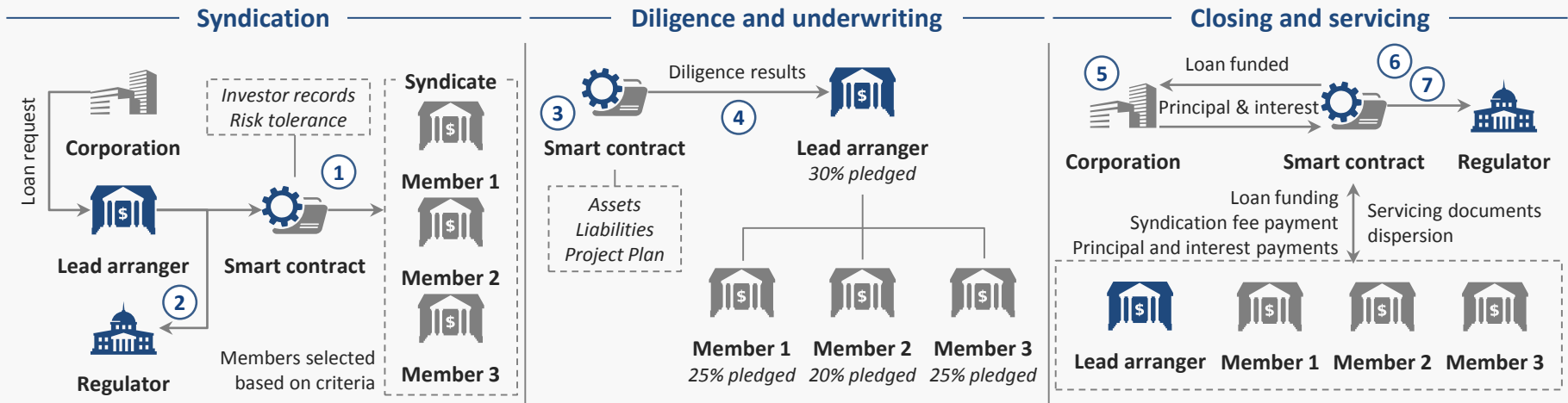


Future-state process description

- 1 A corporation requests a loan from an FI acting as the lead arranger
- 2 Leveraging the corporation's digital identity, the lead arranger performs KYC activities in real time through the DLT's record-keeping functionality, which also provides regulators with a transparent view of activity
- 3 The investor's financial records and risk tolerance stored on DLT automates the selection process, reducing the time it takes to form a syndicate
- 4 Leveraging the corporation's financial information and project plan data accessible through the DLT, diligence activities are automated via a **smart contract**
- 5 Key attributes from the diligence process are populated into the underwriting template, streamlining the process and reducing time through the DLT's transfer of value capability
- 6 Smart contracts eliminate the need for a third party to fund the loan, disperse funds and facilitate the loan servicing process
- 7 Embedded regulation facilitates the review of financial details to ensure AML procedures are followed appropriately

Syndicated Loans

Future-state benefits


















Future-state benefits

- 1 **Automated syndicate formation:** through programmable selection criteria within a smart contract, syndicate formation is automated, reducing the time for a corporation's loan to be funded
- 2 **Embedded regulator:** throughout the syndicated loan life cycle, regulators are provided with a real-time view of financial details to facilitate AML/KYC activities
- 3 **Automated diligence and underwriting:** corporation financial information analysis and risk underwriting are automated, reducing the execution time and the amount of resources required to perform these activities
- 4 **Technology integration:** diligence systems communicate pertinent financial information to underwriting systems, streamlining process execution and reducing underwriting time
- 5 **Reduced closing time:** loan funding is facilitated in real time, eliminating traditional t+3 settlement and centralized lead arranger operations
- 6 **Servicing disintermediation:** activities are executed via smart contracts, eliminating the need for third-party intermediaries
- 7 **Reduced counterparty risk:** the disbursement of principal and interest payments throughout the loan life cycle is automated, reducing operational risk

Syndicated Loans

Critical conditions

| | | |
|--|--|---|
|  <p>Building risk rating framework for syndicate selection</p> |  <p>Standardizing diligence and underwriting templates</p> |  <p>Providing access to financial details on the distributed ledger</p> |
|     |     |     |
| <p><i>FIs must develop a framework that provides guidance for rating and sharing counterparty performance information on the distributed ledger</i></p> | <p><i>FIs must standardize financial attributes to facilitate the automated population of diligence and underwriting templates</i></p> | <p><i>FIs and loan requestors must be willing to store pertinent financial information on the distributed ledger</i></p> |
| <p>Why?</p> <p>Automated syndicate formation relies on a robust counterparty rating system that lead arrangers can leverage for syndicate member selection</p> | <p>Why?</p> <p>The automated population of diligence and underwriting templates requires standardized data fields to move information from one system to another</p> | <p>Why?</p> <p>To facilitate automated syndicate formation, due diligence review and underwriting template creation, pertinent financial details must be accessible through the distributed ledger</p> |
| <p>Challenge</p> <p>Aligning FIs around a single standard for counterparty rating requires an enormous amount of coordination and governance</p> | <p>Challenge</p> <p>The myriad diligence and underwriting collection vehicles across FIs will make alignment around one format difficult</p> | <p>Challenge</p> <p>Given no legal precedent or liability model is established to mitigate the risk of storing proprietary financial information on the ledger, participation is uncertain</p> |



Syndicated Loans

Conclusion

Summary

- **Underwriting automation:** Underwriting activities can be automated, leveraging financial details stored on the distributed ledger
- **Regulatory transparency:** Compliance officials are provided real-time tools to enforce KYC requirements
- **Cost savings:** DLT can provide a global cost reduction opportunity within the process execution and settlement subprocesses of syndicated loans

Outlook

- Applications of DLT within syndicated loans are currently being explored at the proof-of-concept level with a number of incumbents, focusing on:
 - Smart contract settlement and servicing
 - Automated underwriting
- Opportunities exist for FIs to reduce closing-time operational risk and manual activities:
 - Loan funding executed via smart contract
 - Account servicing facilitated via smart contract
 - Automated underwriting activities

Key takeaways

- **Manage loan life cycle via smart contracts:** Syndicated loans can be managed using smart contracts on DLT – KYC verification, due diligence review, underwriting automation, loan funding, payment dissemination, etc. – as the loan moves through the syndicated loan life cycle
- **Execute servicing disintermediation:** Traditionally performed by a third party, closing and servicing activities are executed via smart contract, eliminating third-party fees

Unanswered questions

- **Automated AML activities:** What are the implications of making KYC information more public? Is this a key step to mutualizing KYC information among FIs?

Section 5.4

Deposits and Lending: Trade Finance

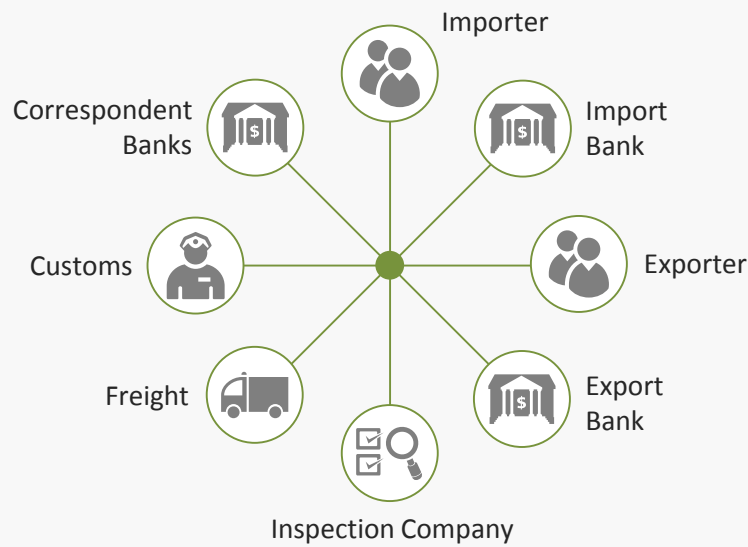
Trade Finance

Introduction

Current-state background

Trade finance is the process by which importers and exporters mitigate trade risk through the use of trusted intermediaries. FIs serve as the trusted intermediary providing assurance to sellers (in the event the buyer doesn't pay) and contract certainty to buyers (in the event that goods are not received). Regardless of counterparty performance, payment and delivery terms (e.g. prepayment, piecemeal or upon delivery) are documented in a letter of credit or open account contract vehicle. FIs command a fee for documentation/oversight of payment terms and for taking on the risk position of either the importer or exporter.

Key ecosystem stakeholders











Overview

- **Financing dominates world trade:** Today's trade operations are facilitated through financing. US\$ 18 trillion of annual trade transactions involve some form of finance (credit, insurance or guarantee)¹
- **The trade finance market is large:** Since financing has become such an integral part of trading, the market has grown substantially to more than US\$ 10 trillion annually¹

DLT has the potential to optimize the regulatory and operations costs of trade finance. This use case highlights the key opportunities in the end-to-end trade finance process

Trade Finance

Key market participants

| Market participant | Role | Description |
|---|-------------------|---|
|  Importer | <i>Core</i> | An entity requesting a cross-border product/service |
|  Import Bank | <i>Core</i> | An FI that assumes risk on behalf of the importer |
|  Exporter | <i>Core</i> | An entity providing the cross-border product/service |
|  Export Bank | <i>Core</i> | An FI that assumes risk on behalf of the exporter |
|  Inspection Company | <i>Supporting</i> | A company that verifies that the goods shipped match those on the invoice |
|  Freight | <i>Supporting</i> | The transport of goods by truck, train, ship or aircraft |
|  Customs | <i>Supporting</i> | The country authority responsible for controlling the flow of goods |
|  Correspondent Banks | <i>Supporting</i> | An FI that provides services on behalf of import/export banks |

Trade Finance

Current-state process depiction



Current-state process description

- | | | |
|---|--|--|
| <p>1 An importer and exporter agree to the sale of a product at a future date and time</p> | <p>5 The export bank provides the exporter with the financing details, which enables the exporter to initiate the shipment</p> | <p>9 Following inspection, the goods are delivered to the importer, which provides a receipt notification to the import bank</p> |
| <p>2 The financial agreement is captured within an invoice, which identifies the quantity of goods sold, price and delivery timeline</p> | <p>6 A trusted third-party organization inspects the goods for alignment with the invoice</p> | <p>10 Upon receiving notification, the import bank initiates the payment to the export bank through the correspondent bank</p> |
| <p>3 The importer provides a bank with a copy of the financial agreement for review</p> | <p>7 Local customs agents within the export country inspect the goods based on the country code</p> | |
| <p>4 The import bank reviews the financial agreement and provides financials on behalf of the importer to a correspondent bank, which has established a relationship with the export bank</p> | <p>8 The goods are transported by freight from <i>Country A</i> to <i>Country B</i> and local customs agents within the import country inspect the goods based on the country code</p> | |

Trade Finance

Current-state pain points



Current-state pain points

- 1 **Manual contract creation:** the import bank manually reviews the financial agreement provided by the importer and sends financials to the correspondent bank
- 2 **Invoice factoring:** exporters use invoices to achieve short-term financing from multiple banks, adding additional risk in the event the delivery of goods fails
- 3 **Delayed timeline:** the shipment of goods is delayed due to multiple checks by intermediaries and numerous communication points
- 4 **Manual AML review:** the export bank must manually conduct AML checks using the financials provided by the import bank
- 5 **Multiple platforms:** since each party across countries operates on different platforms, miscommunication is common and the propensity for fraud is high
- 6 **Duplicative bills of lading:** bills of lading are financed multiple times due to the inability of banks to verify their authenticity
- 7 **Multiple versions of the truth:** as financials are sent from one entity to another, significant version control challenges exist as changes are made
- 8 **Delayed payment:** multiple intermediaries must verify that funds have been delivered to the importer as agreed prior to the disbursement of funds to the exporting bank

Trade Finance

Future-state process depiction



Future-state process description

- 1 Following the sale agreement, the financial agreement is shared with the import bank through a smart contract
- 2 The import bank reviews the arrangement, drafts the terms of the letter of credit and submits it to the export bank for approval
- 3 The export bank reviews the letter of credit; once approved a smart contract is generated to cover the terms and conditions of the letter of credit
- 4 The exporter digitally signs the letter of credit within the smart contract to initiate shipment
- 5 Goods are inspected by a third-party organization and the customs agent in the country of origin (all requiring a digital signature for approval)
- 6 The goods are transported by freight from *Country A* to *Country B* and inspected by local customs agents prior to being received by the importer
- 7 The importer digitally acknowledges receipt of the goods, which initiates payment from the import bank to the export bank via a smart contract

