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Distributed Ledger Technology



A brave new world? What impact will distributed ledger technology have on the financial industry?

We are living in an age of rapid change. The world today is virtually unrecognisable from the world of even 25 years ago. The internet has changed the way we communicate, the way we shop, the way we learn, the way we listen to music, the way we store information – frankly, the way we live. It has become possible to exchange information instantaneously with almost anyone, anywhere, any time.

In response to this level and speed of change, standing still is not an option. We have seen the impact on businesses that adapt and those which don't. For example, the technical revolution hit the taxi industry when mobile app technology allowed people with a vehicle and free time to offer taxi services. Technical disruption is also changing the car industry as IT visionaries have set out to develop cars that can self-park and self-drive using electrical engines and tablet technology. Companies that shy away from technological changes and do not adapt to the new digital environment risk falling by the wayside.

The financial industry is also experiencing these changes and financial companies are looking at new technologies as they emerge and deciding whether or not to embrace them and the new opportunities they provide.

One of the more recent technological developments that holds potential for the financial industry is distributed ledger technology, or DLT. This article looks briefly at what exactly this new technology is and what the potential implications are for Europe's financial market infrastructure.¹

What is distributed ledger technology?

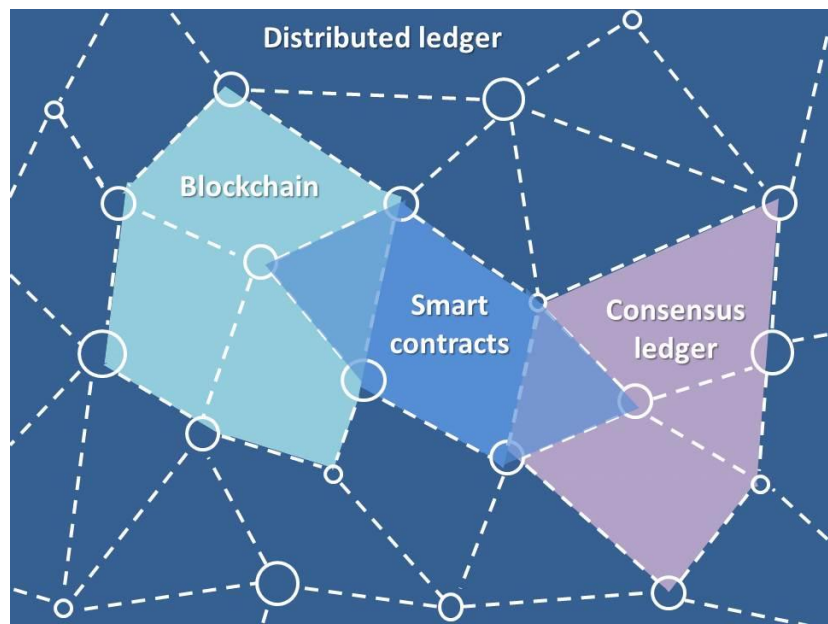
A distributed ledger is essentially a record of information, or database, that is shared across a network. It may be an open, publicly accessible database or access may be restricted to a specified group of users. From a technical perspective it can be used, for example, to record transactions across different locations. The technology that makes this possible is often referred to as "blockchain". The name comes from the fact that some DLT solutions store all individual transactions in groups, or blocks, which are attached to each other in chronological order to create a long chain. This long chain is put together using a mathematical formula – complex cryptography – which ensures the security and integrity of the data. This chain then forms a register of transactions that its users consider to be the official record.

¹ This article draws on the analysis contained in a recent ECB Occasional Paper "Distributed ledger technologies in securities post-trading: Revolution or evolution?" by A. Pinna and W. Ruttenberg.

In addition to blockchains, consensus ledgers are another type of DLT whereby, instead of grouping and chaining transactions, only the balance of members' accounts is updated after each validation round.

Chart 1 Distributed ledgers

(The chart shows a simplified representation of the actual situation.)



Sources: ECB

Who can be member of a network depends on whether the ledger is a restricted or unrestricted ledger. In unrestricted ledgers, anyone can become a member, whereas in restricted ledgers, membership is limited. In both types, each member in the network may have access either to the entire ledger or only to part of it and in all cases can contribute with data.

What are the advantages of this technology?

The fact that the data is spread across a network of connected computers, rather than held by a single, central entity, might make cyber attack less likely and, where it does happen, less effective. An attack would have to successfully target many copies of the ledger rather than just a single, centralised version. In addition, all users will see any changes to the data they have access to, making it much more difficult to tamper with the records without the rest of the network being aware of it.

In today's decentralised structures, the majority of institutions have their own internal validation system for the reconciliation process, which is very costly. If records were kept and updated automatically on the ledger, it could save money.

