

R3 Reports

# An Intraday Liquidity Market Using Blockchain Technology

Baringa, Finteum and R3



A hand is shown reaching towards a digital globe. The globe is composed of a wireframe mesh and is surrounded by various currency symbols (€, \$, ¥, £, ₩, ₹) and a network of glowing nodes and lines, suggesting a global financial network or blockchain technology.

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R3 Research delivers leading insight into the enterprise blockchain industry, from specific real-world application to cross-functional analysis. Drawing from a global team with extensive industry experience, R3 reports stand at the forefront of blockchain research.

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# An Intraday Liquidity Market using Blockchain Technology

Baringa\*, Fintium<sup>†</sup> and R3<sup>‡</sup>

October 19, 2018

## Abstract

Intraday liquidity management inefficiencies cost global banks tens of millions of dollars every year. To address this, financial institutions are designing and implementing intraday liquidity management tools including more robust measuring and monitoring capabilities. This paper presents the case for aligning retrospective intraday liquidity management, which relies on historical data, with active intraday management, which includes forecasting, pre-positioning and borrowing. It proposes and describes the parameters of an intraday market solution using distributed ledger technology to help financial institutions better manage their intraday cash flows.

## 1 Introduction

Intraday liquidity is regularly ranked among the top three concerns for bank treasurers. In response, financial industry participants have invested significantly in their intraday liquidity monitoring and measurement capabilities in order to enhance the resilience of intraday liquidity operations and payment and settlement networks. In addition, industry trends are pointing toward faster, yet more regulated, payments and settlements infrastructure.

Today, intraday liquidity is managed both retrospectively and actively. Over the past decade, the industry focus has been on improvements in retrospective management including intraday risk management reporting capabilities and better payment throttling mechanisms. However, the evolving financial landscape is highlighting the need for better active management.<sup>1</sup>

This has led to an emergence of an efficiency problem for most banks. How should banks walk the fine line of investing liquidity for a return and thus minimize opportunity costs associated with holding a large cash reserve, while still ensuring a sufficient pool is available to support unexpected outflows?

One potential way to accomplish this is through an actively traded market for intraday liquidity management. With traditional settlement infrastructure, this would be difficult to accomplish. However, with emerging technologies – such as blockchain – the creation of a market is more attainable. This paper considers the benefits of such a market with the additional feature of a fiat-linked digital currency. We explore the cost, balance sheet and efficiency benefits that could be realised with this additional intraday liquidity source.

Section 2 describes how banks are addressing active and retrospective intraday liquidity management. Section 3 details the types of intraday financing sources today. Section 4 and 5 introduce

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<sup>1</sup>The direct cost and opportunity costs of holding excess liquidity are increasing and client demands for self-clearing is growing. In addition, there is pressure on existing infrastructures for earlier availability of funds, while multiple stakeholders are also looking for more frequent and transparent reporting of intraday flows.

the features of blockchain that could help intraday markets operate more efficiently and move the sector closer to the end state market solution. Section 6 concludes.

## 2 Intraday Liquidity Management

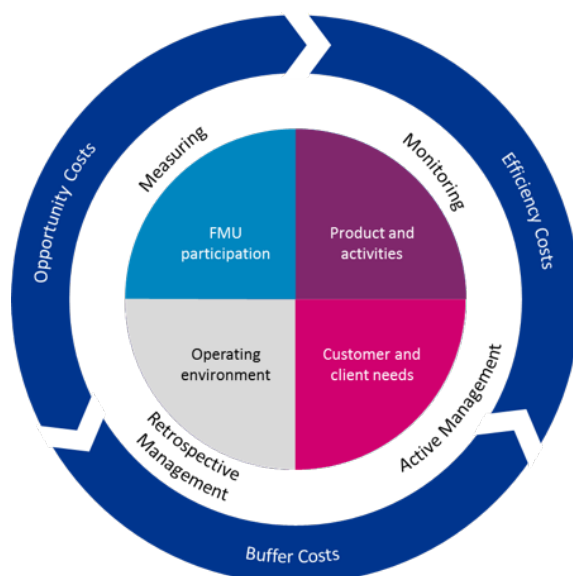
Intraday liquidity refers to cash and securities that can be accessed during a business day to enable banks to meet their payments and settlement obligations throughout that same day.

Before we introduce trends and solutions in the sector, we first set out how financial institutions deal with intraday liquidity management today. Intraday liquidity needs differ based on a financial institution’s business model. As shown in Figure 1, key factors that drive intraday day liquidity needs are:

- **FMU system participation:** direct participants and clearers in financial market utility (FMU) systems and real time gross settlement (RTGS) systems have different intraday liquidity needs than indirect clearing institutions who rely on their correspondent and agent banks to clear cash and securities and conduct payment and settlement activities on their behalf.
- **Products and activities:** products (e.g. equities, fixed income, lending products, structured, primary and secondary markets), transaction types (cash payments, securities for securities trades and cash vs. securities trades), volumes and sizes drive intraday liquidity needs for a bank.
- **Customer and client needs:** banks that provide correspondent bank services typically extend secured and unsecured lines of intraday credit to help facilitate their customers and clients payment and settlement requirements.
- **Operating environment:** business-as-usual (BAU) activity differs from business activity in an environment during which the firm is being impacted by negative market developments (a stress environment).

Intraday liquidity management has a direct impact on firms’ bottom lines through three main channels. The first is efficiency costs or operating expenses. A second channel is the intraday liquidity buffer, which creates a net interest expense. A final channel includes the opportunity cost, which reflects the implicit cost of choosing to use an asset for intraday purposes.

Figure 1: Drivers of Intraday Liquidity Needs



Source: Baringa, Finteam and R3.