Trade Finance

Future-state benefits


















Future-state benefits

- 1 **Real-time review:** financial documents linked and accessible through DLT are reviewed and approved in real time, reducing the time it takes to initiate shipment
- 2 **Transparent factoring:** invoices accessed on DLT provide a real-time and transparent view into subsequent short-term financing
- 3 **Disintermediation:** banks facilitating trade finance through DLT do not require a trusted intermediary to assume risk, eliminating the need for correspondent banks
- 4 **Reduced counterparty risk:** bills of lading are tracked through DLT, eliminating the potential for double spending
- 5 **Decentralized contract execution:** as contract terms are met, status is updated on DLT in real time, reducing the time and headcount required to monitor the delivery of goods
- 6 **Proof of ownership:** the title available within DLT provides transparency into the location and ownership of the goods
- 7 **Automated settlement and reduced transaction fees:** contract terms executed via smart contract eliminate the need for correspondent banks and additional transaction fees
- 8 **Regulatory transparency:** regulators are provided with a real-time view of essential documents to assist in enforcement and AML activities

Trade Finance

Critical conditions

|  Providing transparency into trade finance agreements |  Enabling interoperability with legacy platforms |  Rewriting regulatory guidance and legal frameworks |
|--|--|---|
|     |     |     |
| <p><i>Bills of lading and invoice details must be transparent within the smart contract to reduce counterparty risk</i></p> | <p><i>To ensure smart contracts containing the details of the financing agreement flow through the trade finance process, FIs and technology providers must ensure the ledger is interoperable with many different platforms</i></p> | <p><i>Agreed upon procedures must be established within the end-to-end trade finance process to provide regulators with a real-time view of bills of lading, letters of credit, etc.</i></p> |
| <p>Why?</p> <p>Ecosystem participants must have a transparent view into invoice and bills of lading details to ensure factoring and double spending are not taking place</p> | <p>Why?</p> <p>The creation of letters of credit/bills of lading and goods inspection documentation requires stakeholders to integrate the developed DLT solution with legacy systems</p> | <p>Why?</p> <p>Compliance officials must have a real-time view of financing details within the smart contract to enforce regulatory guidelines</p> |
| <p>Challenge</p> <p>FIs and shipment carriers must establish procedures and liability models that govern the transparent sharing of financial information</p> | <p>Challenge</p> <p>FIs, customs, freight, importers and exporters utilize multiple technology solutions that may be incapable of interfacing with the ledger</p> | <p>Challenge</p> <p>Given the lack of legal/regulatory precedent, the procedures that facilitate the use of smart contract reporting to regulatory agencies will be difficult to establish</p> |



Trade Finance

Conclusion

Summary

- **Letter of credit automation:** Letter of credit creation can be automated leveraging financial details stored on the distributed ledger
- **Regulatory transparency:** Compliance officials are provided real-time tools to enforce AML and customs activities
- **New product opportunities:** DLT within global trade networks will yield new product opportunities for incumbents (or innovators) around lending and securitization of trade obligations
- **Cost savings:** DLT can yield cost savings associated with letter of credit creation, process automation and fraud reduction

Key takeaways

- **Manage letters of credit via smart contracts:** Letters of credit can be managed using smart contracts on DLT – capturing shipment details, financial information and payment data as the letter of credit moves through the trade finance process
- **Consider correspondent banking disruption:** DLT utilization can fundamentally disrupt the role of correspondent banks as FIs work directly with one another

Outlook

- The application of DLT within trade finance is currently being explored at the proof-of-concept level with a number of incumbents, focusing on:
 - Letters of credit encapsulated in a smart contract
 - Electronic invoice ledger
- Opportunities exist for FIs to reduce counterparty risk and fraud by:
 - Providing transparent invoice factoring
 - Reducing bill of lading double spending via transparent tracking

Unanswered questions

- **Pricing:** What is the impact on financing fees (taking into account the cost of implementation) as correspondent banks are eliminated from the trade finance process?
- **Level of disruption:** how will the import banks and export banks ensure that they are not disrupted by new or existing market participants?

Section 5.5

Capital Raising: Contingent Convertible (“CoCo”) Bonds

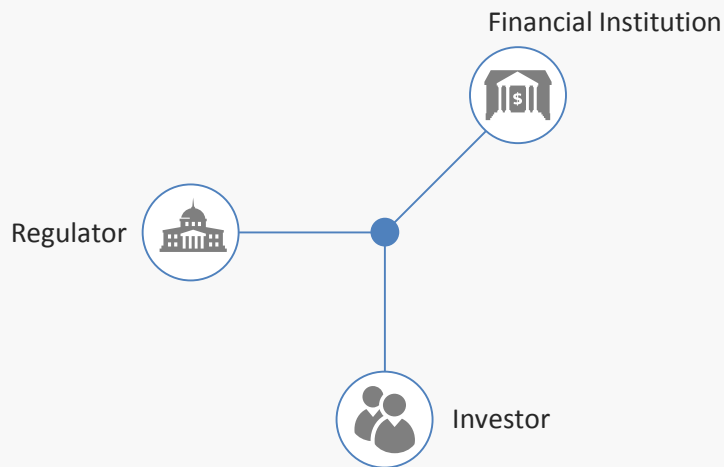
Contingent Convertible (“CoCo”) Bonds

Introduction

Current-state background

Contingent convertible (“CoCo”) bonds are financial instruments that enable banks to increase their capital ratio in case it falls below a predefined threshold. Unlike traditional bonds, “CoCo” bonds provide banks with the ability to convert the bond into equity if a capital ratio condition is met (e.g. bank capital falls below 7.5%) or a discretionary circumstance is determined by the bank/regulators. Today’s banks are responsible for calculating their own capital ratio, and regulators do not have insight unless they request a stress test.

Key ecosystem stakeholders






Overview

- **“CoCo” bond issuance has flatlined:** After experiencing continued double-digit market growth since 2013, issuance flatlined in European markets in 2015
- **A primary concern has been uncertainty:** After being developed as a mechanism to reduce the need for bailouts during financial crises, no “CoCo” bonds have required conversion to equity, making the market largely untested so far
- **Another key concern is the extreme volatility of these instruments:** While yields have been historically high, recent events have had significant impact. High market volatility, fuelled by regulator stress tests in 2016, eliminated all yields within six weeks

DLT has the potential to embed regulation into business processes. This use case highlights key opportunities to reduce volatility and uncertainty regarding this instrument and potentially to increase “CoCo” bond issuance in the future

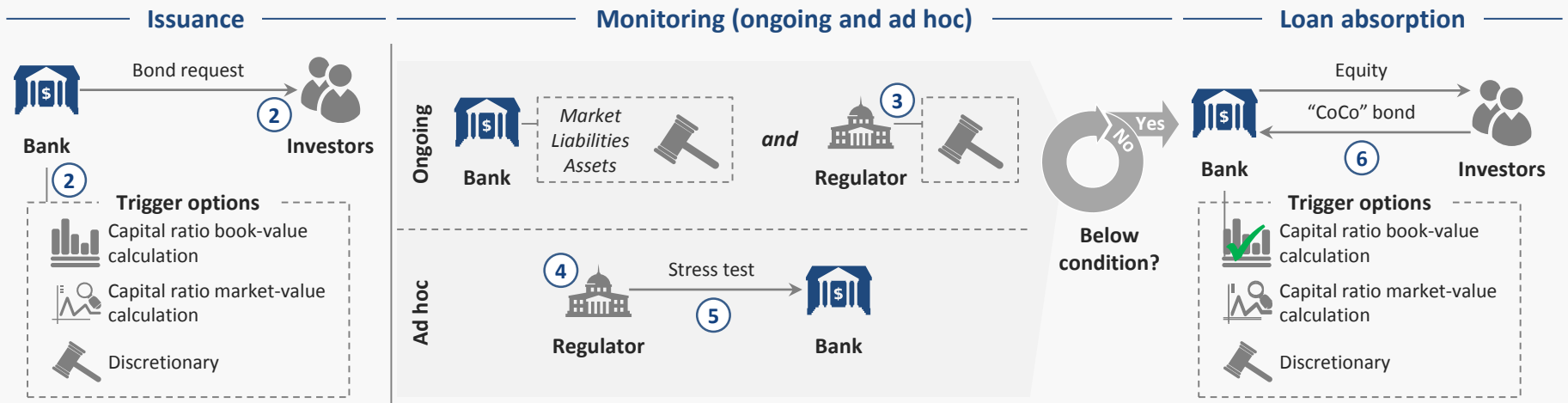
Contingent Convertible (“CoCo”) Bonds

Key market participants

| | Market participant | Role | Description |
|--|------------------------------|-------------------|---|
|  | Financial Institution | <i>Core</i> | The institution that issues "CoCo" bonds and solicits investment from investors |
|  | Investor | <i>Core</i> | The individual and/or institution that agrees to the terms outlined during bond issuance and invests in the asset |
|  | Regulator | <i>Supporting</i> | The entity that ensures market stability; FIs adhere to their predefined loan absorption mechanism criteria |

Contingent Convertible ("CoCo") Bonds

Current-state process depiction

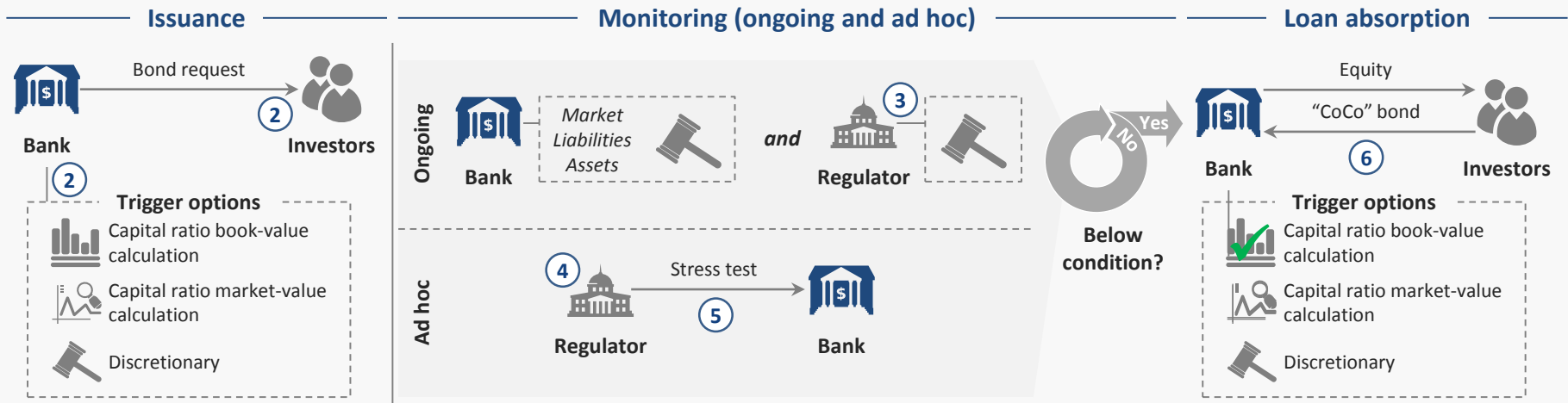


Current-state process description

- 1 To initiate issuance, the bank determines a trigger option through a book-value or market-value calculation (e.g. bank capital falls below 7.5%) to activate loan absorption (conversion of a "CoCo" bond to equity)
- 2 After determining bond attributes (e.g. trigger and maturity date), the bank issues "CoCo" bonds to raise funds from a broad set of investors (including retail, banks, hedge funds and insurance companies)
- 3 The issuing bank and regulator monitor the trigger to determine if loan absorption needs to be activated through two ongoing and one ad hoc mechanisms:
 - a Bank analyses trigger (no frequency mandated by regulator)
 - b Bank and regulator make discretionary decision (e.g. market performance)
 - c Regulator requests point-in-time stress test to assess capital ratio
- 4 If any monitoring mechanism results in requiring loan absorption to be activated (e.g. bank capital falls below 7.5% or discretionary action is taken), the "CoCo" bond is converted into equity at a predetermined conversion rate

