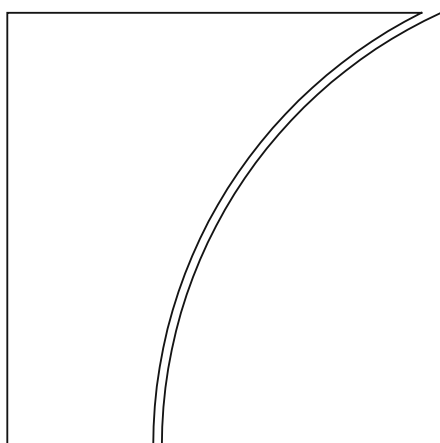


Committee on Payments and Market Infrastructures



Wholesale digital tokens

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BANK FOR INTERNATIONAL SETTLEMENTS

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Executive summary

Traditionally, wholesale transactions are settled by updating balances in account records on a centralised register such as the ledger of a settlement institution. However, new technologies, such as distributed ledger technology (DLT), make it possible to create digital tokens¹ that could potentially be used as a settlement asset, to effect settlement. This report focuses on the role of digital tokens as a means of settling wholesale transactions.

Several potential applications for wholesale tokens are being explored by the private sector. While wholesale tokens could be developed simply for use as alternative payment arrangements, much current work relates to supporting potential new digital token arrangements or platforms in which wholesale tokens would be used for the payment leg of transactions involving other digital assets, including tokenised securities, and even different tokenised currencies. At the current stage of development, it is still unclear what design choices private sector developers will make or what use cases may be adopted.

This report discusses some potential design choices and includes a non-exhaustive list of questions that token developers may need to consider. Important considerations include availability; issuance and redemption; access; underlying assets/funds and claims; transfer mechanism; privacy and regulatory compliance; and interoperability. Depending on the design choices made, there could be a number of implications for safety and efficiency of the token arrangement.

One important element is the nature of the claims on the underlying assets or funds. To function as a safe settlement asset, tokenholders need strong assurances that the token will be accepted by others and will retain its value. To date, some wholesale token proposals have attempted to create a safer settlement asset by employing a model that seeks to “back” the tokens “one for one” with corresponding deposits of central bank money, commercial bank money, or some other sufficiently safe and reliable asset.

For wholesale tokens to derive value or safety from the asset or fund backing they represent, there should be clarity as to on what or on whom a tokenholder has a claim or other right, or how the “backing” relates to that right. The assets backing the token, and linkages between the underlying assets/funds and the token arrangement, may have implications for other design choices, such as availability, or hours, in which the tokens can be transferred; the issuance and redemption mechanism; access; and interoperability.

To perform as a safe settlement asset, wholesale tokens and their usage further require a sound legal underpinning. To date, multiple legal questions relate to the design and use of wholesale tokens for settlement, and to digital tokens more generally. Traditional wholesale payment arrangements, such as real-time gross settlement systems, are based on long-established and well founded legal structures and arrangements. Protections under existing legislation, including payments law, contract law, settlement finality provisions, insolvency law and conflicts of law regimes in their local jurisdictions, were not written with wholesale token arrangements in mind, and may not necessarily unambiguously extend to such arrangements, leading to possible legal uncertainties and risks.

Token developers also need to address some fundamental institutional and risk management considerations in their designs. The potential absence of a central operator or responsible intermediaries in some proposed wholesale token arrangements raises concerns around governance. In general, a clear assignment of responsibilities may be required so that wholesale token arrangements are supported by sound governance arrangements. Similar to traditional financial market infrastructures (FMIs), wholesale token arrangements could pose a range of risks, including, in particular, liquidity and operational risks,

¹ Unless otherwise stated in this document all references to tokens are to wholesale digital tokens.

which would need to be managed. Cross-border or multicurrency wholesale token arrangements may add further complexity.

A wholesale digital token arrangement needs to be compliant with all applicable regulatory and oversight requirements. If a wholesale digital token arrangement is a systemically important FMI, it will be expected to observe the Principles for Financial Market Infrastructures (PFMI) in the same way as other FMIs.² Given this, in designing wholesale digital token arrangements, developers may want to consider whether their design would be consistent with, or could be made consistent with, the PFMI.

While this report outlines a number of useful considerations for token designers, there is no single roadmap for success. Whether wholesale digital tokens offer benefits as a settlement asset will depend on whether they can provide both improved safety and increased efficiency over the traditional account-based settlement assets used today.

Depending upon the design of a wholesale digital token arrangement, the implications for the central bank (eg safe and efficient payments, monetary policy, financial stability) will vary. While such implications are out of the scope of this report, it should be noted that due consideration of these implications would also be needed.