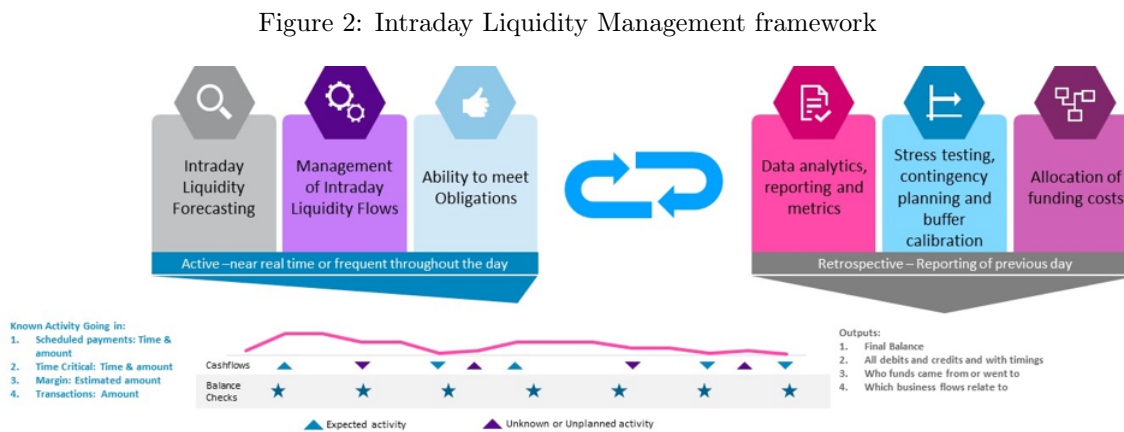
The following sections provide a deep dive into retrospective liquidity management, active intraday liquidity management and the linkage between the two.

## 2.1 The retrospective approach of liquidity management

Traditionally, liquidity management has been "retrospective". For intraday liquidity management, this retrospective view refers to the T+1 monitoring, measuring, managing and reporting of payment and settlement flows owned by the liquidity management function. Subject to risk oversight, retrospective intraday liquidity management includes:

- Data analytics, reporting and metrics: producing planned and ad-hoc reporting on historic cash and securities settlement data to identify trends and provide an attribution of any variances or otherwise unexpected intraday events in coordination with lines of business, operations, risk and finance. The data that represents the variance, or “explain”, is often filtered according to currency, FMU, legal entity, business line, customer/counterparty and product, which often requires combining settlement data with other data sources.
- Stress testing, contingency planning and buffer calibration: assessing intraday liquidity needs as part of broader liquidity stress testing efforts. This is typically calculated by capturing the risk of a change in payment profiles, such as delayed incoming payments, or the ability of the firm to fund its intraday liquidity position if obligations change, such as FMU collateralisation.
- Allocation of funding costs: pricing the cost of intraday liquidity usage effectively into charges to businesses to align strategies with firm-level risk appetite and ensure effective allocation of all contingent liquidity costs.

Liquidity managers leverage retrospective intraday liquidity management to calculate contingent liquidity needs for intraday obligations. As a result this aspect of intraday liquidity management has a direct impact on bank’s liquidity buffer costs. However, retrospective intraday liquidity management is only a component of intraday liquidity management and cannot be viewed in isolation.



*Source: Baringa, Finteam and R3.*

As shown in Figure 2, intraday liquidity management capabilities should align with either retrospective or active intraday liquidity management. This second type of management has received much less attention.

## 2.2 The active approach of liquidity management

Liquidity management can also be active. Active intraday liquidity management is the near real-time monitoring performed throughout the day, measuring and managing payment and settlement flows. Traditionally an Operations-owned role, this includes:

- Intraday liquidity forecasting: similar to data analytics, forecasts are performed for cash and security settlements by different views (e.g., currency, FMU, entity, etc.) and updated periodically throughout the day to account for new payment and settlement activity based on data from trade capture systems and payment systems.
- Management of intraday liquidity flows: matching obligations between FMU and internal payment and settlement systems, monitoring activity with agent banks and managing payment flows to and from internal and external accounts to ensure they are sufficiently funded throughout the day.
- Ability to meet obligations: facilitating the pre-positioning and intraday cash and securities movements across various FMUs and correspondent banks based on limits, reporting and metrics. This also includes running the intraday scenario daily to ensure that the adequate amount of liquidity is held at and allocated for various FMUs, correspondent banks, etc. by currency. The operations function must maintain a funding strategy and playbook for key payment and clearing systems to ensure continued throughput even in times of stress.

Since these activities sit within Operations, active liquidity management operations can become siloed by currency or activity type. The consequence of lacking a holistic view is increased costs and fees. Failed trades, delayed time critical payments and implicit costs of undisclosed, uncommitted credit lines also have an indirect impact on buffer costs, as firms must make conservative assumptions when sizing the intraday buffer to ensure sufficient liquidity at all points throughout the day. This underlines the importance of having a holistic view of liquidity management as the industry implements new tools and measures.

These two ways of managing liquidity have received unequal attention in the market. We suggest that there is a case to be made for more focus on active liquidity management.

### 2.3 Active liquidity management solutions

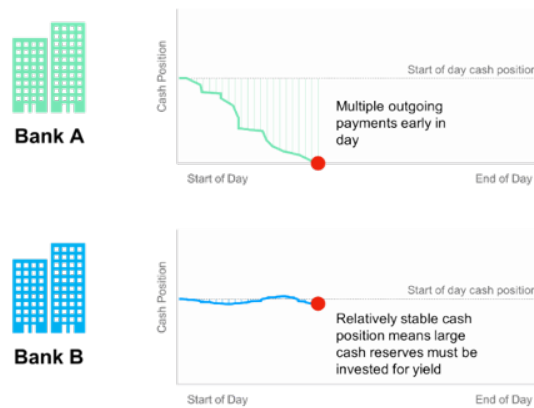
Managing intraday liquidity is a challenge for both banks that start the day in net negative position and banks that start with a stable cash position. In both cases, banks typically address liquidity management challenges using three activities: a live view, intraday borrowing, and throttling capabilities. Active management of these activities would ensure net cash usage falls within acceptable limits throughout the day.

Given the immediate need for liquidity at the start of the day, as shown in Figure 3, operations managers are faced with challenges that influence active intraday liquidity management:

- Managing the bank's start-of-day liquidity to mitigate significant variances day-to-day to ensure the bank is adequately positioned to make all required payments on a timely basis without reliance on inflows.
- Modifying business activities when unexpected market or idiosyncratic conditions arise that limit the bank's ability to source liquidity externally to meet committed obligations.
- Continuing payment and settlement activities in the event that insufficient liquidity in one or more participant accounts prevents timely settlement across a system.

Even in banking models – like custody, for example - where firms experience a relatively stable cash position, there is still a struggle to mitigate the carrying cost associated with large pools of cash. And while variance in liquidity needs for external liquidity sources does not apply, these firms still need to consider approaches to ensure client payment and settlement activity continues despite any hindering systemic issues.