Contingent Convertible ("CoCo") Bonds

Current-state pain points

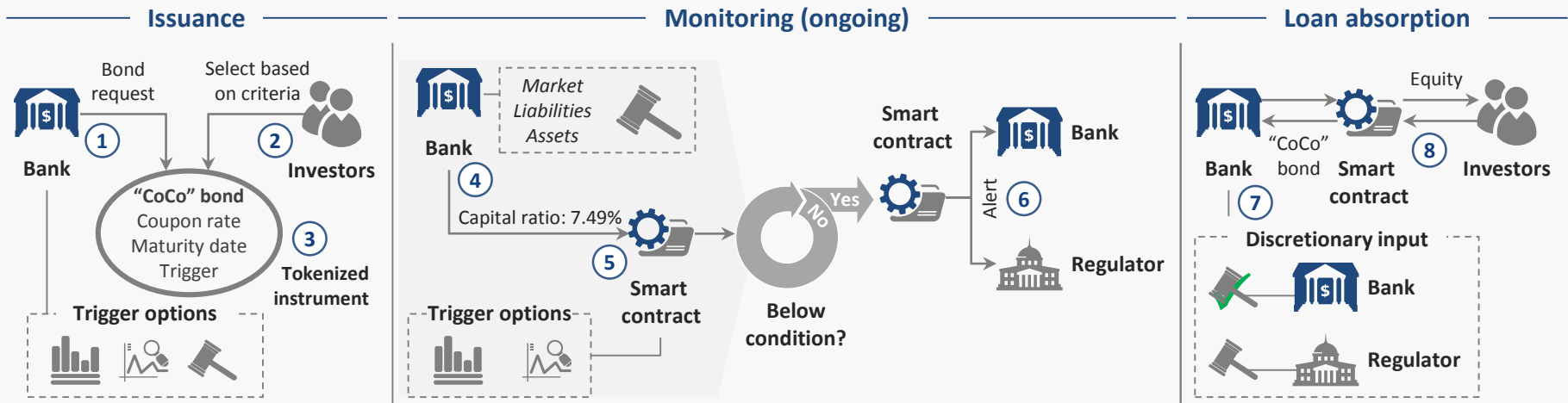


Current-state pain points

- Limited participation:** limited rating information within the "CoCo" bonds market limits participation from large institutional investors
- Inconsistent trigger calculation methods:** banks can complete capital ratio analyses through book-value (using internal models) or market-value (comparing stock market capitalization to assets) calculations
- Ambiguity:** regulators lack insight into capital ratio (aside from requesting point-in-time stress tests) and whether loan absorption may need to be activated in the future
- Lack of real-time reporting:** regulators must rely on public-facing, point-in-time stress tests to assess the health of the banks and "CoCo" bonds market
- Market fear:** bank equities are susceptible to extreme volatility as investors fear stress test results
- Delayed activation time:** since trigger condition calculation frequency is not regulated (e.g. bank capital ratios may be calculated quarterly), "CoCo" bonds may not be converted into equity immediately after the condition is met

Contingent Convertible (“CoCo”) Bonds

Future-state process depiction

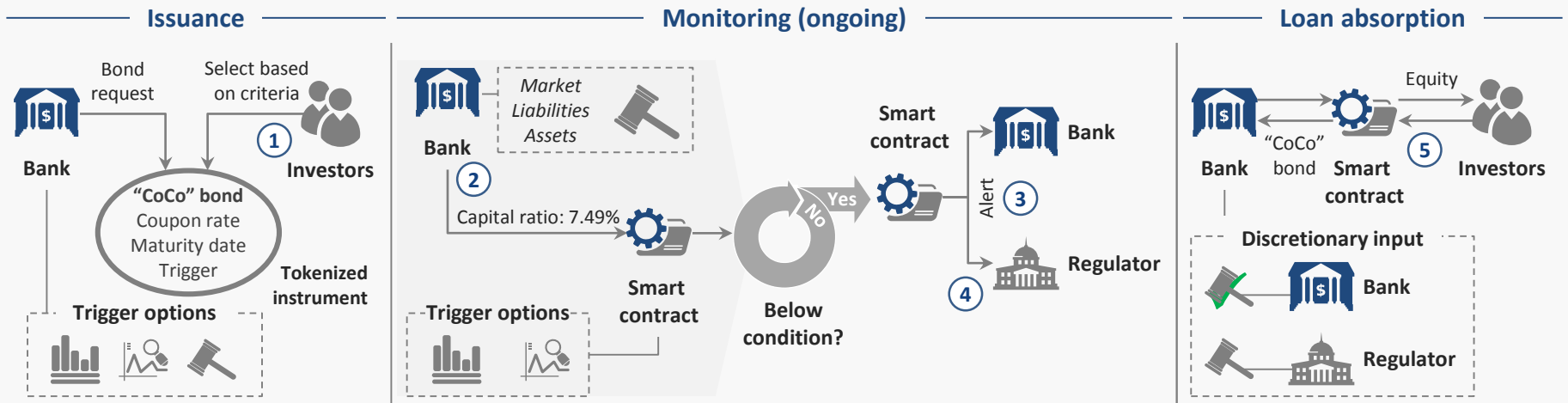


Future-state process description

- 1 Similar to the current state, the issuing bank determines the trigger option through a book-value or market-value calculation to activate loan absorption, and initiates bond issuance
- 2 The bank issues a tokenized “CoCo” bond to raise funds from investors, utilizing the record-keeping functionality of DLT
- 3 The tokenized bond includes key attributes, including a loan absorption trigger, issuing bank, coupon rate and maturity date
- 4 The bank analyses the current capital ratio to determine if loan absorption needs to be activated
- 5 The latest calculation is added directly to the tokenized asset for the bond, providing investors and regulators with transparency into the status of their issued “CoCo” bonds
- 6 If the trigger is reached, regulators and bank leadership are notified in real time through a smart contract
- 7 After a bank or regulator provides discretionary input into conversion (can be automated in the future), loan absorption can be activated through a smart contract
- 8 The “CoCo” bond is converted into equity at a predetermined conversion rate

Contingent Convertible ("CoCo") Bonds

Future-state benefits


















Future-state benefits

- 1 **Increased participation:** up-to-date capital ratio information stored within DLT can increase confidence and lead to developing a "CoCo" bond rating system, enabling large institutional investors to participate within the market
- 2 **Improved calculations:** integrating capital ratio calculations directly into DLT can improve data input maturity and calculation frequency across banks
- 3 **Real-time reporting:** regulators can be notified in real time through a smart contract if a "CoCo" bond trigger is reached
- 4 **Reduced stress tests:** since regulators have access to a bank's capital ratio in real time, bank equity volatility can be reduced as the likelihood for point-in-time stress tests decreases
- 5 **Real-time activation time:** since the frequency of the trigger calculation and reporting increases through DLT, the time to convert a "CoCo" bond into equity after the condition is met significantly reduces

Contingent Convertible (“CoCo”) Bonds

Critical conditions

|  Standardizing attributes for soliciting investment |  Streamlining trigger calculations across FIs |  Developing processes to act on real-time trigger notifications |
|--|--|---|
|     |     |     |
| <p><i>Regulators across markets must initiate conversations with FIs that issue “CoCo” bonds to develop standardized attributes that can be used by investors to make data-driven investment decisions</i></p> | <p><i>Regulators must impose standards for FIs to streamline their methodologies behind trigger calculations, and the frequency that results will be entered into the tokenized “CoCo” bond instruments</i></p> | <p><i>Regulators and bank leadership must develop the business processes required to act on real-time trigger notifications to determine if loan absorption should be activated at that FI and across the market</i></p> |
| <p>Why?</p> <p>Data fields and templates must be standardized to tokenize “CoCo” bonds across FIs within the distributed ledger</p> | <p>Why?</p> <p>Investor confidence in “CoCo” bonds can only increase if standardization exists within the calculation process and, subsequently, loan absorption</p> | <p>Why?</p> <p>Since the viability of “CoCo” bonds is in question due to loan absorption, transparency is required in order for investors to continue investments</p> |
| <p>Challenge</p> <p>Each market requires different data to be provided when issuing “CoCo” bonds; data field units are currently not standardized across FIs</p> | <p>Challenge</p> <p>Each FI currently calculates trigger values independently and with varying degrees of automation</p> | <p>Challenge</p> <p>Regulators may require a significant process overhaul since they are traditionally restricted to point-in-time stress tests to analyse an FI’s capital ratio</p> |



Contingent Convertible (“CoCo”) Bonds

Conclusion

Summary

- **Improved monitoring:** Ongoing monitoring can be standardized across FIs while ensuring that regulators receive real-time notifications of impending loan absorption activation
- **Increased investor confidence:** Ensuring that processes exist to improve visibility into monitoring and loan absorption will increase investor confidence and, potentially, participation

Outlook

- No significant applications of DLT within the “CoCo” bond life cycle have been reported or discussed within blockchain research released to date
- While benefits associated with process execution and reporting costs exist, a majority of benefits are ancillary and focused on improving market stability
- Opportunity exists for regulators to push standardized capital ratio calculations across FIs and to reduce volatility associated with requesting point-in-time stress tests

Key takeaways

- **Ensure educated and empowered investors:** Tokenized bond instruments can enable investors to make informed, data-driven decisions; improved monitoring processes can reduce market uncertainty
- **Allow point-in-time stress tests to become irrelevant:** Smart contracts can alert regulators when loan absorption needs to be activated, while ensuring that “over-reporting” is not a concern

Unanswered questions

- **Business drivers:** Since loan absorption is an indication that a broader crisis may be taking place, is reduced market volatility enough of a driver to warrant investment?

Section 5.6

Investment Management: Automated Compliance

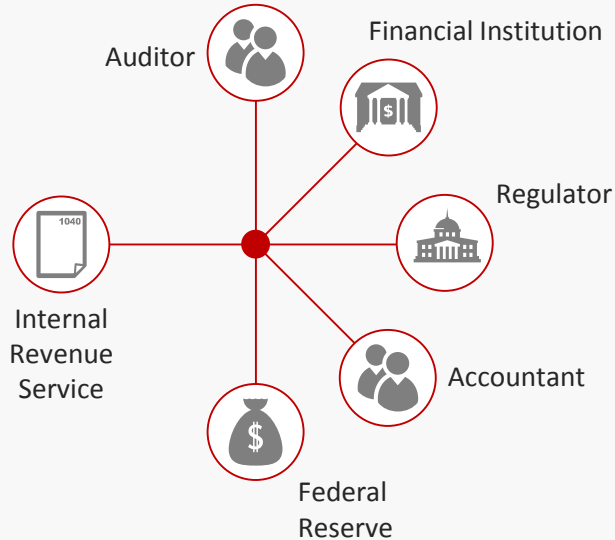
Automated Compliance

Introduction

Current-state background

FIs are responsible for complying with and reporting on a multitude of regulatory requirements. These activities may be executed internally by a functional area within the organization or via a third party. Audit, tax, CCAR and routine Securities and Exchange Commission (SEC) filing (10K/10Q) are just a few compliance-related activities that add additional cost to FIs' annual spend.

Key ecosystem stakeholders









Overview

- **Compliance costs are high:** Compliance activities are a major portion of the cost overhead FIs deal with. In 2014 the largest FIs spent US\$ 4 billion in compliance-related activities¹
- **Auditing costs are high:** Auditing represents one of the largest annual compliance costs for FIs. On average, public companies paid in excess of US\$ 7.1 million in audit fees in 2013²

DLT has the potential to increase operational efficiencies and provide regulators with enhanced enforcement tools. This use case focuses on the key opportunities in the financial statement audit process to highlight an automated compliance solution

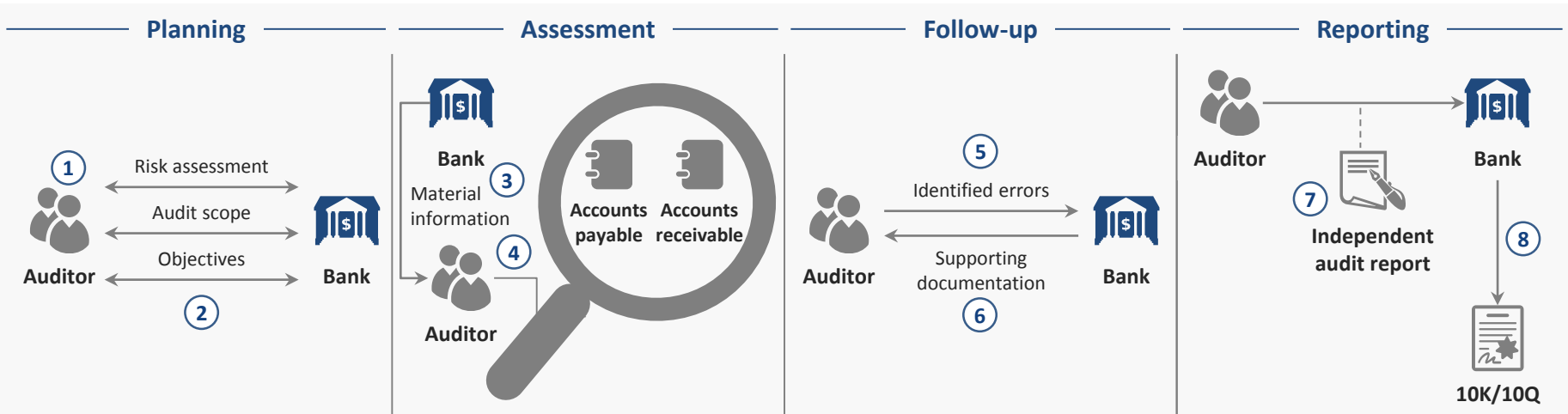
Automated Compliance

Key market participants

| Market participant | Role | Description |
|---|-------------------------------|--|
|  Auditor | <i>Core</i> | Individual(s) who perform(s) the financial statement examination and provide(s) reasonable assurance of the financials via the audit opinion |
|  Financial Institution | <i>Core</i> | An entity providing the financial statements and requesting the audit opinion |
|  Regulator | <i>Supporting</i> | A monitor who verifies adherence to audit activities (e.g. the CCAR regulator is responsible for verifying requisite capital is on hand to conduct operations) |
|  Accountant | <i>Additional participant</i> | Individual(s) responsible for reviewing, preparing and filing the tax statements on behalf of the FI |
|  Federal Reserve | <i>Additional participant</i> | The US government organization responsible for supervising and regulating banking institutions |
|  Internal Revenue Service | <i>Additional participant</i> | The US government organization responsible for tax collection and tax law enforcement |