1. Introduction

Today, wholesale payments between financial institutions are effected through central systems and payment arrangements using traditional account-based transfers. These work by debiting the account of the paying participant and crediting the account of the receiving participant or their respective settlement agents, which may or may not be the same entity.³ New technologies open up new ways to achieve settlement using digital tokens. As an example, new technology could allow for assets to be tokenised and transferred peer-to-peer without necessarily involving a central third party to effect settlement. Digital tokens could enhance wholesale payments by allowing the use of new settlement platforms (eg based on DLT). This could, in turn, enable alternative access to settlement assets, or enhance efficiency in other ways, such as more frequent settlement, longer availability, harmonised data standards, and richer data/transparency. Although wholesale digital tokens could potentially provide benefits for financial markets, they are not without risks.

For settlement of wholesale transactions, safety is paramount. A safe settlement asset retains its value to the holder and is therefore acceptable to others as a means of payment. As a generally accepted rule, central bank money is the safest type of money in its own jurisdiction. In contrast, commercial bank money is the liability of a financial institution and its use introduces credit risk into the settlement process. Similarly to traditional commercial bank money, wholesale digital tokens issued by private developers (eg commercial banks) may introduce credit risk if arrangements are not adequately designed and managed, even if the tokens are backed by safe assets.⁴ In addition to credit risk, liquidity risk, settlement risk and finality are also critically important for wholesale settlement and should be considered when designing wholesale token arrangements.

² The wholesale digital token arrangement could be classified as a payment system or, depending on the other tokenised assets that are part of the arrangement, it may also be classified as a central securities depository or a securities settlement system.

³ CPMI defines a settlement agent as an entity that manages the settlement process for transfer systems or other arrangements that require settlement. The settlement agent sometimes differs from the owner or settlement institution of the system. A settlement agent may be a central bank, a commercial bank or financial market infrastructure (FMI) and, hence, settlement usually involves debiting and credit accounts at one or more of these entities.

⁴ For example, if the commercial bank conducting settlement becomes insolvent, a participant in the wholesale digital token arrangement may not have immediate access to their funds or may not ultimately receive the full value of their funds.

Wholesale token arrangements may be designed in a variety of ways depending on their use case. Design choices made by developers, such as the issuance mechanism and the availability of the token, among others, could impact the overall safety and efficiency of the arrangement. Further institutional and risk management considerations, such as governance structure, legal basis, and operational risk may also play a role in determining whether wholesale digital tokens can deliver improvements to the wholesale payments landscape. These issues may be even more important for arrangements that operate cross-border and should be well understood and managed appropriately.

This report builds on prior work by the CPMI and is a first attempt to highlight the critical elements of wholesale token arrangements and the overall issues developers should consider from a risk management perspective. It is organised as follows: Section 2 offers a tentative definition of digital tokens and the arrangements that support them; Section 3 discusses potential applications of wholesale tokens; Section 4 explores design elements of wholesale token arrangements; and Section 5 concludes.

2. Concepts

Wholesale digital tokens are still at an early stage of development and could potentially take a variety of different forms, making any attempt at conceptual analysis preliminary. Nonetheless, there are some basic differences between traditional settlement arrangements and new token-based ones. This section sets out some key concepts that are used in this report.

2.1 Wholesale settlement

In this report, we discuss digital tokens used for wholesale settlement. Although the term “wholesale” can be used to describe a variety of characteristics, it typically includes large-value transactions settled between financial institutions (usually banks). This report excludes digital tokens held by retail consumers but does not attempt to further define a wholesale institution other than to assume there is some type of restriction on the institutions that can hold and transfer the token (ie there are access requirements for the arrangement). Although digital tokens can also be used as a store of value, this analysis focuses on the role of digital tokens as a means of settling wholesale transactions.

2.2 Tokens as a settlement asset

Traditionally, wholesale transactions are settled by updating balances in account records on a centralised register or ledger of a settlement institution, such as a central bank, FMI or commercial bank. In this model, a positive account balance represents a liability of the entity providing the account (ie the entity owes account holders the funds they have in their accounts). Account balances can be moved from one account to another (ie payments made) on the settlement institution’s ledger by “book entry transfer”.

New technologies, such as DLT, make it possible to represent and transfer assets in new ways. Digital tokens are a key example. To take advantage of new technologies (without the need for existing FMIs to adopt them), private initiatives are exploring the possibility of creating digital tokens representing an asset on a new platform. The wholesale digital tokens considered in this report represent a claim, either on a specific issuer or on underlying assets or funds, or some other right or interest. Insofar as a token is a simple representation, the credit risk and value of a token will be determined by the underlying claim (eg if a token represents a claim on a commercial bank, credit concerns could reduce the market value of the token, just like that of any other claim on the bank).