Figure 3: Net cash position by banking model



Source: Baringa, Fintium and R3.

Banks address these challenges using several active intraday liquidity management capabilities.

The short-term solution is to use real-time information from SWIFT messages, central bank data and agent bank information to enable the building of a live view of actual cash positions. With this view, banks can perform reconciliations throughout the day against projected positions to determine outstanding flows and current exposures.

Banks continue to use intraday borrowing from a central bank or via uncommitted, undisclosed credit lines from their agent banks as sources of intraday liquidity throughout the day. These two sources have disadvantages. For the former, excess unencumbered collateral sitting idle at the central bank can easily be converted into cash, but it comes with an opportunity cost. This collateral can be used for yield enhancement in other trades and transactions, or balance sheet reduction. For the latter, credit lines from agent banks may be reduced or withdrawn at any time without notice, making them an unreliable source of funding when banks need it most – during instances of increased trade volume, market volatility or stress. In order to limit the impact of such considerations, regulators and banks alike have moved toward leveraging the analytics performed retrospectively to determine the size of a buffer to address intraday liquidity needs. Here, however, banks must walk a fine line. While holding a buffer enables robust active intraday liquidity management, the costs of too large a buffer can quickly outweigh the operational benefits.

Banks are also developing throttling capabilities and other processes aimed at managing payments in a more deliberate manner than with a first-in-first-out model. By layering in logic that intelligently prioritises obligations, performs netting, enables dynamic payment queuing and allows the bank to slow, or stop, payments deliberately, banks can manage liquidity levels throughout the day and in response to any emerging or new risks. Although banks are investing in throttling capability improvements, this mitigant introduces potential issues as well. If all banks withhold payments, the payments system could grind to a halt, interrupting client and proprietary settlement activity. To address this, the Bank of England has set throughput requirements to ensure banks make a proportion of payments by specified deadlines. However, it applies retrospectively to average measurements, so the risk still exists during a given day. Additionally, throughput requirements are not a global standard, increasing the risk in other currencies.

For banks where there is no shortage of liquidity to facilitate payments and settlements, these mitigants do not address the core issue. That is, how does a bank walk the fine line of investing liquidity for a return and thus minimize opportunity costs associated with holding a large cash reserve, while still ensuring a sufficient pool is available to support unexpected outflows?

The question remains whether holding an intraday buffer or improving throttling capabilities is enough to actively manage intraday liquidity throughout the day. Methods to ensure continued availability of intraday liquidity sources and uninterrupted payment and settlement access need to be supported by more active management mechanisms to ensure net cash usage falls within acceptable limits throughout the day.

## 2.4 How banks are linking retrospective and active intraday liquidity management

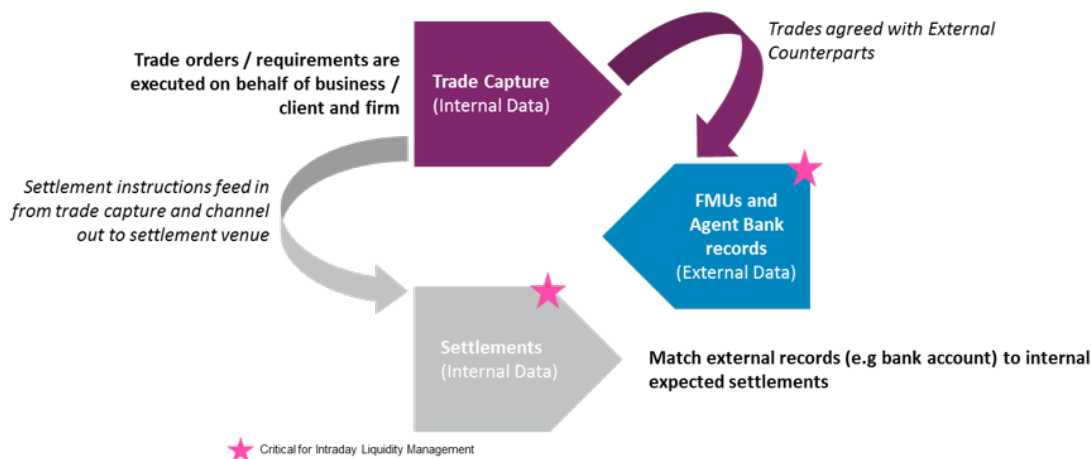
In this section, we have made the case that firms should complement their retrospective intraday liquidity management to mitigate systemic risks, with active intraday liquidity management capabilities to address operational and efficiency costs. The two goals are closely connected. An effective active intraday liquidity management process ensures that the retrospective intraday liquidity management tools are well positioned to serve the desired purpose and vice versa.

As firms develop more robust data analytics capabilities for retrospective intraday liquidity management, the resulting operational improvements shape intraday forecasting and subsequent funding actions by helping firms better anticipate the “unexpected” flows and efficiently meet all obligations in a timely manner. Conversely, as firms are better able to manage active intraday liquidity management via enhanced forecasting, they can move away from overly conservative assumptions when calibrating the intraday liquidity buffer, reducing buffer costs and enabling the more efficient deployment of liquidity.

The core components that underpin these capabilities will be the operating model, data (shown in Figure 4 below) and supporting IT infrastructure. Enhancements will be needed to ensure firms can effectively deliver a robust intraday liquidity management program.

Firms are still operating under legacy roles and responsibilities, established based on historic business activities and market conditions. As intraday liquidity management has evolved, however, the Treasury Middle Office function has emerged across the industry to bridge the gap between Operations and Treasury. This function enables a coordinated and holistic approach to active intraday management in line with Treasury’s strategic goals and retrospective landscape view<sup>2</sup>. Once banks have thought about enhancements to their operating model, they will be better positioned to identify opportunities to rationalize processes and systems, enhance data and break down siloes to build the foundation to enable a more cohesive intraday liquidity management approach. With a new, more functional operating model in place, enhancements to data and technology infrastructure will act as an enabler to further support the desired intraday liquidity capabilities.

Figure 4: Technology infrastructure and data flow for intraday liquidity management



Source: Baringa, Finteam and R3.