Automated Compliance

Current-state process depiction

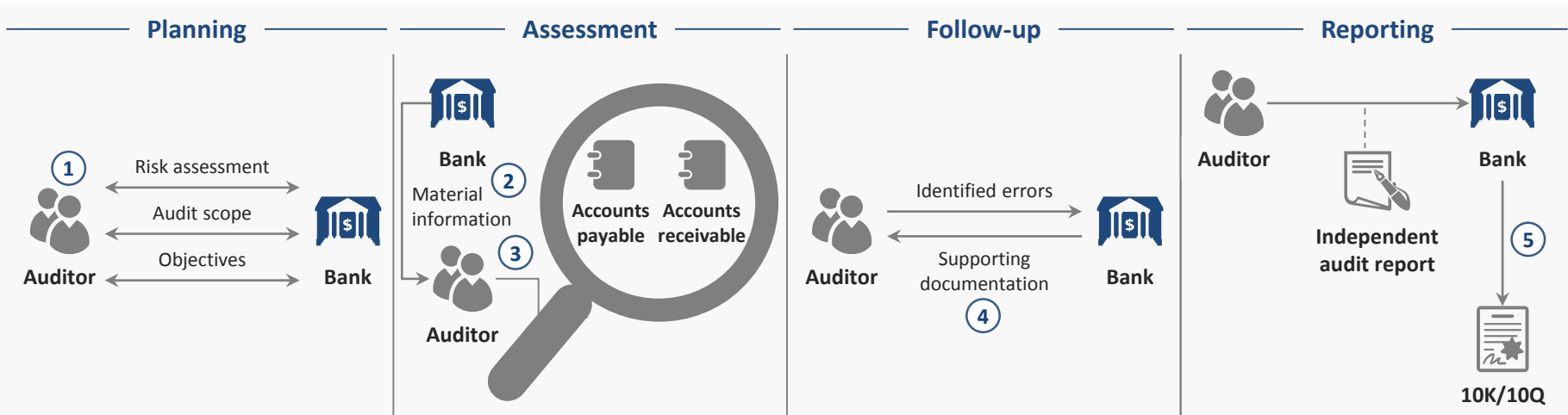


Current-state process description

- | | | | |
|---|--|---|---|
| <p>① Annually, auditors coordinate with the bank to perform the required audit of financial statements</p> <p>② Members of the audit team work directly with the bank to perform an initial risk assessment and align on the scope, objectives, timing and resources required</p> | <p>③ The bank provides the audit team with copies of financially material data and access to the systems that enable analyses to be conducted</p> <p>④ Auditors evaluate the information provided for completeness and conduct tests for accuracy in parallel to performing the evaluation</p> | <p>⑤ Throughout the process, auditors work directly with the leadership and representatives from the bank to address identified errors within the data and testing exceptions</p> <p>⑥ As exceptions are identified, the audit team requests additional information to determine the depth of the concern</p> | <p>⑦ At the conclusion of the evaluation, the audit team releases an opinion of the overall financial health of the bank in the form of an independent audit report</p> <p>⑧ The bank uses the results of the report to populate its quarterly and annual filings (10K/10Q)</p> |
|---|--|---|---|

Automated Compliance

Current-state pain points

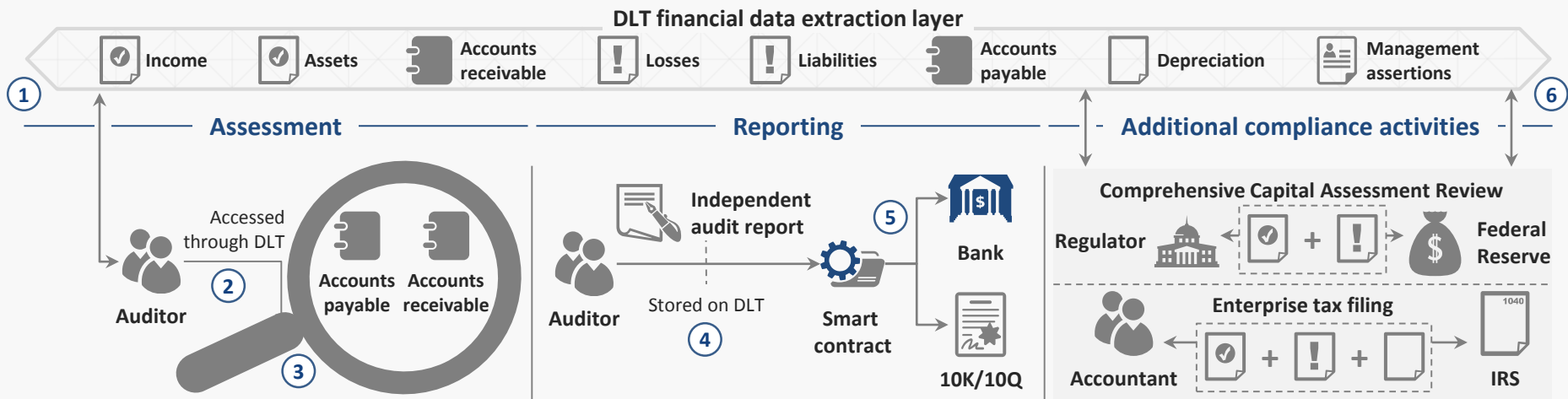


Current-state pain points

- 1 Resource-intensive:** scope formation, risk assessment and audit planning require representatives from multiple functional areas, reducing productivity as individual employees cannot complete their daily activities
- 2 Time-intensive review:** pulling sample data for audit review is time-intensive and inefficient due to dependency on manual activities
- 3 Lack of technology integration:** information is copied from source systems and provided to auditors, adding inefficient manual processes that increase the likelihood of errors
- 4 Resource-intensive:** exception and error follow-up requires additional interaction with representatives from multiple functional areas, further reducing productivity
- 5 Lack of technology integration:** information provided in the independent audit report does not feed directly into quarterly and annual filings (10K/10Q), duplicating efforts

Automated Compliance

Future-state process depiction

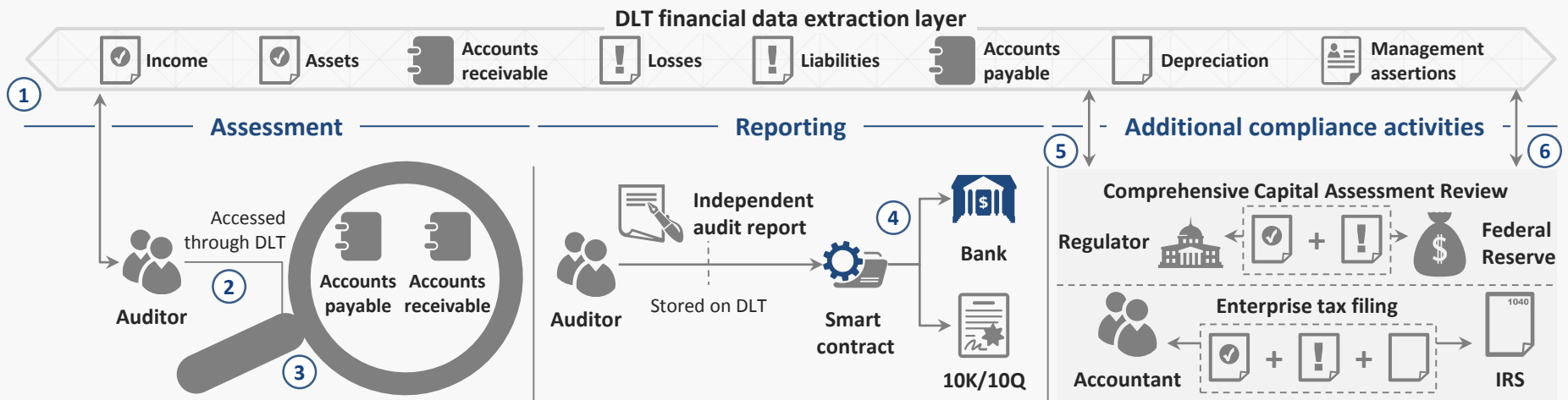


Future-state process description

- ① Financially material information is accessible to auditors in real time through the use of a financial DLT enabled data extraction layer
Since auditors have authorized access to this data, representatives and leadership of the bank do not need to be involved with audit planning and data distribution
- ②
- ③ The audit team performs an audit evaluation using data directly from the DLT, eliminating errors generated from manual activity and the requirement for follow-up
- ④ Auditors develop the independent audit report and store it on the DLT for real-time access by the bank and regulator
- ⑤ A smart contract facilitates the movement of information from the audit report to financial reporting instruments, minimizing duplicate efforts
- ⑥ In the future, DLT is uniquely positioned to seamlessly execute and automate compliance activities such as:
 - Comprehensive Capital Assessment Review (pictured)
 - Enterprise tax filing (pictured)
 - Real time tasks for trading in financial instruments (e.g. insider trading)
 - Processing information about new regulatory developments

Automated Compliance

Future-state benefits



Future-state benefits

- 1 **Data transparency:** enabling data stored within financial systems to be accessible via DLT through the financial data extraction layer provides immutable and transparent records that are updated in real time
- 2 **Automated review:** financial information accessible via DLT enables an automated review via audit software, reducing the time and resources required to perform these activities
















- 3 **Reduced errors:** audit teams have authorized access to financial data, eliminating errors generated by manual activities and streamlining the update process
- 4 **Integrated systems:** reporting activities executed via DLT facilitates the creation of quarterly and annual filings, reducing duplicate efforts

In the future, DLT can enable additional compliance activities to be seamlessly executed through automation:

- 5 The bank provides Federal Reserve officials with authorized access to facilitate automated capital analysis and store results on DLT
- 6 The bank provides tax accountants with authorized access to real-time financial data to facilitate tax calculations and automate IRS tax payments

Automated Compliance

Critical conditions

|  Providing compartmentalized access to data |  Automating faster and efficient enforcement of regulations |  Enabling interoperability with legacy platforms |
|--|--|---|
|     |     |     |
| <p><i>The DLT solution must ensure access can be authorized at the financial category level (e.g. assets, liabilities, etc.)</i></p> | <p><i>FIs and regulators must transition to a real-time cadence for sharing financially material information</i></p> | <p><i>Legacy platforms of FIs and regulatory agencies must be capable of feeding data directly into and extracting data from the distributed ledger</i></p> |
| <p>Why?</p> <p>To mitigate risk, external users should only have access to financial data that is material to their compliance activity</p> | <p>Why?</p> <p>Providing regulators with real-time transparent access to financial data enables the regulatory enforcement of compliance-related activities</p> | <p>Why?</p> <p>To facilitate process automation, technology platforms must be capable of transmitting and receiving data on the distributed ledger</p> |
| <p>Challenge</p> <p>Current DLT solutions authorize access to the ledger as a whole and do not provide the capability to partition access</p> | <p>Challenge</p> <p>Given no legal/regulatory precedent, establishing a shared arrangement between the regulator and FIs will be arduous</p> | <p>Challenge</p> <p>FIs and regulatory agencies use multiple technology solutions that may be incapable of interfacing with the ledger</p> |



Automated Compliance

Conclusion

Summary

- **Process automation:** Audit examination activities are executed via automated audit software, dramatically reducing the time and resources required to perform the audit
- **Regulatory transparency:** Audit officials are authorized access to pertinent financial information to execute the audit examination
- **Cost savings:** DLT can provide major cost savings in process execution and reporting

Key takeaways

- **Audit continuously:** The convergence of automated audit software and access to real-time financial information facilitate continuous auditing, which provides greater confidence in the financial health of the organization
- **Extract financial data:** Financial information stored on a distributed layer facilitates the automated execution of additional compliance activities (e.g. CCAR, tax filing, etc.)

Outlook

- Applications of DLT within automated compliance are currently being explored at the proof-of-concept level with a number of incumbents, focusing on:
 - Continuous auditing
 - AML/KYC verification
 - Automated tax filing
- Opportunities exist for FIs to reduce headcount and manual activities:
 - Eliminating planning/follow-up activities
 - Automating assessment/reporting activities

Unanswered questions

- **Continuous auditing:** Will more frequent financial statement audits (potentially continuous) have adverse effects on investor decisions?