2.3 Peer-to-peer transfers

DLT and other recent technological innovations make it possible to create digital tokens that could potentially be used as a settlement asset without necessarily involving a *central* third party, such as a settlement agent or a payment system operator, to effect final settlement. Instead, digital tokens can be directly held by participants of the token arrangement and transferred between each other in a peer-to-peer manner, much as physical paper-based assets such as paper stock certificates or banknotes can be transferred. The ability to transfer a token directly does not mean that there is no role for third parties. Indeed, validation of transactions by third parties can be an element of DLT-based systems.

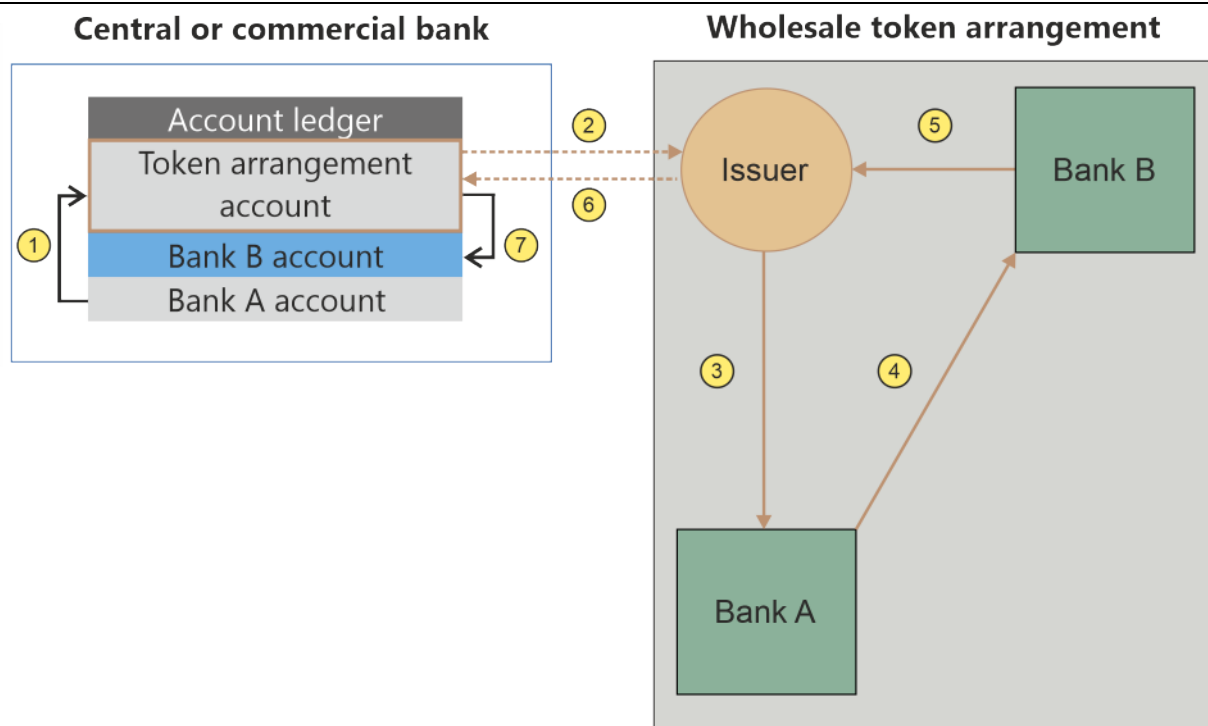
While this distributed ledger settlement is sometimes called “peer-to-peer” settlement, it should not be confused with retail or general purpose payment arrangements intended to facilitate payments between individuals. For this report, the “peers” involved are a group of entities that are participants in the arrangement.

2.4 Token arrangements

This report uses the term “token arrangement” to describe the set of platforms and/or entities that enable the issuance, redemption and transfer of the wholesale digital tokens. Potentially many actors (eg controllers, validators or other specialised functions depending on the design model) may be involved in the various elements of a token arrangement.

Graph 1 presents a stylised model of one possible type of token arrangement. At a high level, in this example the workflow for issuing, transferring and redeeming tokens is:

1. Bank A buys tokens by transferring funds to a token arrangement’s bank account through book entry transfer.
2. The change in the balance in the token arrangement’s account triggers the Issuer to issue an equivalent amount of new tokens.
3. The Issuer allocates these tokens to Bank A using the wholesale token arrangement.
4. Bank A transfers wholesale token directly to Bank B (peer-to-peer).
5. When Bank B redeems the tokens, it returns them to the Issuer.
6. This prompts the Issuer to return the equivalent amount of funds from the token arrangement’s bank account.
7. The Issuer transfers these funds from the token arrangement’s bank account to Bank B via book entry transfer.