<sup>2</sup>Baringa has published additional viewpoints on treasury middle office. Re-examining these points is out of scope for this paper. For more information on intraday liquidity management and Baringa’s views on treasury middle office operations, please refer to <https://www.baringa.com/our-thinking/baringa-blogs/june-2018/intraday-liquidity-management-and-the-case-for-tre/?lang=de>.



### 3 Intraday Financing Sources

The intraday liquidity landscape has been growing more complex since the financial crisis of 2008. Market trends over the past decade have had affected both the demand for and supply of intraday liquidity. The evolution of payment and settlement system requirements has happened over time in 5 key stages focus on:

1. Risk control with the introduction of RTGS for high-value payments and delivery-versus-payment (DVP) systems. These minimized settlement and counterparty risks and enables an up-to-date, accurate view of a bank's position/<sup>3</sup>
2. Liquidity costs related to RTGS and DVP systems. These costs are offset by algorithms and bilateral and multilateral netting arrangements e.g. CHIPS in the USA and TARGET2 in EU. The more recent drive to central counterparty clearing houses (CCPs) and the introduction of CLS further mitigated settlement and counterparty risks, while enabling firms to use their liquidity more efficiently via margining and netting capabilities.
3. Timing criticality of payments mandating that key obligations, such as CLS pay-in or variation margin settlement, are made by a certain point in the day to facilitate ongoing payment, clearing and settlement activities. This feature has a systemic importance, as it enables a system-wide settlement intraday, thus further mitigating settlement risk for system participants.
4. Throughput requirements. These requirements ensure that adequate payment volumes are made throughout the day such that a system may continue to function even during times of market volatility or distress. Another important step to systemic resilience, these requirements ensure that member banks have made, at a minimum, a specific percentage of usual daily payments by a specific cut-off time.
5. Speed and efficiency which is the latest step toward enhancing the payment landscape with the introduction of the renewed RTGS.<sup>4</sup>

These five stages tell us that the payments and settlements landscape has changed significantly and will continue to evolve and impact banks' balance sheet usage, operating costs and liquidity buffer costs.

#### 3.1 Industry trends

Global financial markets are undergoing structural changes that will continue to affect the management of intraday liquidity. The four main changes are detailed below.

First, on the macroeconomic front, low and slowly rising interest rates globally, coupled with liquidity and capital regulation, have led banks to hold excess cash and collateral at central banks. Typical investment avenues, such as short-term placements and highly liquid securities, have continued low yields that make them less attractive investment options in the current market. As central banks look to normalise monetary policies with gradual increases in interest rates, banks are reviewing the opportunity costs of holding excess liquidity. Additionally, recent volatility in emerging markets such as Argentina and Turkey, combined with historic stock market highs, increase the possibility of a risk adjustment.

Second, banks' underlying legacy infrastructure is under pressure while clients, especially indirect clearers, are striving for greater transparency and control over their intraday net cash usage patterns. These institutions are typically at the mercy of their agent banks to manage all their intraday payments and receipts to clients, custodians, central counterparty clearing and financial market utilities.

Third, financial market infrastructure is moving to meet client, regulator and investor demands for greater transparency and efficiency. Although in emerging stages across the globe, "Faster Payments" initiatives, led by the UK, are examples of market infrastructure moving toward addressing

<sup>3</sup>For more on this topic, see <https://www.banque-france.fr/sites/default/files/hervo.pdf>/Fbis

<sup>4</sup>For more details, visit <https://www.bankofengland.co.uk/payment-and-settlement/rtgs-renewal-programme>.

greater speed and transparency across banking flows. Through “Faster Payments”, payment times between customer accounts are being reduced from three working days to real-time transfers.

Lastly, new market entrants and technologies such as blockchain are disrupting the current intraday management industry by creating a real time updating digital ledger that records data changes to support instantaneous payment and settlement. Cryptocurrency markets have led to a debate around benefits of distributed governance, decentralised organisations and democratised standards, which challenge today’s market infrastructure.

These new, evolving and potentially opposing market trends continue to put pressure on bank treasurers to explore the efficacy of the funding model for intraday liquidity. We argue that it is possible to create additional source of intraday liquidity funding by creating a transparent financial market for intraday borrowing using blockchain.

### 3.2 Intraday Sources

To understand what such a market might look like, we turn first to a description of the financing sources available to feed intraday liquidity needs, as these have also evolved during the past years.

The cost behind the financing sources used today depend on the type of settlement asset used, i.e. central bank money, agent bank money or securities collateral.<sup>5</sup> Each of these sources of intraday liquidity are used by Operations functions to actively manage intraday liquidity to ensure payments and settlements are made on a timely basis. For most banks, their net cash usage is primarily impacted by receipts of payments and settlements from other participants throughout the operating day. If the balance of these receipts is too small relative to the payment value to be made at a particular time, there are available sources of intraday liquidity, such as central bank lines of credit or agent bank credit lines.

The cost of potential intraday liquidity sources can be categorized as either opportunity cost, the implicit cost of choosing to use it for intraday purposes as opposed to another alternative, and direct cost, the recognised cost of maintaining the source for intraday purposes (i.e., buffer cost and operating cost).

Figure 5: Intraday Liquidity Sources and Associated Costs

	Intraday liquidity source	Costs ranking		
		Opportunity	Direct	Overall
Increasing cost	Third party payment receipts	●	●	●
	Unsecured credit lines from central bank e.g. net debit cap in the US	●	●	●
	Unsecured credit lines from agent banks	●	●	●
	Collateral pledged to agent banks for secured credit lines	●	●	●
	Cash reserves at central banks	●	●	●
	Unencumbered high-quality liquid assets that can be monetised	●	●	●
	Collateral pledged at central banks that can be easily converted to cash	●	●	●

Source: Baringa, Finteam and R3 - cost ranking by authors

Although agent bank credit lines are typically thought of as interest-free, there is an increased concentration of correspondent banking activities and funding costs related to critical time windows. For instance, CLS settlement processes have triggered a move towards greater concentration

<sup>5</sup>“Recent developments in intraday liquidity in payment and settlement systems” FRÉDÉRIC HERVO, Feb 2008 <https://www.banque-france.fr/sites/default/files/hervo.pdf>

of correspondent activity into direct participants and nostro agents for CLS. Further, as direct participants and nostro agents begin to increase the market share in correspondent activity, they are able to charge for the prioritisation of time critical funding obligations.