Section 5.7

Investment Management: Proxy Voting

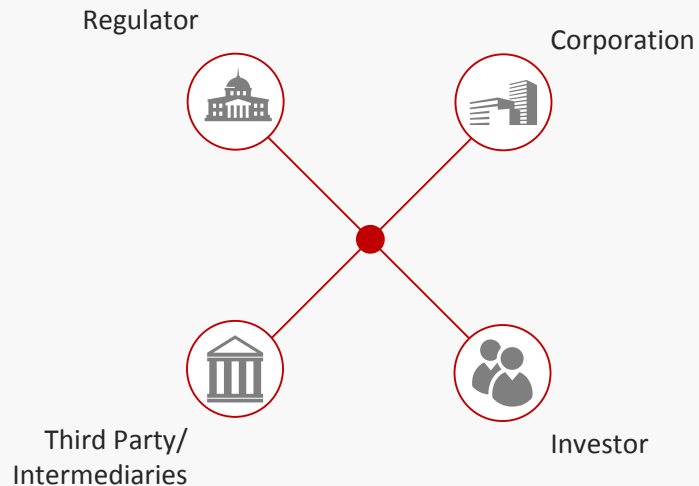
Proxy Voting

Introduction

Current-state background

Proxy voting facilitates remote investor voting on topics discussed during annual corporate shareholder meetings without requiring attendance. To ensure investors are able to make an informed decision, corporations are responsible for distributing proxy statements. Currently, a third party is responsible for delivering these statements to investors in partnership with intermediaries that track order execution. Investors conduct a manual analysis before casting their vote directly to the third party.

Key ecosystem stakeholders



Overview





- **Retail investor participation is low compared to institutional investor participation:** On average, institutions voted 83% of their shares, while retail investors voted 28% of their shares¹
- **As a result, significant participation in elections is lacking each year:** From 1 July to 31 December 2015, approximately 24 billion shares remained “un-voted” as a result of this turnout¹
- **Efforts are being launched to improve retail participation:** As investor activism strengthens, leadership is recognizing the need to engage all shareholders throughout the voting process

DLT has the potential to transfer value irrefutably. This use case highlights the key opportunities to improve retail investor participation in proxy voting

1. ProxyPulse: First Edition 2016, ProxyPulse.

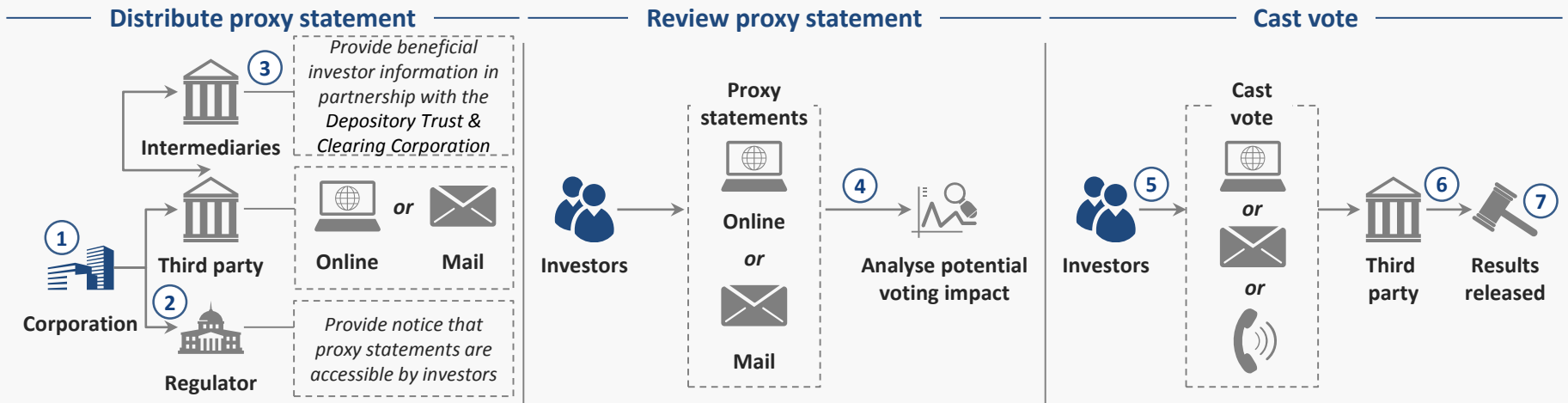
Proxy Voting

Key market participants

| Market participant | Role | Description |
|--|-------------------|--|
|  Corporation | <i>Core</i> | The publicly traded entity that would like to improve proxy voting response rates by implementing a DLT solution |
|  Investor | <i>Core</i> | An individual and/or institution that participates in the voting process by receiving proxy statements and casting a vote via phone, mail or online channels |
|  Third Party/Intermediaries | <i>Supporting</i> | Entities that facilitate the proxy voting process, while ensuring that statements are distributed to all beneficial investors |
|  Regulator | <i>Supporting</i> | A monitor who ensures proxy statements are distributed to all investors and the voting process is completed without any illegal or suspicious activity |

Proxy Voting

Current-state process depiction

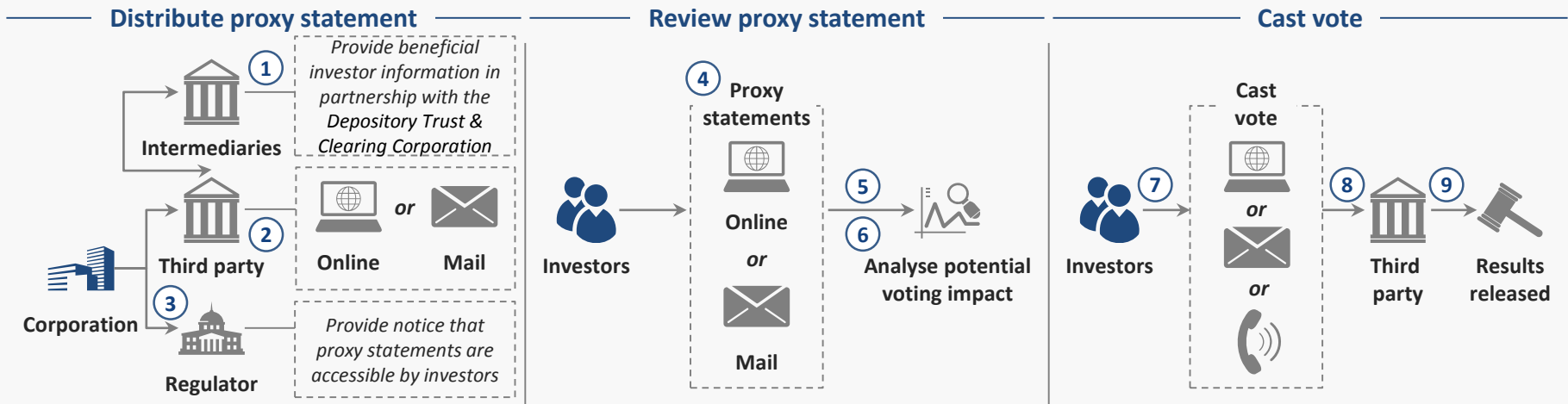


Current-state process description

- 1 The corporation develops a proxy statement internally in partnership with various teams, including general counsel and accounting
- 2 The corporation simultaneously provides a third-party organization with the documents to distribute to shareholders (via online and mail) and notifies the regulator that the proxy statement is available
- 3 The third-party organization works with intermediaries to obtain beneficial investor information that may not be available
- 4 Investors analyse the proxy statement to determine the potential impact of the votes being solicited during a corporation's shareholder meeting
- 5 Investors cast their vote directly to the third-party organization either online or by mail or phone
- 6 Results are not shared with investors or the corporation throughout the voting process
- 7 During the shareholder meeting, votes cast by attendees are aggregated with those submitted by proxy and announced

Proxy Voting

Current-state pain points

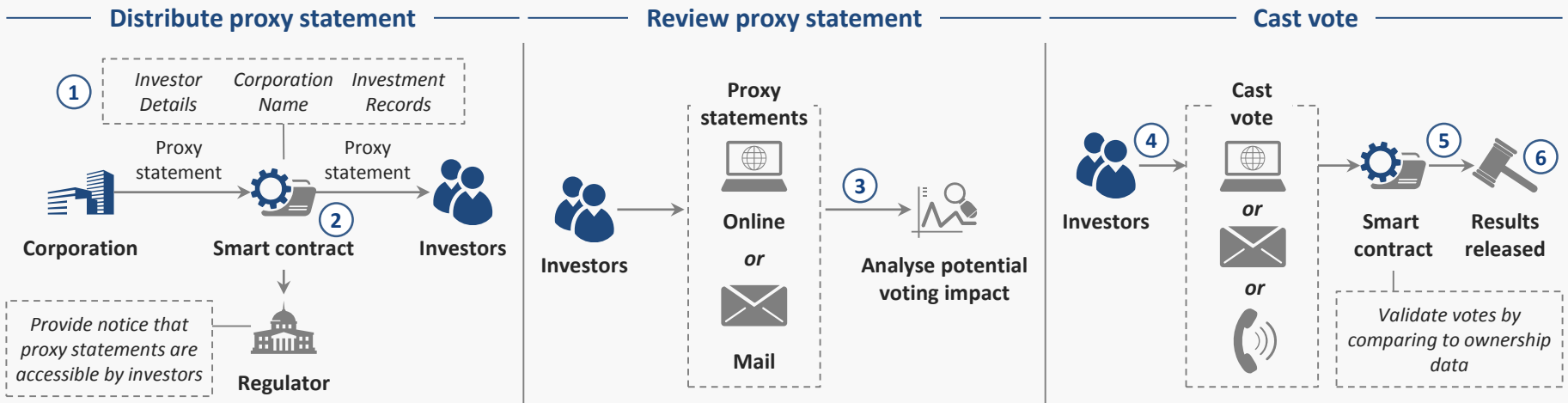


Current-state pain points

- 1 **Ambiguity:** a single view into the total population of registered and beneficial investors does not exist without intermediaries
- 2 **Costly distribution process:** since the online portal for statement distribution can only occur if an investor has “opted-in”, significant print and mail expenses are incurred
- 3 **Limited distribution:** depending on the market, proxy statements cannot be shared with institutional investors, restricting the number of potential votes that can be cast
- 4 **Misleading representation:** summaries within proxy statements can provide a misleading view into a corporation’s health
- 5 **Error prone:** in some cases, minor data errors are uncovered by institutional investors conducting detailed analyses
- 6 **Manual intensive process:** given the length and unstructured format of proxy statements, investors have to manually determine the information that will help facilitate an informed decision
- 7 **Minimal retail investor participation:** in the United States (and other countries worldwide), a majority of shares owned by retail investors go unvoted each year
- 8 **Lack of transparency:** the corporation and voters do not receive insight into the process until they are made available by the third party
- 9 **Voting discrepancies:** the number of shares held by investors may differ from the number of votes cast; depending on the regulation, these votes are either adjusted or not counted

Proxy Voting

Future-state process depiction



Future-state process description

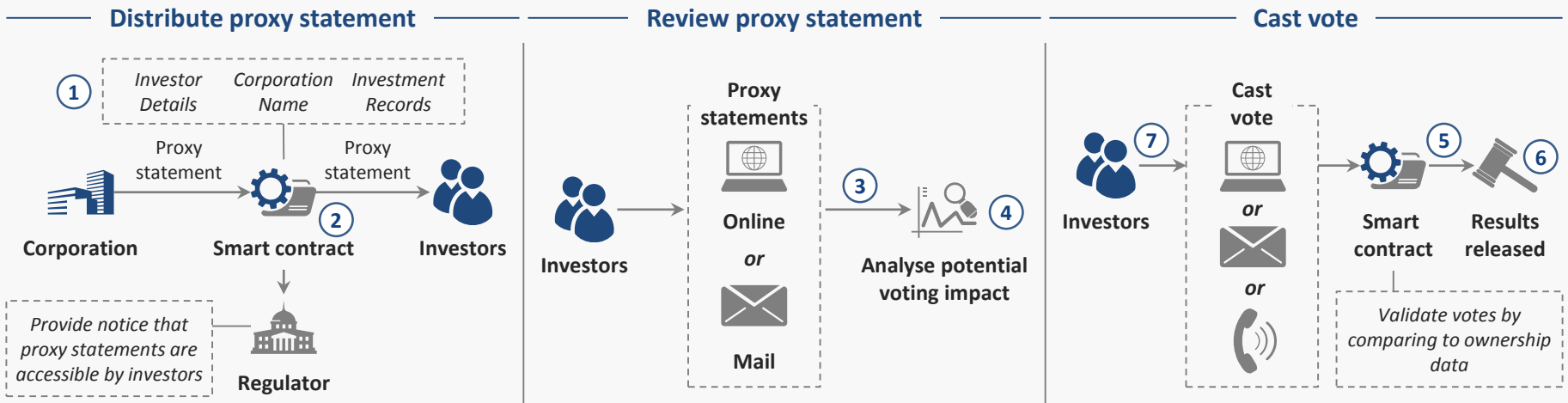
- 1 As orders are executed to invest in a corporation's equity, DLT stores investment records including the number of shares
- 2 After a corporation has finalized its proxy statement, a smart contract ensures that it is sent to all investors (via an online portal or mail) and the regulator is notified that the documents are available

- 3 Investors analyse the proxy statement to determine the potential impact of the votes being solicited during a corporation's shareholder meeting through DLT's transfer of value capability