"Smart contracts: it's like having a paper contract that can read itself and carry out the agreed terms as and when they come into effect."

Another advantage of DLT is the possibility to automate contracts. Imagine you have bought a ticket to a concert that is only refundable if the singer falls sick. With an automated, or "smart contract", there would be no need to call the agency to get the money back if the concert is cancelled; it would just happen automatically and the money would appear in your account.

With DLT, "smart contracts" can be used to process transactions based on agreements of "if this happens, then do this..." and ownership of the underlying value or asset can be automatically transferred. The terms of the contract are written in computer language. It is like having a paper contract that can read itself and carries out the agreed terms as and when they come into effect.

Streamlining complex market processes

As with all technologies, it will take some time to understand the full implications. However, DLT could prove useful in some parts of the financial market and may also have an impact on the post-trade world. The securities market is quite complex, involving a wide range of actors and technical and legal arrangements. A securities trade goes through a number of processes before it is finalised, involving many different actors, as shown in Chart 2 below.

Chart 2
Who is involved in the securities trade lifecycle?

(The chart shows a simplified representation of the actual situation.)



Sources: ECB

With the establishment of the Economic and Monetary Union, it was clear that streamlining such a complicated process, which varied significantly between Member States, would be essential to making cross-border payments and securities trading more cost-effective and attractive. The Eurosystem has been working to put in place a harmonised financial market infrastructure in Europe which facilitates this. In the past 15 years it has developed two major innovations in this field: TARGET (now TARGET2) and TARGET2-Securities (T2S). Both of these platforms have changed the way payments and securities are processed in Europe and have aligned a number of processes across countries. It makes straight-through processing, i.e. automated processing without the need for manual intervention, possible in the settlement layer. Off the back of the T2S project, the market has initiated extensive harmonisation work which aims to extend these benefits beyond settlement to other parts of the post-trade process.

Whether or not DLT proves useful in solving problems and removing barriers in the field of market infrastructure remains to be seen. However, DLT is being tested and investigated by market players on a global scale.

Possible specific uses of DLT in the securities market

In the securities domain the market is currently discussing a number of uses for DLT. The following list provides a brief overview of some of these theoretical discussions.

- Easy tracking of securities ownership: Asset servicing could be simplified if securities were issued directly on the ledger and the ledger were used to keep track of the ownership of the security.
- Help small and medium-sized enterprises (SMEs) gain access to funding: If SMEs could issue securities directly on the ledger, they would have access to a wider pool of investors and possibly expand their funding opportunities.
- Shorter settlement cycles and fewer intermediaries: Having issuers and investors on the same ledger has the potential to improve efficiency as the settlement cycle would be shortened and the number of intermediaries could be reduced.
- Collateral savings: Shortening the settlement cycle would also lower the amount of collateral needed for settlement. In addition, the collateral pledged would be freed up more quickly.
- Optimised reconciliation processes: If records are updated automatically, it could save costs incurred in the reconciliation process.
- Improved regulatory reporting: As all information would be on the ledger, organisations could meet their regulatory reporting obligations in a more efficient manner.

"DLT is being tested and investigated by market players on a global scale."

- Increased transparency: All participants would have full transparency regarding the activities involving their accounts on the ledger.
- 24/7 processing: No central operator is needed and the ledger would be open around the clock. This would support the globalisation of the securities market.
- Automated corporate actions: Using “smart contracts” could bring cost savings as corporate actions can be done automatically.

General considerations

There are three important areas where careful reflection is needed.

First, if DLT were to make it possible for issuers to reach investors by issuing directly onto the ledger, the wider impact of this would need to be carefully assessed. The notary and bookkeeping function would still be needed as it includes a number of other important tasks besides recording newly issued securities. For example, it makes sure that only the amount of securities that are publicly issued are actually traded and no unwarranted securities are created. This is essential for ensuring confidence in the underlying claim that the owner of the security has on the issuer. This function is usually performed by central securities depositories and if issuers were to issue directly to investors via a distributed ledger, an accountable institution would still be needed to validate the transaction without direct contact between the issuer and investor, as is the case today.

Another consideration is whether a distributed ledger could provide delivery versus payment, i.e. where cash payment is made immediately upon receiving the security. At the moment, T2S is able to provide delivery versus payment because the platform holds both the securities and central banks’ cash accounts. Payment can thus be made immediately using central bank money, eliminating settlement risk. If this were also to be the case on a distributed ledger, both the cash leg and the securities leg would need to be on the ledger.

Finally, if issuers and investors interact directly on the ledger, it could potentially make financial institutions redundant in this field. The immediate question from the perspective of a regulator would be who would be responsible in case of technical malfunctions and who should be regulated in order to ensure the stability of the system.