Given the costs listed above in Figure 5 and improving capabilities for timely payments, observers sometimes question why there is no actively traded intraday liquidity market. There are different viewpoints on why an intraday liquidity market does not already exist.

Our theory, which is also the most common theory, is that it would be operationally too difficult to execute the two payments as time critical obligations with timing certainty using existing booking systems, processes and settlement rails. With current market infrastructure, it will be difficult to have visibility into payment/settlement messaging on a minute by minute basis, to book trades with tenors shorter than overnight and to settle transactions with a guarantee of when cash will be sent and received.

There have been some initiatives that are comparable to an intraday market, but not the same. For example, CLS Now is a recent initiative that enables banks to transact FX swaps with settlement roughly within one hour. The Utility Settlement Coin (USC) project could also improve timing certainty around settlements for participants.

### **3.3 Intraday Borrowing Market Concept**

In order to clearly articulate how this concept would work, Baringa and Fintium met with professionals in Europe across liquidity management, treasury markets, operations and risk functions. Together, we conducted market research on an intraday borrowing market concept. Working closely with R3, we also explored the use of blockchain to facilitate the funding exchange and settlement process between borrowers and lenders.

#### **3.3.1 Key premises for an intraday borrowing market**

Leveraging some of the benefits of technological advancement and disruptor firms, an intraday market that brings together borrowers and lenders in a seamless manner can provide additional intraday funding capacity to the industry.

Unlike other funding markets, where the shortest tenor to lend and borrow is overnight, an intraday market can provide funding on a more frequent basis to support payment activity throughout the day. To do this, an intraday market will need to operate based on the following principles:

- Transaction execution speed that supports dramatically shorter settlement windows
- Timing certainty on repayment through systemic controls and legal recourse
- Agreement between participants on risk mitigation, such as collateral, via contractual means
- Integration with various systems and processes to broaden the range of accessible participants
- Transparency that allows participants and regulators access to key data underpinning transactions and charges, as well as system-wide reporting
- Operational resilience in varied market conditions, ensuring continued operation in times of high transaction volume, stress and volatility
- Dependability - participants can be assured of continued market access, including during idiosyncratic stress, and the market continues to function during market-wide stress
- A clear and robust governance framework that addresses market rules, processes, oversight mechanism and guidelines for change management
- Security, including data protection
- Commercial viability via incentives and benefits for lender and borrower banks and market facilitation entities that ensure sustainability as markets evolve

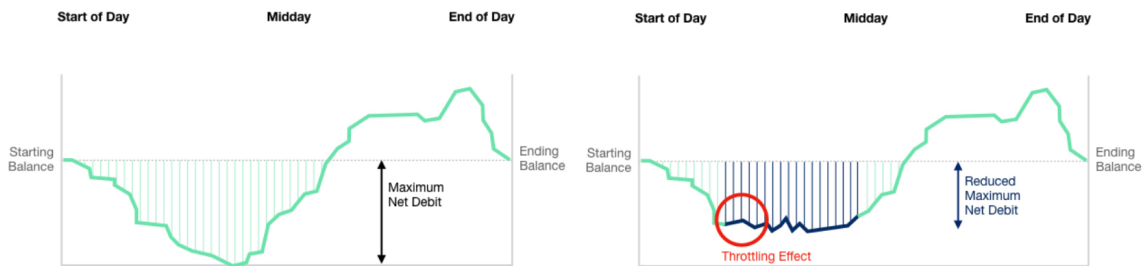
### 3.3.2 Impact on net cash usage patterns

The purpose of an intraday borrowing market is to provide access to funds throughout the day to facilitate smoother payment and settlement activity.

In a business-as-usual environment, net cash usage patterns are typically managed between credit line limits provided by agent banks or central banks. In normal market conditions, these mechanisms work well albeit not most efficiently from a cost perspective. Managing intraday liquidity using this process will result in higher active management costs, specifically operating costs, to access these funding sources as well as retrospective intraday liquidity buffer costs. Daily maximum outflows<sup>6</sup> at credit line floors result in higher intraday liquidity buffer measurements.<sup>7</sup> As firms near the close of business, a relative increase in receipts to payments enable operations teams to close out net debit positions and pre-position accounts to address payment and settlement needs the following business day.

Throttling has the ability to help actively manage intraday liquidity costs by smoothing a firm’s net cash position profile, as shown below in Figure 6, ultimately lessening the effects of cash flows on the mean maximum net outflow calculations. However, as described in Section 2 above, throttling is operationally taxing for a bank under business-as-usual and may have negative effects on the wider financial system. Further, as a result of the gridlock risk it poses in normal conditions, it is generally not viewed favourably as a mechanism to actively manage intraday liquidity.

Figure 6: Net Cash Usage patterns pre- and post-throttling



Source: Baringa, Finteam and R3 – charts are for representation only and not based on actual data.

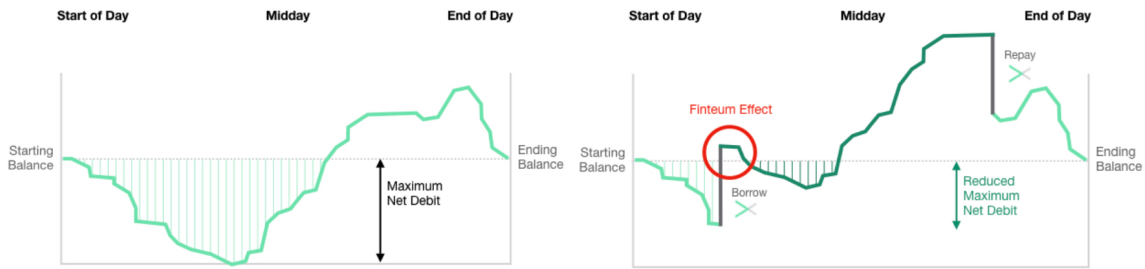
With an intraday borrowing market, banks could complete the following actions to drive their net usage patterns and intraday liquidity costs, as shown in Figure 7 below. By borrowing funds from lenders in the market to satisfy payment needs at an intraday cost, banks can potentially decrease the amount of intraday credit lines needed. This added intraday source can result in less intraday reliance on these lines of credit thereby providing the potential to manage these operating costs with credit line providers more effectively. As payment receipts filter in, banks will continue to use receipts to fund actual payment outflows. However, with an intraday market, excess receipts can be used to repay funds that were borrowed to minimize initial borrowing costs. In addition, any excess receipts can be lent on a minute by minute basis to other borrowers in the market.