- 4 Investors cast their vote either online or by mail or phone directly into the DLT as a tokenized asset through back-end infrastructure integration
- 5 A smart contract ensures votes are valid by comparing the number of votes cast to ownership data
- 6 Results are shared with the corporation and/or investors in real time or during a shareholder meeting

Proxy Voting

Future-state benefits









Future-state benefits

- 1 **Disintermediation:** since all investment records are stored on DLT, partnerships with a third-party organization and intermediaries are not required; a smart contract can notify regulators of proxy statement availability and ensure distribution to investors
- 2 **Streamlined distribution process:** DLT can reduce the costs associated with printing and mailing proxy statements (difficult to compute savings since investor must “opt-in”)
- 3 **Improved accessibility and participation:** DLT can increase the mechanisms that can be used to access proxy statements (e.g. native mobile applications)
- 4 **Future automated analyses:** in the proposed future state, the current proxy statement format will continue to be distributed to investors, but future implementation can enable investors to conduct personalized, automated analyses
- 5 **Automated validation:** smart contracts can ensure that voting is aligned to share ownership at the time of the vote
- 6 **Increased transparency:** depending on requirements, voting data could be made available to the corporation and/or voters in real time
- 7 **Improved accessibility and participation:** DLT can increase mechanisms used to cast votes (e.g. native mobile applications)

Proxy Voting

Critical conditions

| | | |
|---|---|--|
|  <p>Storing investment records on a distributed ledger</p> |  <p>Integrating legacy voting mechanisms into tokens</p> |  <p>Collaborating across actors to ensure success</p> |
|  |  |  |
| <p><i>Corporations and/or exchanges must store all investment records on a distributed ledger in order to identify beneficial investors without the need for intermediaries</i></p> | <p><i>To ensure investors have a broad set of mechanisms to cast votes, systems will need to be developed to convert votes cast via mail or phone into tokens that can be stored on the distributed ledger</i></p> | <p><i>Corporations may choose to partner among each other and/or exchanges to minimize parallel development, while providing investors with confidence that the voting system is not susceptible to corruption</i></p> |
| <p>Why?</p> <p>Third parties currently work directly with central securities depositories to ensure investors are engaged appropriately throughout the process</p> | <p>Why?</p> <p>Proxy voting must be accessible by investors across demographics to ensure no discriminatory consequences exist during the process</p> | <p>Why?</p> <p>If each corporation develops a voting solution, investors will not be able to standardize analysis across investments; conflict of interest concerns may exist</p> |
| <p>Challenge</p> <p>Ensuring that all investment records are stored on a distributed ledger with corresponding digital identities will require industry discussion regarding whether equity post-trade activities should also be facilitated through DLT</p> | <p>Challenge</p> <p>To ensure no manual processes exist while converting votes cast via mail into tokens, creative solutions will need to be developed to read voter responses autonomously and with complete accuracy</p> | <p>Challenge</p> <p>Process and liability models must be established to outline alternative procedures in the event the smart contract does not successfully validate and/or count votes</p> |



Proxy Voting

Conclusion

Summary

- **Streamlined distribution:** Smart contract technology reduces manual processes associated with proxy statement distribution, reducing the time and manpower required to perform the process
- **Automated reconciliation:** Smart contract technology prevents investors from casting more votes than the shares they own and provides real-time updates for error correction, potentially increasing the total number of counted votes

Outlook

- Applications of DLT within proxy voting are currently being explored at the proof-of-concept level by incumbent exchanges:
 - NASDAQ
- Opportunities exist for FIs to improve participation and accessibility to:
 - Proxy statements
 - Vote casting mechanisms

Key takeaways

- **Ensure voting transparency:** The potential exists for DLT to provide a transparent view of voting data during annual shareholder meetings
- **Provide central authority disintermediation:** Investment records stored on the distributed ledger and proxy statements disseminated via smart contract technology eliminate the need for third-party intermediaries and associated fees

Unanswered questions

- **Cost vs benefits:** When voting operations are executed faster and at lower cost, will voting frequency increase? Additionally, will this change the relationship between companies and activist investors?

Section 5.8

Market Provisioning: Asset Rehypotheccation

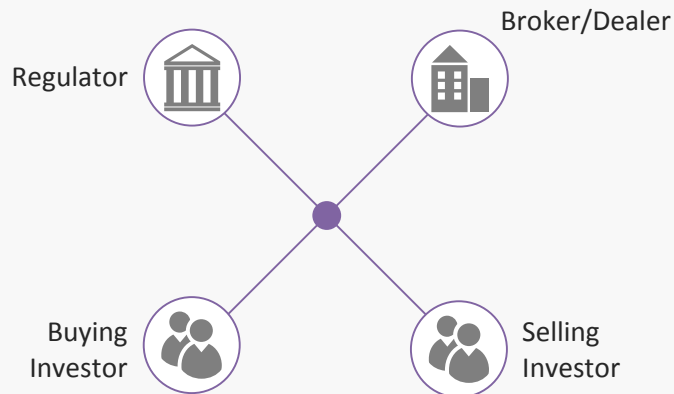
Asset Rehypothecation

Introduction

Current-state background

Asset rehypothecation is a common practice in which FIs securitize existing collateral to reduce the cost of pledging collateral in subsequent trades. As assets are rehypothecated, ownership structures and asset composition can become ambiguous due to the lack of clear transaction and ownership history, exacerbating counterparty risk and asset valuation uncertainty. Regulatory constraints are designed to limit the extent to which an asset can be rehypothecated, but without a mechanism for tracking transaction history, enforcement is not possible.

Key ecosystem stakeholders







Overview

- **The secondary trading market is large:** Secondary trading has become an extremely common practice, driving its volume in the US loan market to US\$ 628 billion in 2014¹
- **Secondary market trading is increasing:** Although the secondary trading market is already substantially large, it continues to grow; between 2013 and 2014 secondary trading volume increased by 21%¹

DLT has the potential to optimize the regulatory components of asset rehypothecation. This use case highlights the key opportunities to improve information transfer in the end-to-end broker/dealer process

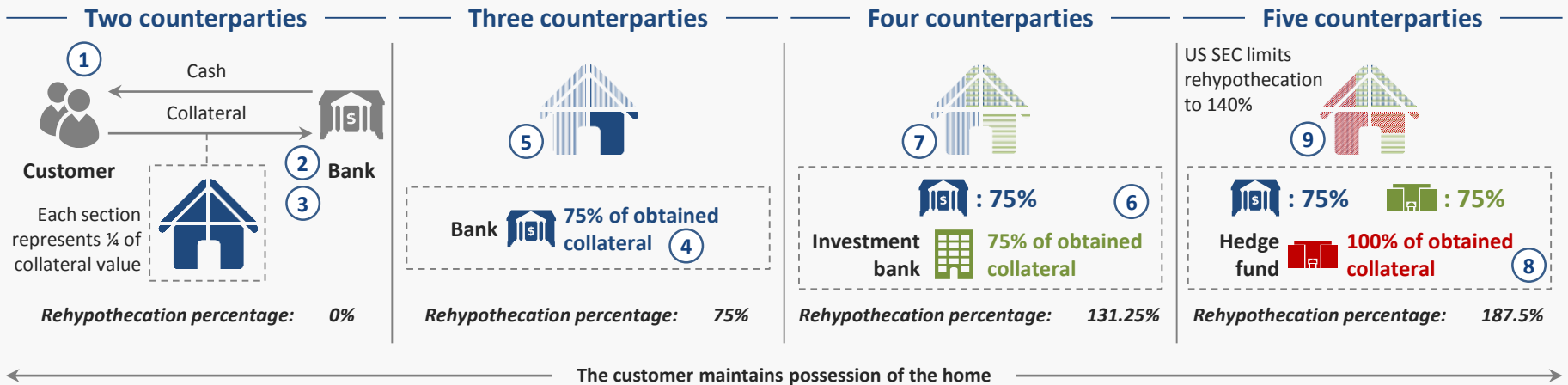
Asset Rehypothecation

Key market participants

| Market participant | Role | Description |
|--|-------------------|--|
|  Broker/Dealer | <i>Core</i> | An entity that assists investors in buying or selling securities |
|  Selling Investor | <i>Core</i> | An entity or individual attempting to sell the security |
|  Buying Investor | <i>Core</i> | An entity or individual attempting to purchase the security |
|  Regulator | <i>Supporting</i> | A monitor that verifies adherence to regulatory requirements |

Asset Rehypothecation

Current-state process depiction

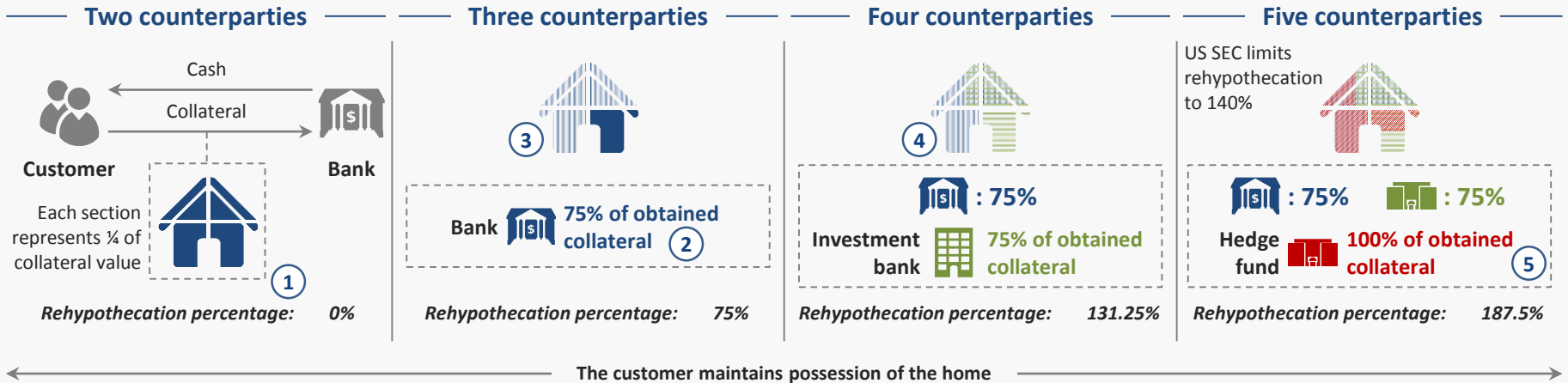


Current-state process description

- 1 A customer acquires a loan from a bank to purchase a home
- 2 In exchange, the customer provides the bank with the house as collateral and authorizes rehypothecation to improve the rate
- 3 During the mortgage repayment period, the bank may use the house as collateral in subsequent transactions
- 4 The bank securitizes a portion (75% within the example) of the mortgage debt along with other mortgages and sells it to an investment bank
- 5 The investment bank now has 75% of the house value in collateral that can be used in subsequent trades
- 6 The investment bank repackages the debt obtained (75% of 75% within the example) into a security (e.g. mortgage-backed), which is further divided into tranches and sold to a hedge fund based on its risk appetite
- 7 The hedge fund has now secured 56.25% of the original house value (that can be used in subsequent trades)
- 8 The hedge fund uses a broker/dealer to sell a derivative in over-the-counter markets, where the underlying asset is the rehypothecated percentage obtained (100% of 75% of 75% within the example)
- 9 The ownership and collateral value becomes ambiguous, creating a scenario where the total value pledged far exceeds origination

Asset Repothecation

Current-state pain points

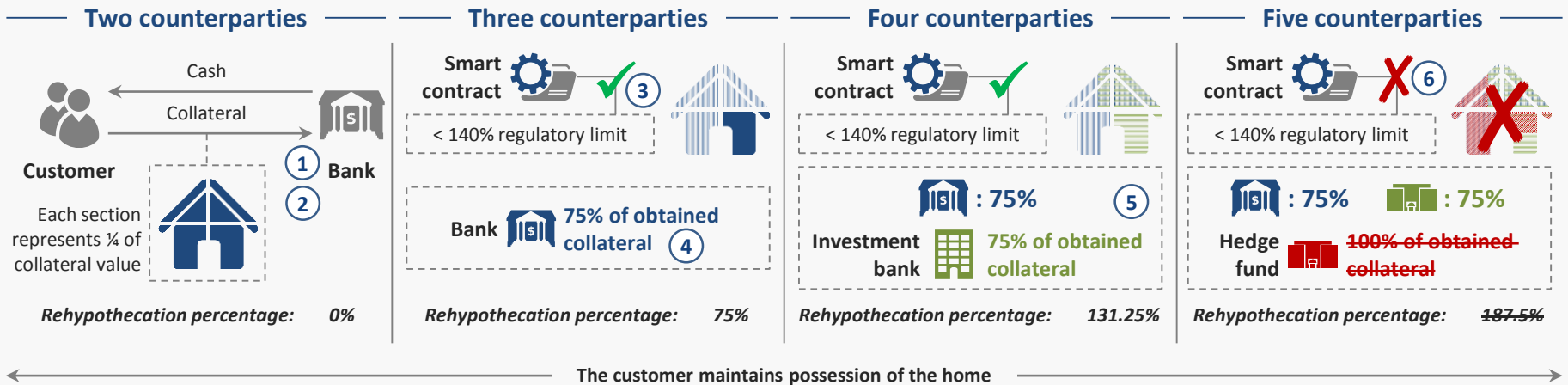


Current-state pain points

- Lack of regulatory reporting:** within secondary trading markets, reporting requirements do not detail the transaction history of the asset (e.g. purchase price, purchase date and loan originator) or other counterparties with claims to the asset
- Counterparty risk:** investors lack insight into additional counterparties with ownership claims to the asset
- Lack of transparency:** regulators do not have the ability to track securities as they are rehypothecated in the market, making enforcement of regulator limits nearly impossible
- Security value ambiguity:** since a detailed transaction history is not maintained, each trade leveraging a percentage of the collateral makes it more difficult to determine the true value of the asset
- Systematic failure:** if default occurs with any of the players, a part or even the entire transaction chain is affected, which may have unintended consequences on adjacent operations in the financial system