What will the future look like?

Moving forwards, a number of scenarios are possible. Three possibilities for what could happen in response to the emergence of DLT are described below.

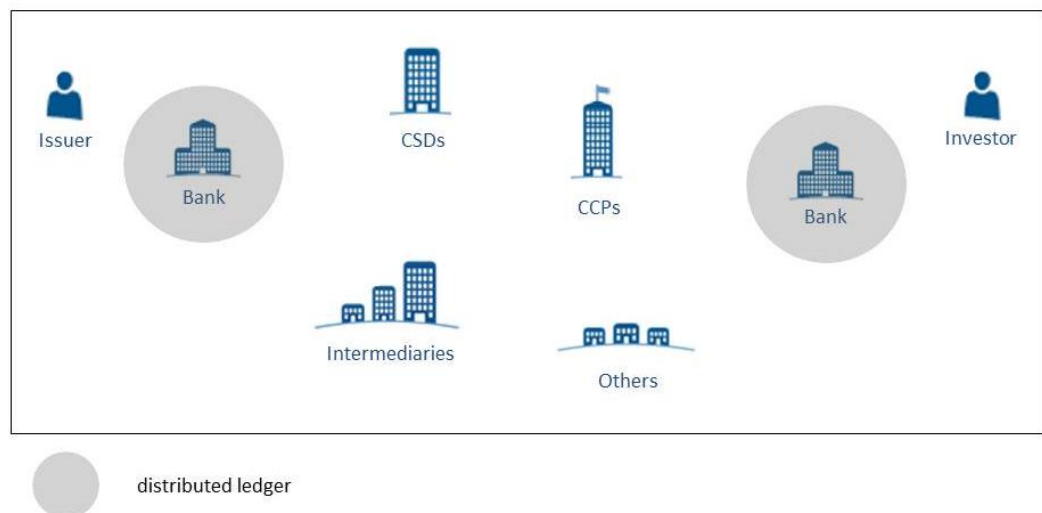
Scenario 1 – “As is”: Established institutions embrace the new technology to improve internal efficiency, but broader business practice remains unchanged.

It is possible that individual institutions will use DLT to produce their own solutions that improve their internal efficiency. However, the creation of multiple differing solutions would not foster an innovative settlement market in Europe and beyond. The only major change would be that all intermediaries with direct access to the same ledger would receive near real-time updates on changes in ownership of securities in that ledger. However, there would be no automatic updates across separate ledgers and it could lead to new fragmentation.

Chart 3

Scenario 1: Fragmentation and no interoperability between ledgers

(The chart shows a simplified representation of the actual situation.)



Sources: ECB

Scenario 2 – “Adoption model”: Core players (such as central securities depositories) adopt market-wide distributed ledgers, meaning that some other players become redundant.

An alternative scenario is where a set of core players adopt a shared distributed ledger. This is similar in concept to T2S, which is a shared platform open to all central securities depositories that sign the legal contract.

If this were to happen, services such as asset servicing, safe keeping arrangements and account segregation could take place on the shared ledger. For example, the

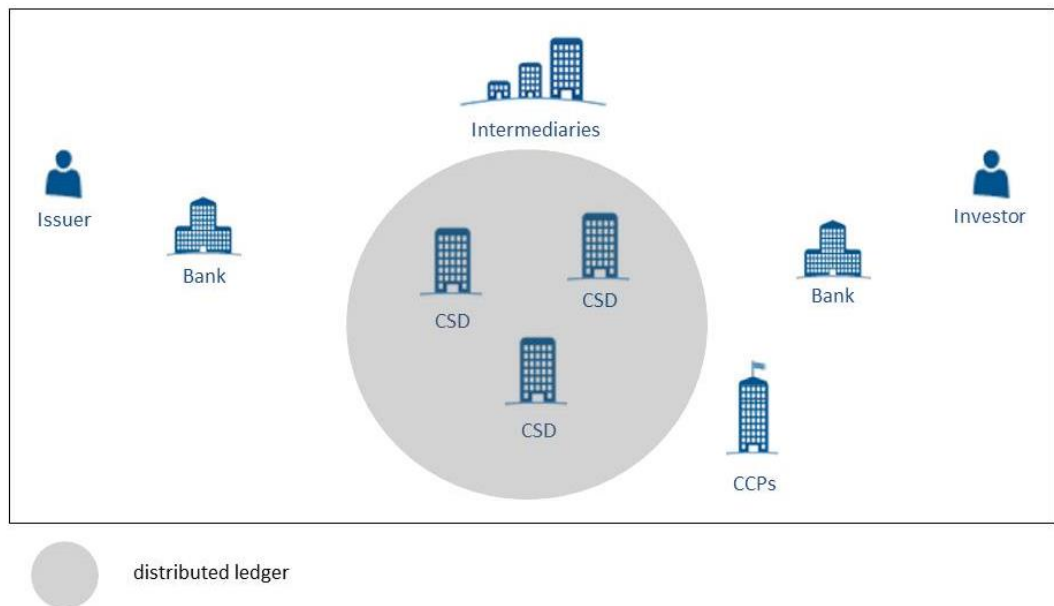
segregation of assets (needed by brokers to keep the assets of their customers in separate accounts) could be done at no extra cost, and regulatory reporting could be done automatically and in near real-time. Regulators could keep track of transactions and outstanding positions directly on the ledger. Smart contracts could also be employed to automate asset services. This could lead to certain intermediaries becoming redundant.