3. Potential innovations using wholesale digital tokens

Several potential applications for wholesale tokens are being explored by the private sector. While wholesale token arrangements could be developed simply for use as alternative payment arrangements, much current work relates to supporting a potential new digital token ecosystem in which wholesale tokens would be used for the payment leg of transactions involving other digital assets. Whether tokens offer benefits as a settlement asset will depend on whether they can provide both improved safety and increased efficiency over traditional account-based settlement assets.

3.1 New settlement platforms

Globally, the vast majority of securities are currently issued in immobilised or dematerialised form, and recorded in book entry format at a central securities depository. This allows for transfers via book entry by intermediaries. In many cases, settlement of such a transfer can require two separate platforms, often operated by separate entities: a securities settlement system to settle the transfer of securities and a payment system to settle the funds transfer. To address settlement risk, these financial market infrastructures have in place delivery-versus-payment (DvP) mechanisms, which essentially link a securities transfer and a funds transfer so that the securities leg takes effect only if the corresponding payment is made.⁵ However, this process is complex and requires the legal frameworks of the two infrastructures to work together to ensure that security delivery is final only if the corresponding funds transfer is final, and vice versa.

⁵ CPSS (1992).

The representation of securities and other assets by digital tokens is currently being explored to assess the potential benefits of DLT for improved settlement of financial assets. If securities are represented with digital tokens but there is no equivalent tokenisation on the funds side, the payment leg of the transaction must settle over traditional account-based infrastructures, which may generate inefficiencies and add to the complexity of the process.

Where both the funds and securities are represented by digital tokens (wholesale tokens and tokenised securities, respectively), DvP settlement could conceivably be effected in different technical configurations, such as on a single platform (integrated model), or two connected platforms (interfaced model). It is even possible to conceive DvP settlement in which securities and funds are settled on two different platforms, without the involvement of a third-party intermediary, provided that each counterparty is a participant in both platforms.⁶

An equivalent arrangement may be possible for tokenising different currencies that could then be exchanged conditionally to remove settlement risk in foreign exchange transactions, ie via payment-versus-payment (PvP) settlement.⁷ Currently, PvP mechanisms are only available for settlement of a subset of currencies.⁸ Much of the settlement of foreign exchange transactions occurs bilaterally, using correspondent banking relationships without PvP settlement mechanisms (exposing banks to the risk of paying out in one currency and not receiving the countercurrency in return).

3.2 Access to an alternative settlement asset

The role of non-banks, including payment service providers, broker dealers, large corporations and fintech companies in payments around the world, has been growing in importance over recent years.⁹ Non-banks have sought direct or indirect access to payment systems, and in particular, access to central bank money to improve the safety of their settlements and, in some cases, to reduce their reliance on commercial banks (for competitive, cost or other reasons). Yet, access to payment systems often remains restricted to banks. As a consequence, non-banks tend to rely on commercial banks to settle their payments.

In this context, wholesale tokens that are designed to be backed by central bank deposits could potentially represent a safe and efficient alternative to settlement in traditional commercial bank money. This may particularly be the case for entities that may be unable or unwilling to access central bank payment systems. However, this assumes that non-banks have the right to hold digital tokens (see Section 4.1.3). The benefits that tokens may or may not bring to the wider payments ecosystem will depend on whether they can improve safety or efficiency vis-à-vis traditional account-based settlement assets.

3.3 Other efficiency considerations

To support the provision and risk management of payment services, interest has increased in more frequent settlement, extending operating hours, and providing richer data in payment messages, as well as in interoperability and “programmable money” (ie the ability to automate processes by preprogramming actions to be taken if a specific event occurs). Digital token arrangements could potentially provide these improvements. However, these improvements do not necessarily require

⁶ This technique is known as “hashed timelock contracts” and has been further explained, among other DvP techniques on DLT platforms, in ECB and BOJ (2018).

⁷ Similar to DvP, PvP is a settlement mechanism that ensures that the final transfer of a payment in one currency occurs if and only if the final transfer of a payment in another currency or currencies takes place.

⁸ All existing PvP foreign exchange FxMs operate in a limited number of currencies. The largest and most widely used of these, CLS Bank International, at present operates in 18 currencies.

⁹ CPMI (2014).

technological changes or the introduction of tokens. Each can be achieved to some extent with existing payment systems and current technology.