This additional flexibility will allow banks to actively manage their operating costs while influencing their retrospective buffer costs.

<sup>6</sup>Under PRA Pillar 2 guidance, firms must calculate a buffer add-on to address intraday liquidity risk and mitigate the risks associated with double duty. The intraday buffer add-on is a function of the firm’s mean maximum net debit on a system-by-system basis, among other factors.

<sup>7</sup>In the case where a firm is unable to calculate its mean maximum net debit, the PRA has proposed alternative methodologies such as level of liquidity recycling as proxy. In order to address contingent needs, firms are required to also calculate a stress-uplift based on scenarios proposed in BCBS 248 “Monitoring tools for intraday liquidity management”.

Figure 7: Net cash usage pattern with an intraday market such as Fintium (see Section 4)



Source: Baringa, Fintium and R3 – charts are for representation only and not based on actual data.

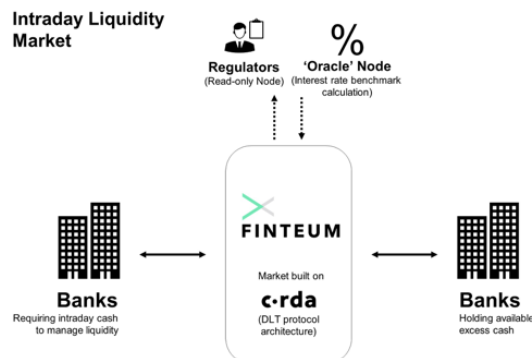
## 4 The design of an intraday market

Given a rising rates environment, it is increasingly valuable for treasurers to have more tools and mechanisms to manage balances more closely. This section will walk through the structure of how Fintium’s platform connects borrowers and lenders. It will walk through the decision to create a central entity to mitigate risk relating to (three main types) of risk. These considerations lead to three use cases for the platform, specifically intercompany management and cross-currency management, along with how to handle situations involving large transactions.

### 4.1 Product: Borrower and Lender Market

At certain times of the day, banks have excess intraday liquidity in a given currency and have completed the majority of payments for that day. In those situations, a bank may be willing to earn additional return by lending that currency for a few hours. On the other side, as shown in Figure 8 below, a borrowing bank could reduce the maximum net debit for the day by accessing these excess funds. This would create a more efficient settlement system by matching excess and deficit without needing to establish new netting mechanisms or change existing settlement processes for other products.

Figure 8: Fintium’s intraday market solution



Source: Baringa, Fintium and R3.

The market shown above is an interbank market. However, it’s also possible that other lenders would enter this market. For example, buy-side firms such as asset managers that currently lend to banks overnight and longer through money market transactions would potentially be comfortable with the intraday credit exposure.

Leveraging blockchain as an enabling technology to bring borrowers and lenders together enables transaction data to be shared with a central entity, or a regulator, and assures parties that historical transaction records have not been changed. Sharing trade data with counterparties through blockchain removes delays associated with reconciliation and failed settlement. Unlike current money market infrastructure, using digital currency removes the need for legacy settlement rails and can allow settlement timing be established in advance. There is no ideal interest rate benchmark available for intraday lending. Also, bilateral negotiation on rates would slow the market. A data provider could publish real-time rates to the network as part of a role called an “Oracle” node.

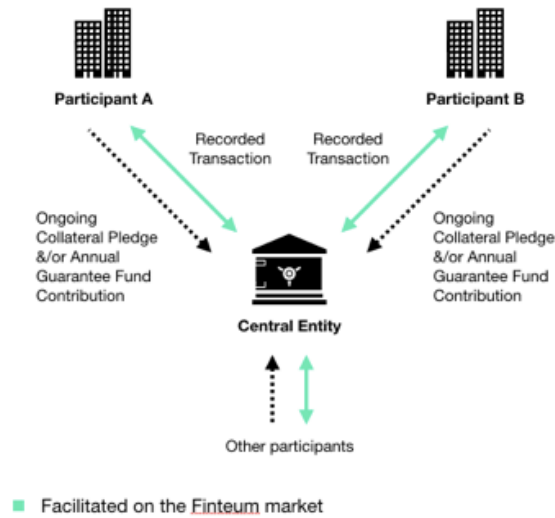
## 4.2 Initial Risk Considerations

Many participants have highlighted that intraday borrowing will create intraday credit risk. Banks and regulators do not have risk appetite for another unsecured interbank market. Participants have also highlighted the risk of an individual participants being closed out of the market in case there is negative news surrounding them. Lastly, participants have highlighted the operational risk around failure to pay or failure to repay. All three of these risks have led to the proposal of a central entity.

Creation of a central entity can achieve three main goals; credit risk mitigation, market anonymity and repayment timing certainty. Firstly, on risk mitigation, if an individual participant partly collateralises their lending exposure to partly mitigate the credit risk, the central entity can hold this collateral on behalf of the market. It is also possible that the central entity would hold a guarantee fund, similar to the credit insurance for other CCPs. Participants would need to provide contributions for this insurance. Clearly there are trade-offs for stakeholders between the cost of this risk mitigation and the market dependability. Secondly, by facing a central entity in either a borrowing or a lending transaction, participants can avoid bilateral exposures. This creates an anonymous market that participants would not be closed out of in case of bad news. Thirdly, the central entity could step in to make a lender whole in a failure to repay scenario, using the collateral held. If failure to repay is due to default or insolvency then the central entity could access the insurance through the guarantee fund, and liaise with the administrators instead of the onus being on the lender. If failure to repay were due to systems outage or an operational issue, the central entity would make the lender whole and take temporary credit risk to the borrowing entity while it is resolved. This would be necessary for lenders to feel confident and because timing certainty is crucial for the participants.

This proposed market structure, shown in Figure 9 below, has been discussed with potential participants and market stakeholders but is subject to refinement and review.

Figure 9: Finteam’s proposed market structure (subject to change)



Source: Baringa, Finteam and R3.

### 4.3 Use Cases

We have thought through three examples of how an actively traded financial market for intraday liquidity could help to optimise global bank processes.