Asset Rehypothecation

Future-state process depiction

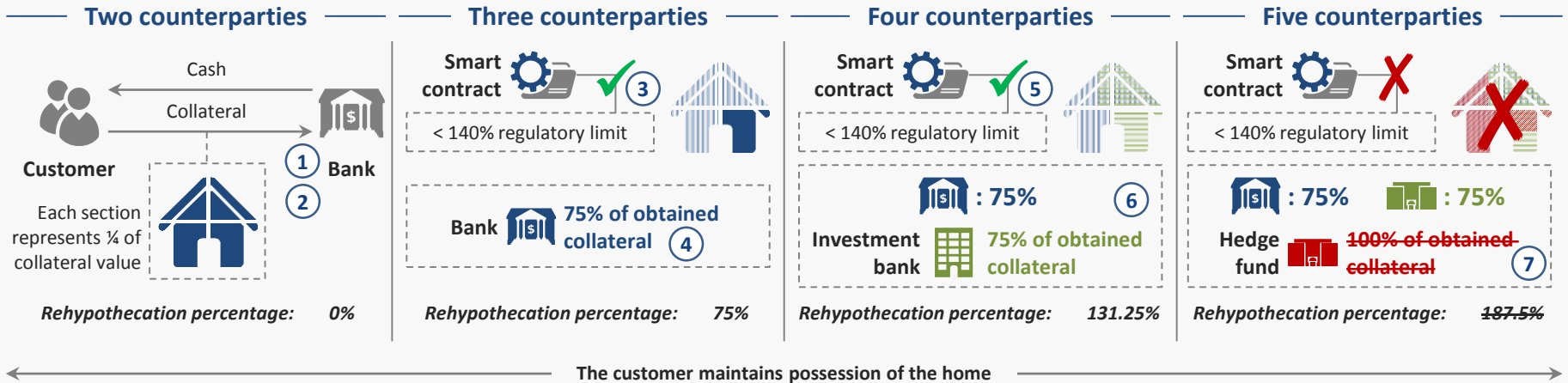


Future-state process description

- ① Collateral obtained by the bank is tokenized to record the transaction history of the underlying asset on DLT
- ② A smart contract encapsulates the tokenized collateral and facilitates record-keeping and the transfer of value
- ③ In subsequent trades, the smart contract broadcasts the transaction history details (e.g. collateral value and counterparty information) to participating entities
- ④ Investors receive a transparent view of the asset history along with associated counterparty information (via the counterparty rating system) to enhance trade decisions
- ⑤ Regulators receive authorized real-time access to view the transaction details and monitor regulatory infractions
- ⑥ The smart contract restricts the additional hypothecation of the asset once predetermined regulatory rehypothecation limits are met

Asset Reprehypothecation

Future-state benefits


















Future-state benefits

- 1 **Transparency:** the collateral value, risk position and ownership history are transparent to investors, aiding in investment decision-making
- 2 **Counterparty risk:** counterparties are rated based on transaction history, enabling investors to hedge their risk by selecting a counterparty that best fits their risk profile
- 3 **Automated processing:** DLT increases processing efficiency, reducing manual processes and associated costs
- 4 **Embedded regulation:** regulators maintain a clear view of the asset history (e.g. value, ownership and risk position), enabling the enforcement of regulatory constraints
- 5 **Automated enforcement:** a smart contract ensures assets are not rehypothecated over regulatory limits
- 6 **Financial stability:** the enforcement of regulatory controls and the transparent transaction history greatly reduce the risk of systematic failure in the event of default
- 7 **Disintermediation:** a smart contract facilitates the movement of funds and assets, eliminating the need for costly intermediaries

Asset Rehypothecation

Critical conditions

|  Tokenizing assets using a shared standard |  Fostering engagement among the financial ecosystem |  Architecting solution to manage over-the-counter (OTC) templates |
|--|--|---|
|     |     |     |
| <p><i>FIs and technology providers must work together to tokenize collateral linked assets within the financial system</i></p> | <p><i>FIs throughout the financial system must agree to participate in a tokenized asset trading system and comply to the agreed upon rules and regulations</i></p> | <p><i>Technology providers must design a flexible distributed ledger solution that accounts for non-standard and future formats of OTC templates</i></p> |
| <p>Why?</p> <p>To track assets and calculate rehypothecation percentages via smart contract, collateral tokenization is required</p> | <p>Why?</p> <p>To accurately track assets as they move through the financial system, all FIs conducting trades must participate in the distributed-ledger-based solution</p> | <p>Why?</p> <p>While the ledger will most likely refer to documents stored externally, the solution must be flexible in case modifications to OTC templates are required in the future</p> |
| <p>Challenge</p> <p>A tokenization standard among FIs will be difficult to establish, as will incorporating legacy assets into the distributed ledger</p> | <p>Challenge</p> <p>DLT is still unproven; a framework for participation must be established and support from the financial services community must be gained</p> | <p>Challenge</p> <p>FIs and technology providers will need to collaborate to ensure flexibility and minimal downstream impacts to smart contracts</p> |



Asset Rehypothecation

Conclusion

Summary

- **Asset tokenization:** Collateralized assets are tokenized and stored on the distributed ledger where transaction history details are stored in perpetuity
- **Regulatory transparency:** Compliance officials maintain a real-time view of asset transaction history (value, ownership, risk position) to assist in the enforcement of regulatory control limits
- **Collaboration:** successful implementation of DLT would require a significant amount of standardization and normalization of static data between market participants

Key takeaways

- **Reduce counterparty risk:** The transparent view of asset history (value, ownership and risk position), coupled with a counterparty rating system, assists investors in aligning their risk appetite with potential trade partners
- **Financial system stability:** smart contract technology terminates trades that violate regulatory controls, reducing the propensity of systemic failure within the financial system and improving collateral management

Outlook

- Applications of DLT within asset rehypothecation are currently being explored at the proof-of-concept level with a number of incumbents, focusing on:
 - Gold markets
 - Repurchase markets
 - Asset transfer
- Opportunities exist for counterparty risk reduction and enhanced regulatory enforcement tools:
 - Counterparty rating system
 - Asset transaction history storage
 - Regulatory transparency
 - Smart contract enforcement

Unanswered questions

- **Asset history tokenization:** Identifying asset value, ownership and risk position is a major challenge in today's financial system, so how will this issue be resolved so that transaction histories can be stored on the ledger?
- Will regulators require OTC markets to comply with this implementation?

Section 5.9

Market Provisioning: Equity Post-Trade

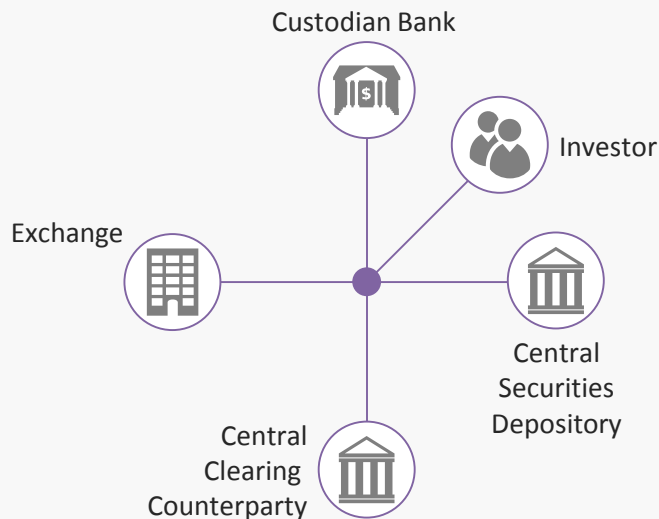
Equity Post-Trade

Introduction

Current-state background

Equity post-trade processes enable buyers and sellers to exchange details, approve transactions, change records of ownership and exchange securities/cash. These processes are initiated after an investor receives confirmation of an executed trade from the exchange. Central Securities Depositories (CSDs), working in partnership with custodians, match trades and validate investor credentials. After successful validation, Central Clearing Counterparties (CCPs) net all transactions and transfer cash/equity to all involved custodians. Custodians store assets in safekeeping accounts in partnership with CSDs, who are responsible for initiating asset servicing (e.g. income distribution and proxy voting) as required.

Key ecosystem stakeholders






Overview

- **Significant volume exists within the equity market:** The NYSE, for example, processes millions of trades and billions of shares each day¹
- **Processes are time-intensive:** Following confirmation of a trade, post-trade settlement and clearing processes take anywhere from one to three days to complete (depending on the market)
- **Intermediaries are costly:** Within the United States, banks, central agency bodies and intermediaries generate approximately US\$ 9 billion in various post-trade activities²

DLT has the potential to improve the efficiency of asset transfer. This use case highlights the key opportunities to streamline clearing and settlement processes in cash equities

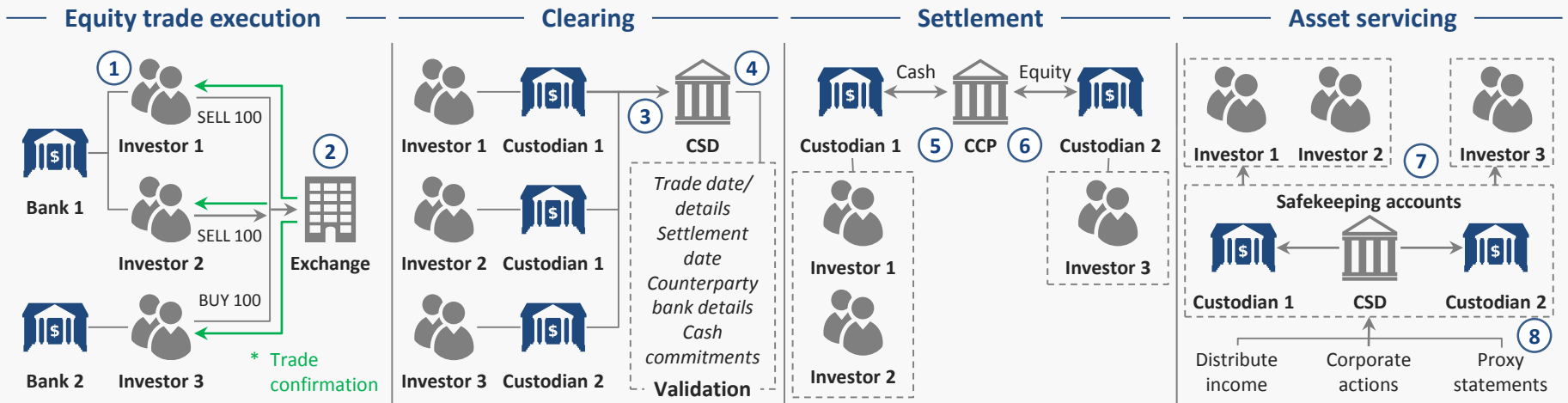
Equity Post-Trade

Key market participants

| Market participant | Role | Description |
|---|-------------------|---|
|  Custodian Bank | <i>Core</i> | An entity that investors use to place trades with the exchange, and that manages post-trade processes and stores assets for servicing |
|  Investor | <i>Core</i> | An individual or organization that instigates equity post-trade processes by initiating a trade |
|  Central Securities Depository | <i>Core</i> | The entity that supports matching trade sections prior to settlement and facilitates asset servicing processes |
|  Central Clearing Counterparty | <i>Core</i> | The central body that manages counterparty credit risk during settlement by acting as the buyer to the seller and vice versa to the buyer |
|  Exchange | <i>Supporting</i> | The entity that matches equity “buy” and “sell” orders on behalf of investors, and confirms them prior to successful post-trade processes |