3.3.1 Reduced settlement cycles

Today, many markets (eg securities, foreign exchange) settle transactions some days after they are arranged (eg “T+2”). The time delay allows for counterparties to make sure they have the funds and securities ready to exchange; it also facilitates netting. However, longer settlement cycles can heighten the risk of settlement failures by prolonging the duration of the exposure. In recent years, a number of large, coordinated projects have reduced the time between execution and settlement of trades in particular markets, and in many jurisdictions new or modified systems built on traditional technology provide payments in real time (defined as availability of transferred funds within seconds).¹⁰

3.3.2 Longer availability

Due to time zone differences, markets and payment systems in one jurisdiction might be closed when those in other jurisdictions are open. This naturally restricts the window during which funds can be transferred across jurisdictions, potentially resulting in slower settlements. This risk can be addressed by opening domestic systems for longer, as is happening in some jurisdictions. In addition, the adoption of fast payments that allow retail customers to transfer money 24/7 with immediate reusability of funds increases the demand for longer operating windows for wholesale payment systems, in part to address demands for payment in off-hours in excess of funds on deposit. Most token arrangements are expected to operate 24/7.

3.3.3 Harmonised messaging standards

As discussed in previous CPMI reports, a lack of cross-border standardisation in payment message formats and contents adds cost and time to a payment because the operational efficiencies, economies of scale and network effects that apply to domestic payments can be lacking.¹¹ Central banks, multilateral organisations, and the private sector currently are working to address these inefficiencies, and new payment systems built today often focus on integrating with existing systems and “future-proofing” so that they are compatible with new technologies as they develop.

3.3.4 Richer data and transparency

Currently most payment systems do not allow users to track the status of payments in real time, in contrast to the real-time information available in many other areas of modern business. Hence, there is demand for more granular and immediate information on the status of payments. Richer data also open up the prospect for greater payment flow automation and efficiency gains in cash management. The quality and availability of payment data used to monitor cash flows, manage treasury risks and reconcile balances is currently diverse, and can depend on the ability to include richer information in payment messages, which relates to the standards used, as discussed above.

¹⁰ Real-time and other fast settlement cycles occur on a gross basis. While the speed of execution provides some advantages to system participants, it does not provide the liquidity-saving benefits of deferred net settlement systems.

¹¹ eg CPMI (2018a).

4. Token design

Because the technology and use cases for wholesale digital tokens are at an early stage of development, it is still unclear what design choices developers will make. This section addresses some potential design choices based on a limited dialogue with the industry, highlighting areas where ambiguity remains, and includes a non-exhaustive list of questions that token developers may need to consider.¹²

4.1 Design elements of an arrangement

4.1.1 Availability

Wholesale token arrangements, and token arrangements more generally, may be designed to allow tokens to be transferred 24/7 or during some defined window of time. Depending on the design chosen, this could also have implications for issuance/redemption and liquidity risk, as discussed in Sections 4.1.2 and 4.2.3, respectively.

Key questions

- Q1. What are the operating hours for the wholesale token arrangement? During what hours would tokens need to be transferred? During what hours could new tokens be issued (and/or redeemed)? Do the issuance and transfer hours overlap fully or not?
- Q2. During which times can underlying assets or funds backing the token be provided or removed?
- Q3. What risks do the operating hours pose, especially where the hours of the connected infrastructures do not overlap with the hours of the wholesale token arrangement?

4.1.2 Issuance and redemption

A wholesale token arrangement would need to have an entity or mechanism in place to control the issuance and redemption of tokens. This could be done either automatically or manually, and with the direct involvement of the central bank or another authorised entity, depending on the institutional and technical design of the arrangement. In particular, the process of issuance may require adding to the aggregate amount of the underlying assets/funds that back the token. The process for increasing or reducing such assets in order to change the supply of tokens introduces risks, depending on the assets and entities involved.

Key questions

- Q4. What triggers the issuance of tokens (eg funding via a deposit into the account of the issuer via a different payment system)? Are tokenholders able to trigger issuance without involving the issuer? Are all tokenholders equally able to trigger issuance?
- Q5. What triggers the redemption of tokens? How does the ownership or claim on the underlying asset change following a redemption?
- Q6. Are there limits on the value of tokens that can be in circulation? How are these limits determined and enforced?
- Q7. Are there limits on the value of tokens that each participant can hold at one time?

¹² Many of the considerations discussed in this section could also be applicable to token arrangements for transferring other digital assets, but these are outside the scope of this report.

4.1.3 Access

It is possible that not all tokenholders will have the same level of access to the wholesale token arrangement. It should be clear which tokenholders can obtain, hold, transfer and/or redeem tokens. Access issues may be particularly important for wholesale token arrangements that contemplate tiered participation levels, including where indirect tokenholders rely on direct tokenholders for funding and defunding. Such tiered arrangements may be conceptually more complicated and present additional risks.

Key questions

- Q8. Who has access to the wholesale token arrangement? What are the access criteria? Who controls access?
- Q9. What requirements are tokenholders required to meet and adhere to? What responsibilities do tokenholders have?
- Q10. Who can send/receive a token? How is this operationalised?
- Q11. Who can hold a token? How does token ownership work in tiered arrangements with direct and indirect tokenholders?
- Q12. What is the process for funding and defunding in tiered arrangements with direct and indirect tokenholders?