#### 4.3.1 Intercompany Management

Banks need to manage liquidity carefully across global legal entities. This is especially true of international activity where banks have been influenced by regulators to manage liquidity on a regionalised basis, transferring activity to subsidiaries or intermediate holding companies and treating intercompany transactions and exposures similar to third party. Banks are also conscious of entity lending restrictions and trapped liquidity. Intercompany management is important in a BAU and stress environment, but also influenced by recovery and resolution planning which requires liquidity resources and management capabilities to be accessible for remaining entities in a scenario when non-core entities are dissolved.

In a BAU environment, banks often operate through one primary clearing and settlement entity for each currency. The implications are operational **reliance**, **risk** exposures, and **operational strain**.

- Clearing activity creates a web of intercompany operational **reliance** for firms operating in multiple currencies and jurisdictions. It often also creates reliance on a single agent bank in a foreign jurisdiction, for example, a U.S. entity can be reliant on an E.U. entity within the same group for clearing, and on that E.U. entity’s agent bank for settlement.
- **Risk** exposures are being created throughout the day. For example, an E.U. entity that makes payments on behalf of a U.S. entity before receiving payments from them or on their behalf creates intercompany credit risk exposure (or some banks may refer to this as intercompany settlement risk or intercompany Herstatt risk). Sometimes the E.U. entity will have capabilities to govern and manage these exposures, similar to how an agent bank manages third party exposures, but often not. Banks can mitigate this risk using intercompany credit lines, throttling or through intercompany lending.
- However, these options create **operational strain**. Credit lines require governance, monitoring and operational processes to ensure limits are appropriate and being adhered to, and that drawing on lines is being appropriately recorded and governed. Throttling requires holding

back outgoing payments for another entity’s activity, which requires operational capabilities and monitoring. Lending could be a straightforward nostro transfer and could be intraday to match the risk exposure, if a banking group has intraday loan booking capability. Otherwise, the loan may require cancelling an overnight trade. It’s also difficult to price intraday lending at arms length, which is required to prove transfer pricing is effective.

Having an active intraday borrowing market could alleviate some of these difficulties. Banks could see the pricing of other banks’ recent intercompany trades without viewing counterparty data, and could have the operational capability to actively manage risk exposures intraday. An intraday borrowing market would not remove intercompany operational reliance but managing risk exposures through lending and then analysing the lending data would give each legal entity metrics to quantify the reliance.

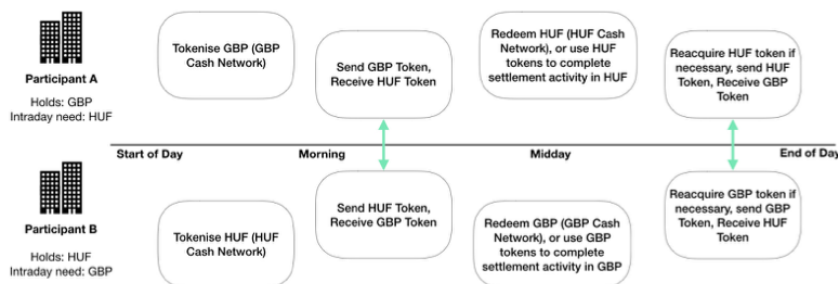
### 4.3.2 Cross Currency Management

The intercompany borrowing market can also serve as a currency risk mitigation tool. For example, if an agent bank for a smaller currency were to withdraw uncommitted credit lines, it would become important to collateralise that currency’s nostro intraday. Banks could normally complete an FX swap transaction overnight or longer, or borrow in money markets, or buy securities in order to have assets in the correct currency for collateralisation. However those transactions would not be efficient from a risk and balance sheet management perspective. It would be more efficient to borrow intraday and to use the funds borrowed to collateralise the nostro.

Some banks have also highlighted the possibility for the intraday borrowing market to be further developed into an intraday FX swap market, as a natural extension of single-currency intraday borrowing, but which would be difficult to price without single-currency intraday borrowing.

It is quite difficult to hold liquid assets in one currency and to use them to facilitate settlement in another currency. Creating an intraday borrowing market could potentially facilitate this in two ways. Firstly, it could be possible to use foreign currency assets to issue tokens and then to lend those tokens intercompany. Secondly, having an intraday FX swap market would mean that a bank could hold assets in one currency and swap it with a third party to transfer intercompany, as represented in Figure 10 below.

Figure 10: Cross Currency Management using Finteam



Source: Baringa, Finteam and R3.

### 4.3.3 Large Transactions

Sometimes banks will need to pre-position liquidity in a given currency to facilitate foreseen settlement needs in that currency. For example, if a broker dealer is facilitating an IPO, distribution of the proceeds can create large intraday liquidity needs on the value date and the dealer will swap or borrow into that currency one or two days in advance. This is inefficient from a balance sheet perspective. On the settlement date, the dealer will see large spikes in intraday usage, which need to be explained to regulators. An intraday borrowing market could facilitate this, but would need to be set up in such a way that the dealer could borrow intraday value T+2 in the morning, repaying T+2 in the afternoon.



In conclusion, these three examples help to demonstrate the potential value of actively traded intraday liquidity.

## 5 Blockchain Technology and an Intraday Liquidity Market

This section examines whether blockchain can be useful as an enabling technology for a financial market for intraday liquidity. Enterprise blockchains allow mutually distrusting entities to come to, and maintain agreement on shared facts directly with each other. These shared facts can represent cash, assets, and contracts across a broad range of industries.

In a payments or capital markets context, a blockchain can facilitate immediate settlement and reconciliation on-ledger – a network of nodes interacting directly can streamline counterparty interactions. For example, depending on the implementation, a blockchain can reduce the number of dependencies on a centrally controlled or operated market infrastructure when that market infrastructure introduces other undesirable consequences, such as operational central points of failure, suboptimal netting, or a lack of interoperation with other assets.

Some blockchain platforms allow greater design flexibility than is possible with existing disparate financial market infrastructures. Assets on ledger may ultimately free many payment and capital markets from these rigid, siloed, complex infrastructure today, enabling new types of transactions.

There have been several initiatives, most recently with Project Jasper in Canada, where blockchain technology served as a bridge technology for assets from different issuers, allowing interoperation between disparate infrastructures.<sup>8</sup> In an ideal case, think of the benefits for liquidity managers if, within certain jurisdiction, different types of assets could freely move on-ledger between counterparties, with certainty, speed, and advanced automated process capabilities.<sup>9</sup> This can occur without infringing upon each issuer’s own sovereignty regarding the rules and restrictions regarding their own assets.