Equity Post-Trade

Current-state process depiction

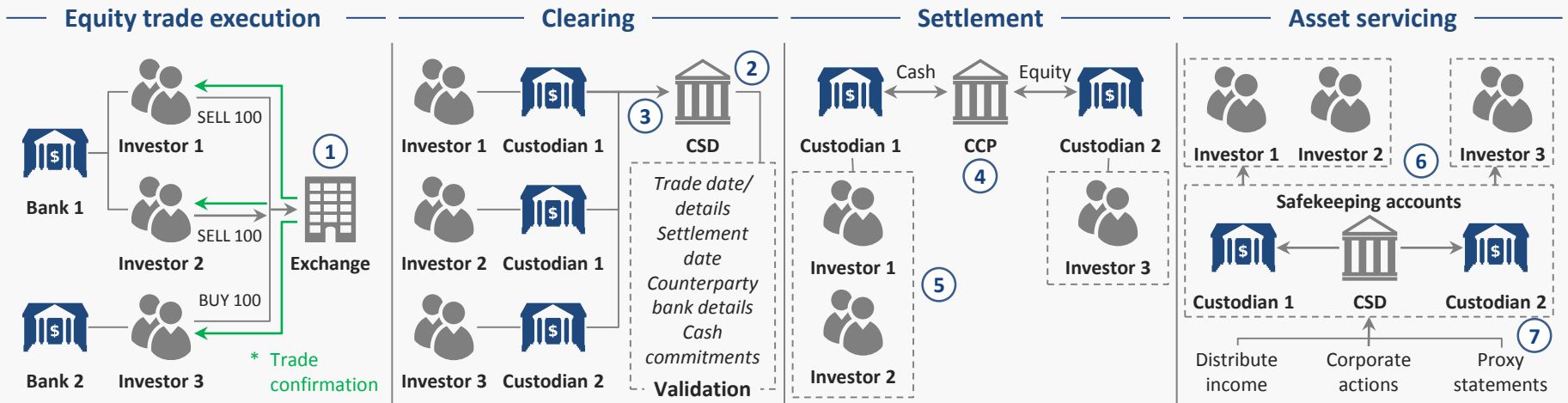


Current-state process description

- 1 Investors use interfaces provided by the bank of their choosing to place equity trade orders through the exchange
- 2 The exchange is responsible for matching the equity trade orders placed by investors across banks in order to confirm trades in real time and initiate post-trade processes
- 3 Utilizing securities settlement systems, custodian banks send their section of the trade details to the CSD on behalf of the investor
- 4 The CSD is responsible for validating the trade details provided by all custodian banks (e.g. cash commitments and settlement date) and matching all sections of the trade
- 5 After matching all sections of the trade, CCPs determine the “net transaction” across all trades and custodian banks to minimize the number of required transactions
- 6 The simultaneous transfer of equity and cash is managed by the CCP between custodian banks on behalf of all involved investors
- 7 After the required assets are transferred, equity and cash are stored in safekeeping accounts managed in partnership by custodian banks and the CSD
- 8 As various servicing processes occur, third parties work directly with the CSD to ensure custodian banks and, ultimately, investors are engaged

Equity Post-Trade

Current-state pain points

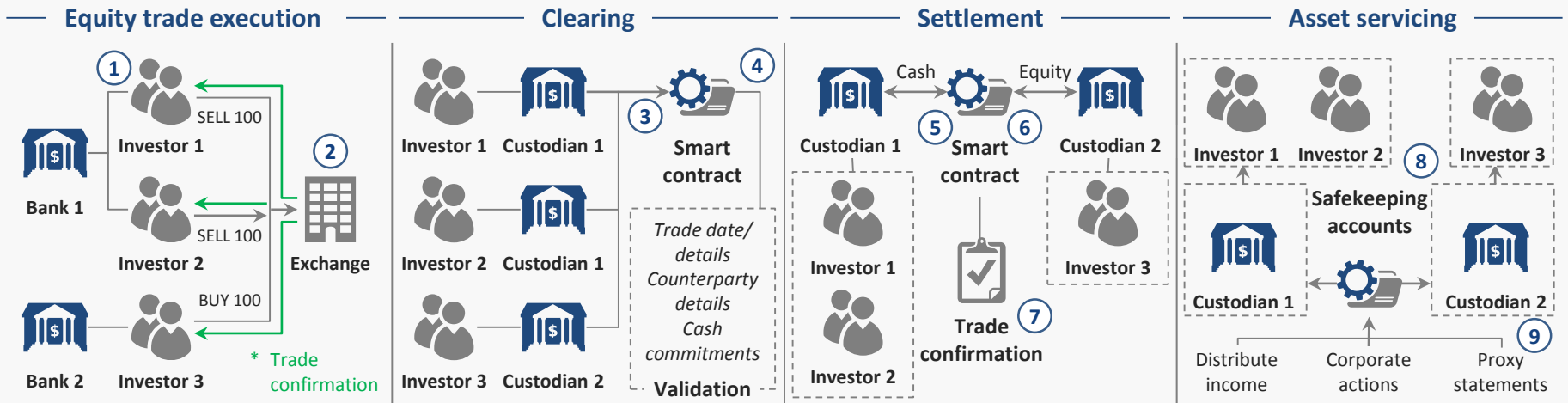


Current-state pain points

- 1 Duration between trade execution and settlement:** despite investors being able to see traded assets in their account shortly after receiving confirmation, settlement occurs t+3, which limits the actions that investors can take in the interim
- 2 Inconsistent data:** as a result of frequent changes to counterparty bank details, CSDs must manually validate a number of transactions prior to settlement
- 3 Counterparty risk:** custodians must account for the possibility that a counterparty is unable to settle when due
- 4 Operational risk:** CCPs must account for the possibility that technology and/or manual errors result in inaccurate settlement
- 5 Settlement ambiguity:** investors are inconsistently notified when their trades settle depending on custodian procedures
- 6 Safekeeping account complexity:** since securities settlement systems connect safekeeping accounts across custodian banks at the CSD, custodians have limited flexibility to store assets
- 7 Costly intermediaries:** corporations must involve third parties and intermediaries to initiate asset servicing

Equity Post-Trade

Future-state process depiction

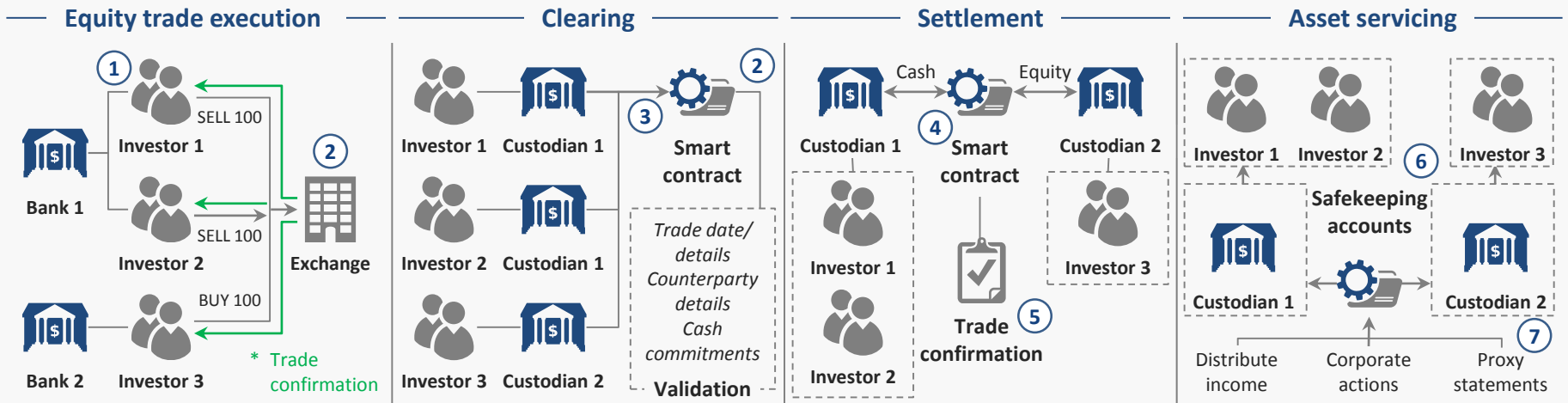


Future-state process description

- 1 Similar to the current state, investors use the interfaces provided by the bank of their choosing to place equity trade orders through the exchange
- 2 The exchange is responsible for matching the equity trade orders placed by investors across banks in order to confirm trades in real time and initiate post-trade processes
- 3 Custodian banks send their section of the trade details to the DLT on behalf of the investor
- 4 A smart contract validates the trade details provided by all custodian banks (e.g. cash commitments and counterparty details) and matches all sections of the trade in real time
- 5 After matching all sections of the trade, a smart contract determines the “net transaction” to minimize the number of required transactions
- 6 Smart contracts ensure the simultaneous transfer of equity and cash between custodian banks on behalf of all investors
- 7 Confirmation is stored in the DLT to facilitate future processes
- 8 After required assets are transferred, equity and cash are stored in safekeeping accounts managed solely by custodian banks
- 9 As various servicing processes occur, smart contracts notify custodian banks and investors in real time

Equity Post-Trade

Future-state benefits









Future-state benefits

- 1 Reduced settlement time:** through downstream, post-trade automation and efficiency enhancements, settlement could potentially be reduced to real-time settlement, trade date plus one day or trade date plus two days
- 2 Standardized data requirements:** standardizing data fields for trade matching improves the efficiency of existing clearing processes
- 3 Reduced counterparty risk:** through automated validation, custodians benefit from the reduced likelihood that the counterparty is unable to settle
- 4 Reduced operational risk:** through the use of a smart contract to transfer equity and cash, the likelihood of technology and/or manual errors is decreased
- 5 Real-time confirmation:** by storing trade confirmations on DLT, investors can receive notification of settlement without relying on a custodian
- 6 Reduced account complexity:** custodians will be able to store assets with greater flexibility since integration with securities settlement systems will no longer be required
- 7 Servicing disintermediation:** servicing activities initiated via a smart contract eliminate the need for third-party intermediaries

Equity Post-Trade

Critical conditions

|  Incorporating “net transaction” benefits within settlement |  Achieving multistakeholder alignment across participants |  Standardizing reference data utilized to match trades |
|--|--|--|
|  |  |  |
| <p><i>Custodian banks and regulators will need to work together to determine if and how to incorporate the benefits achieved by netting in order to minimize transactions and money transferred across custodian banks</i></p> | <p><i>Regulators, custodian banks and exchanges must work in partnership to develop a solution that can handle billions of dollars in daily transaction volume, while providing the economies of scale to benefit players of all sizes</i></p> | <p><i>Custodian banks will need to work together to develop a standardized set of data fields that can match trades while providing investor anonymity and confidence in automation</i></p> |
| <p>Why?</p> <p>CCPs aggregate executed trades to optimize the movement of assets; the inability to perform similar activities may add inefficiencies to settlement</p> | <p>Why?</p> <p>Given the complexity of post-trade processes, all entities involved must be willing to directly participate with one another to ensure market stability</p> | <p>Why?</p> <p>The inability to standardize this data will cause manual post-trade validation processes to still be required, inhibiting the disintermediation of CCPs and CSDs</p> |
| <p>Challenge</p> <p>Since smart contracts execute commands in real time, batching trades with some predefined frequency may require customization</p> | <p>Challenge</p> <p>If CCPs will be disintermediated as a result of a successful implementation of DLT, governance and collaboration will be required to ensure a liability model exists in case technology failures occur</p> | <p>Challenge</p> <p>Since traditional data fields used to match can change frequently (e.g. bank details), significant collaboration is required to standardize attributes that are not prone to constant updates</p> |



Equity Post-Trade

Conclusion

Summary

- **Process automation:** Clearing, settlement and servicing activities are executed via automation, dramatically reducing the time and resources required to perform these processes
- **Reduced settlement time:** Smart contract technology facilitates customizable settlement timelines (real-time settlement, trade date plus one day, trade date plus two days), reducing the time it takes to exchange assets
- **Cost savings:** DLT can provide a global cost reduction opportunity associated with process execution and fee reduction

Key takeaways

- **Reduce operational risk:** Simultaneous settlement of cash and equity executed via smart contract reduces the likelihood of manual errors and the resources required to execute the process
- **Provide central authority disintermediation:** Settlement and servicing activities are executed via smart contract, eliminating costly fees

Outlook

- Applications of DLT within equity post-trade are currently being explored at the proof-of-concept level with a number of incumbents and FinTechs, focusing on:
 - Private equity trading
 - Clearing and settlement solutions
- Opportunities exist for FIs to reduce costs and improve operational efficiencies:
 - Eliminating fees through disintermediation
 - Executing clearing and settlement via smart contract

Unanswered questions

- **Real-time settlement:** Will the savings associated with transitioning to faster settlement meet or exceed the value of “float” revenues earned today by holding assets during the settlement period?
- What are the settlement implications of operating a “slow lane” and “fast lane” (i.e. real-time settlement and trade date plus three days)?

Section 6

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The logo for the World Economic Forum features the words "WORLD", "ECONOMIC", and "FORUM" stacked vertically in a bold, grey, sans-serif font. A blue arc, resembling a stylized globe or a smile, curves around the text from the top left to the bottom right.

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