4.1.4 Underlying assets/funds and claims

For wholesale tokens to be exchanged peer to peer without the direct involvement of an intermediary, tokenholders need to have a strong assurance that the token will be accepted by others and will retain its value (ie be a safe settlement asset). Central bank money is typically the safest type of money in its own jurisdiction, as central banks are generally tasked with managing the supply of money effectively. Settlement at commercial banks or non-central bank-operated FMIs (also referred to as commercial bank money) exposes account owners to additional counterparty credit and liquidity risk.

To date, some wholesale token proposals attempt to create a safer settlement asset by employing a model that seeks to back the tokens “one for one” with corresponding deposits of central bank money, commercial bank money, or some other safe and reliable asset. For wholesale tokens to derive value or safety from the assets or funds they attempt to represent or are backed by, there should be clarity as to what or on whom a tokenholder has a claim, or how the backing relates to the tokenholder’s claim.

Developers of wholesale token arrangements will need to clearly demonstrate the legal rights and relationships between issuer, tokenholder and underlying assets, including any exposure the tokenholder has to losses, such as in the event of a default of the issuer(s) or other relevant party to the arrangement. Even in arrangements in which the wholesale token is backed by deposits held in a central bank account, the claim of the tokenholder will generally not be equivalent to central bank money, assuming that the claim is not on the central bank, and will therefore inherently incur additional credit and liquidity risk.

Key questions

- Q13. What mechanisms are used to safeguard the value of the token?
- Q14. How does the asset backing of a token relate to the tokenholder’s position from a legal perspective? Does a direct holder have a claim on the underlying assets or an entity? If it is a claim on an entity, is it a secured or unsecured claim? Does each tokenholder have an individual claim on a specific underlying asset or funds, or do all tokenholders have a joint claim on a pool of assets? What type of claim or right does an indirect holder have?

Q15. For tokens backed by underlying assets or funds, how is the valuation of the underlying performed? What happens if the value of the assets rises or falls relative to the value of the token? What procedures are followed to stabilise the value of the token relative to the value of the underlying ?

4.1.5 Transfer mechanism

Wholesale token arrangements may differ on how much decentralisation and intermediation is required to transfer tokens. For example, an arrangement could be designed to allow tokenholders to transfer tokens without a central party engaged in the transfer, and others may require trusted third parties to validate the transactions in some manner. Wholesale token arrangements with multiple participant tiers may have more complex transfer arrangements. For example, indirect tokenholders may need to use direct tokenholders as correspondents.

Key questions

- Q16. How are token transfers effected? Does the arrangement use DLT?
- Q17. How are token transactions verified? Does the issuer (or any other entity) play any role in verifying transactions?
- Q18. Is the settlement in real time? Is the settlement gross or net and, if net, how are liquidity-saving mechanisms used to reduce prefunding costs?
- Q19. Where the token is used in exchange of value transactions (eg securities or foreign exchange), how is conditionality of the two transactions achieved (ie final delivery/payment occurs if and only if the corresponding final payment occurs)?

4.1.6 Privacy and regulatory compliance

The interplay of the design choices may have an impact on the privacy characteristics of the arrangement. If DLT is used, the institutional and technical configuration of the network will affect the level of privacy for the arrangement, and there may be a trade-off between privacy and efficiency. In particular, the amount of information shared may be different for tokenholders, regulators, the issuer and other stakeholders, and may have implications for compliance with anti-money laundering and combating the financing of terrorism (AML/CFT) regulations, among other things (eg “know-your-customer” requirements and consumer and data protection).

Key questions

- Q20. What level of privacy is achieved in the arrangement (among tokenholders, issuer, regulator and other stakeholders)? Who can see or obtain what information?
- Q21. How does the arrangement support and ensure compliance with AML/CFT regulations?
- Q22. How does the arrangement support and ensure compliance with data protection regulations?

4.1.7 Interoperability

A wholesale token arrangement could be connected to various other arrangements and entities, including other token arrangements and traditional infrastructures. Some potential interlinkages include connections with other token arrangements or traditional FMIs for DvP and PvP token settlement; and

connection to traditional FMIs, custodians and settlement institutions for safekeeping of underlying assets/funds, funding and defunding. Each of these interlinkages could expose the wholesale token arrangement to varying risks, including legal, operational and financial risks depending on the contractual and operational arrangements in place.