This scenario would not create additional fragmentation, but might require a neutral third party to act as a catalyst in the development process to ensure an industry-wide solution is adopted. Again, this could be conceptually similar to the Eurosystem’s role in the post-trade harmonisation work brought about by the T2S project.

Chart 4

Scenario 2: No additional fragmentation as an industry-wide solution is used

(The chart shows a simplified representation of the actual situation.)



Sources: ECB

Scenario 3 – “New world”: Issuers and financial technology companies bypass financial institutions and create “peer-to-peer” systems for securities transactions, transforming the post-trade industry.

In this extreme scenario, existing post-trade processes would be replaced by automated clearing and settlement between issuers and investors, eliminating the “middle man”. This could provide greater access to financing for small investors and

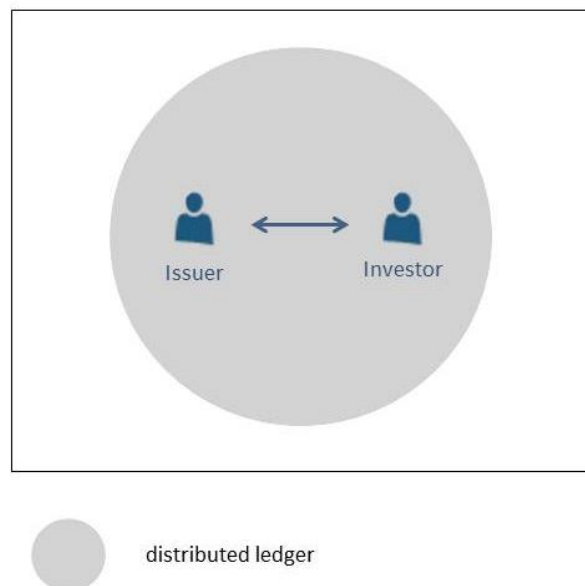
SMEs. Companies and governments could issue their financial instruments directly on the ledger and smart contracts could handle corporate actions automatically.

This would make financial institutions redundant, but would then raise the question of who should be regulated in order to ensure the stability of the system. It would completely transform the financial system as we know it.

Chart 5

Scenario 3: Financial institutions redundant, who should be regulated

(The chart shows a simplified representation of the actual situation.)



Sources: ECB

Why does it matter to the Eurosystem?

It is of utmost importance to the Eurosystem that this new technology, if used, is used in a way which will promote a level playing field and not introduce new fragmentation to the financial system. For this reason, it supports the development of common solutions for all new technologies that might be used in the future, not just DLT. The Eurosystem plays a catalyst role by supporting the industry to develop its own initiatives. It is well placed to do so given its extensive knowledge and understanding of the financial market and its pan-European reach. Should DLT prove to be a useful solution for the industry, the Eurosystem could consider whether it would also be meaningful for it to play a catalyst role in the field of DLT.

In addition, the Eurosystem is responsible for operating and overseeing the financial market infrastructure and so it is important that as the financial market landscape changes, it monitors these changes closely to assess whether it needs to adjust the services it offers or its oversight framework.

As part of its vision for 2020², the Eurosystem has initiated discussions with the market on how innovation can increase efficiency, in an effort to find effective shared solutions that continue to remove fragmentation and move Europe closer to a true Single Market. The Eurosystem will continue this close collaboration with the market in order to benefit from the full knowledge and experience of both the private and public sectors.

"The Eurosystem will continue its close collaboration with the market."

Conclusion

DLT is a very new technology and it is therefore still difficult to predict exactly what kind of an impact it will have on the financial market infrastructure. However, it certainly presents a number of interesting possibilities that deserve further investigation. The Eurosystem is closely following developments and considering all of the possible implications for its role as operator, catalyst and overseer.

² For more information on the Eurosystem's vision for 2020, see <http://www.ecb.europa.eu/paym/initiatives/html/index.en.html>