Key questions

- Q23. Does the wholesale token arrangement interoperate with other traditional and/or token arrangements? If so, with what types, and how do they interoperate?
- Q24. What legal and operational arrangements connect the wholesale token arrangement to these other arrangements?
- Q25. What risks do these interlinkages create and how are they mitigated and managed?
- Q26. What contingency procedures would be followed in the event of an operational outage affecting a linked arrangement? What impact would this have on the wholesale token arrangement?

4.2 General organisation and risk management

The design of a wholesale token arrangement can bolster its operational and financial soundness, but may also be a source of risk for its participants. This section addresses some fundamental institutional and risk management considerations for token developers when designing arrangements.

If a wholesale digital token arrangement becomes a systemically important FMI it will be expected to observe the PFMI in the same way as other systemically important payment systems.¹³ Given this, in designing wholesale digital token arrangements, developers may want to consider whether their design would be consistent with, or could be made consistent with, the PFMI.

4.2.1 Legal basis

To perform as a safe settlement asset, wholesale tokens require a sound legal underpinning. To date, multiple legal questions relate to the design and use of wholesale tokens for settlement, as to digital tokens more generally. Traditional wholesale payment arrangements, such as real-time gross settlement systems, are based on long-established and well founded legal structures and arrangements. Protections under existing legislation, including payments law, contract law, settlement finality provisions and conflicts of law regimes in their local jurisdictions, were not written with wholesale token arrangements in mind, and may not necessarily extend to such arrangements, leading to possible legal uncertainties and risks. Their legal soundness can lead to especially complex questions when arrangements involve multiple legal jurisdictions, such as through the access of foreign tokenholders and cross-border transfers. While the specific legal questions will depend on the design of the arrangement and jurisdictional legal framework, other general questions should also be considered.

Key questions

- Q27. What laws govern the arrangement and its enforcement?
- Q28. What is the legal status of the token, the underlying assets or funds, and how the token is backed by the underlying?

¹³ Depending on the other tokenised assets that are part of the wholesale digital arrangement, it may also be classified as a central securities depository or a securities settlement system.

- Q29. How are the tokens held and transferred? When and how are transactions settled with finality (both for token transfers and any funding/defunding)? How are DvP and PvP achieved for exchange-of-value transactions?
- Q30. Who is liable for holdings and transfers, including for the token arrangement?
- Q31. What specific legal risks arise from cross-border activity and foreign tokenholders in the arrangement, and how are these mitigated?
- Q32. How are rights enforced?

4.2.2 Governance

As noted throughout this report, decentralised systems that enable peer-to-peer transfers of digital assets are frequently presented as having potential benefits for safety and efficiency. However, the potential absence of a central operator or responsible intermediaries in some of these arrangements raises questions around governance – namely, who or what is responsible for setting and enforcing the rules of the arrangement, managing risks and maintaining and upgrading a shared infrastructure. In general, a clear assignment of responsibilities may be required so that wholesale token arrangements are supported by sound governance arrangements, which would require a clear set of rules, procedures, and a legal entity with responsibility for ongoing comprehensive risk management of the arrangement. For arrangements that are highly automated and highly decentralised, sound governance principles may need to be incorporated in advance into the arrangement's rules and automated processes.

Cross-border or multicurrency wholesale token arrangements may add further complexity to the governance structures. These large interconnected arrangements should consider structures and governance that could facilitate holistic system-wide risk management and oversight of the entire arrangement.

Key questions

- Q33. What is the legal and ownership structure and organisational form of the wholesale token arrangement?
- Q34. Who is responsible for developing, maintaining and updating the rules and operating the wholesale token arrangement? Who is responsible for resolving disputes?
- Q35. If the arrangement spans multiple jurisdictions and/or multiple legal entities, which governance body or bodies have responsibility for the entire enterprise, and how are they constituted?

4.2.3 Liquidity risk

The wholesale token arrangement design needs to consider the liquidity risks related to issuance and redemption of tokens. Liquidity risks could exist when the wholesale token arrangement operating hours do not fully overlap with the availability and operating hours of connected infrastructures. Today, whether settled in central bank or commercial bank money, wholesale payments are funded using account-based deposits held by the payer with the settlement institution or intraday credit extended by that settlement institution. In the absence of intraday credit, if the available intraday balance in the payer's account is insufficient to execute its payments, this could result in gridlock in the payment system, preventing payments from being executed. Thus, in many cases, central and commercial banks provide intraday credit to banks and other account owners. However, central banks can create unlimited liquidity in their domestic currency, which is an inherent difference from commercial bank money.

Key questions

- Q36. When connected infrastructures are used for funding/defunding, when are they available?
- Q37. Can tokens be transferred outside account funding/defunding hours? If so, how is funding/defunding achieved when key infrastructures are closed?
- Q38. Is intraday credit offered in the wholesale token arrangement (eg by the issuer, direct tokenholders, or another entities)? Is overnight credit offered? Is credit collateralised or subject to caps?

4.2.4 Operational risk

Like traditional payment systems, wholesale digital token arrangements pose a range of operational risks. These risks will depend largely on the arrangement's design. For example, a DLT arrangement, in which multiple copies of the transaction records are held in different nodes, may improve resiliency and data integrity, as compared with traditional payment systems. However, this design could also result in reduced transaction capacity and/or scalability relative to a traditional system. It is important that developers recognise and manage the range of operational risks, including those stemming from interlinkages to traditional systems. Several considerations should be taken into account.

Key questions

- Q39. What are the wholesale token arrangement's operational reliability objectives and what policies are in place to achieve and monitor compliance with these objectives?
- Q40. What outsourcing arrangements, service providers and partnerships does the arrangement rely on? Are any of these critical to the arrangement's operations? How are those entities chosen and what contractual agreements are in place?
- Q41. What key person or financial dependencies does the arrangement have?
- Q42. How scalable is the wholesale token arrangement's capacity to handle increasing volumes?
- Q43. How will the wholesale token arrangement monitor and address potential security vulnerabilities and threats, including cyber security?
- Q44. What is the wholesale token arrangement's business continuity plan in case of an operational outage affecting the arrangement and/or other arrangements or linked FMIs?
- Q45. Who is responsible for ongoing operational performance and risk management (including cyber)?

4.2.5 Transparency

It is important that wholesale token arrangements provide sufficient information to enable tokenholders and relevant authorities to fully understand the risks and responsibilities of all tokenholders in the arrangement, and the arrangement itself, including the role of issuer, linked FMIs and services, and the central bank(s) of issue.

Key questions

- Q46. How are the rules of the wholesale token arrangement, including funding and defunding, disclosed to tokenholders and prospective tokenholders as well as to relevant authorities?
- Q47. What relevant rules, regulations, or standards does the arrangement intend to observe and how?

- Q48. What information do the rules and/or participant contracts contain about tokenholders' rights and obligations?
- Q49. What performance data from the arrangement is made available to tokenholders, authorities or the public?

5. Conclusions

Digital tokens are being explored by the private sector to support peer-to-peer settlement for a wide range of assets, including payments. Wholesale token arrangements differ from traditional payment systems mostly in the technology used and the mechanisms used to hold and transfer the settlement asset.

At the current stage of development, many of the tokens envisaged as wholesale settlement assets represent a claim related to a pool of assets or funds and are characterised as being backed by commercial or central bank deposits denominated in a sovereign currency. With sufficient clarity on the nature of rights or claims embedded in the wholesale digital token, and on how the asset or funds backing relates to such right or claim, a token could provide a safe or efficient alternative to settlement in traditional commercial bank money, especially when the underlying asset is represented by central bank money. However, even in cases where a wholesale token is backed by deposits held in a central bank account, the claim of the tokenholder will generally not be equivalent to central bank money, assuming that the right or claim is not on the central bank, and therefore will inherently incur additional credit and liquidity risk.

Other design features, such as the issuance mechanism, rules for access to the token, availability of the token arrangement (and supporting funding/defunding mechanism), transfer mechanism, and interoperability, may further affect the ability of tokens to improve safety and efficiency over traditional settlement arrangements. In addition, token arrangements raise new organisational and risk management challenges (eg appropriate governance, legal soundness, operational risk management and transparency) that need to be properly understood and addressed. These items, among others, should be carefully considered by developers of such arrangements.

A wholesale digital token arrangement needs to be compliant with all applicable regulatory and oversight requirements. If a wholesale digital token arrangement is a systemically important FMI it will be expected to observe the PFMI in the same way as other FMIs. Depending upon its design and use, a wholesale digital token arrangement may also have implications for the central bank (eg smooth conduct of payments, monetary policy, financial stability). Consequently, in addition to the questions set out in this report, the developers of wholesale digital token arrangements should expect that they may need to address the central bank's policy concerns.

References

Bank for International Settlements (1996): Implications for central banks of the development of electronic money, October.

Committee on Payments and Market Infrastructures (2014): Non-banks in retail payments, September.

——— (2015): Digital currencies, November.

——— (2016): Fast payments, November.

——— (2018a): Cross-border retail payments, February.

——— (2018b): Central bank digital currencies, March.

Committee on Payment and Settlement Systems (1992): Delivery versus payment in securities settlement systems, September.

——— (2003): The role of central bank money in payment systems, August.

Committee on Payments and Settlement Systems and the Technical Committee of the International Organization of Securities Commissions (2012): Principles for financial market infrastructures, April.

European Central Bank and Bank of Japan (2018): Securities settlement systems: delivery-versus-payment in a distributed ledger environment, March.

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