Automatable processes on a shared blockchain network can also enable new types of interactions. For example, pre-agreed rules can be programmed to self-execute network-wide, automatically, without necessarily requiring a single active party maintaining and overlooking those rules. These self-executing contracts can involve atomic transactions, such as delivery-versus-payment, or netting capabilities for payments.

However, there are some challenges which could slow the widespread adoption of blockchain technology for intraday liquidity use cases. There needs to be careful thought given to the degree of decentralisation employed and this needs to find a pragmatic balance for the industry. In many enterprise settings, complete decentralization at every level is impossible and undesirable. In some cases industries require pragmatic architecture that strikes the right balance between avoiding reliance on a centralised entity and ensuring each entity has sufficient decision making power, autonomy and accountability.

The following section will discuss several of these potential benefits from introducing an enterprise blockchain specifically within an intraday liquidity market context. When necessary, Corda is used to describe specifics regarding implementation.<sup>10</sup>

### 5.1 Predictable Transactions

Consider this scenario – a bank trader agrees an overnight interbank unsecured money market transaction for same-day value. Currently, unless the operations departments of the two banks separately coordinate on a specific settlement agreement, the receiving bank often has very little transparency on what time today those funds will arrive.

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<sup>8</sup>Project Jasper, Phase III, was a collaborative initiative between the Bank of Canada, TMX Group, Payments Canada, Accenture, and R3.

<sup>9</sup>For a review of these types of assets, visit <https://www.bis.org/press/p130106a.pdf>. Ultimately, the rise of global asset issuance, seen recently in the World Bank’s Ethereum-based bond, has the potential to eventually further open up a worldwide market for these assets.

<sup>10</sup>Corda is a blockchain platform built from the ground up by R3, its members and the open source community (Hearn, 2016).

Further, the settlement might fail due to incorrect trade details entered on one side of the transaction which could take hours to reconcile and amend. Sometimes, the trade could even settle the following day, and a borrowing bank could still need to pay the interest, even without receiving the funds on the day the bank requested.

Anticipating incoming payments requires substantial guesswork – much resource is currently devoted towards anticipating the timing of incoming payments. These difficulties makes intraday liquidity managers’ jobs today extremely difficult when considering their many different counterparties.

Blockchain technology may offer improvements to clearing and settlement, which could address these issues:

**Clearing and messaging, using an off-ledger settler** - a marginal improvement that allows better coordination between banks for some incoming and outgoing transactions would have a material difference on an intraday liquidity manager’s ability to manage transaction flows.

Having a shared record between counterparties, enabled by blockchain technology, would allow counterparty nodes to ensure they are always aligned. From the moment trade details are entered by the two counterparties, they can be agreed so that both have a shared data record of the trade details. Both parties could more easily check transaction status with fewer manual confirms. This is important for the intraday market because timing is crucially important and anything that would slow the settlement process, such as delayed reconciliation, needs to be reviewed for efficiency.

**Direct settlement on ledger** - there are several initiatives underway to develop digital fiat currency on ledger. Theoretically, if the digital fiat currency is suitably credit-worthy and operationally resilient, transactions between nodes on a blockchain network could represent final settlement between banks. Having the capability to transfer money on-ledger makes that timing certainty can occur within seconds rather than within hours using existing payment and settlement rails.<sup>11</sup>

There are two ways that money on ledger can emerge. Initiatives will either be driven by a central bank, or a central bank may allow the private sector to provide the operational platform, perhaps competitively with other market participants. If a central bank drives the innovation, then operators such as Payments Canada in Canada or Fedwire in US could operate the service. If the private sector is allowed by a central bank to innovate and issue tokens backed by central bank money, then a competitive marketplace for these solutions may emerge. As blockchain technology matures, and competitive pressures from technical developments increase, both approaches are becoming more likely. Either approach would require substantial buy-in from regulators and central banks, as they represent a significant change from the market structure in place today.

## 5.2 Automatable Processes

Blockchain technology allows flexibility for wide range of implementations that may ultimately allow parties to better coordinate transactions amongst themselves. A particular transaction could happen automatically between all relevant counterparties when certain conditions are met. This can allow more flexibility in the timing and ability of each party to transact, and lead to lower costs for settlement as part of an algorithm for an application, and not a further ‘value added service’ of a third party.

For example, a repayment deadline could automatically trigger either an interest payment process, or a penalty repayment process on-ledger. Further, the exchange of certain types of liquidity could be conditional on terms agreed upon bilaterally, or multilaterally beforehand between counterparties.

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<sup>11</sup>Cryptocurrencies may have some shortcomings within an enterprise setting, but anyone who has spent three days waiting for an equity to settle in their equity trading account before having funds available to transfer to a bank account, and then have had to wait three to five days for an ACH transfer to receive funds in a bank account, can see the promise of assets settled within the hour on a blockchain. Wholesale architecture is different from retail architecture, but many market infrastructures suffer from similar delays.

### 5.3 Interoperability

Interoperability can refer to integration with existing systems, interactions of different assets or applications on the same protocol (e.g. money and securities), and interactions between different blockchain protocols (e.g. Corda and Fabric). Generally, a lack of interoperability between products and institutions' systems are at the heart of many of the excessive complexities across capital markets today, manifesting as costs for technology, risk management, regulatory reporting, and regulatory compliance, etc.

Integration into existing infrastructures is necessary for all enterprise blockchain solutions. Using tools well known to bank developers, such as Java language and Java Virtual Machines, can ease the burdens to integration.

Leading enterprise blockchain platforms aim to enable a global marketplace of applications. In the case of Corda, the platform has been built so that data can be passed between business networks. Applications such as Fintium, can benefit from a broad network of CordApps to interoperate with. If a network with money on-ledger exists, tokens that are issued on a money network could potentially be seamlessly loaned on a separate Fintium network. Likewise, money borrowed on the Fintium network could potentially be used to transfer to an unrelated corporate node on a separate Corda network. The breadth of benefits from broader interoperability across a financial ecosystem requires continued exploration – but such a development may enable many new types of flexibility with assets.

The enterprise blockchain marketplace would benefit from consolidation around 2-3 blockchain platforms to ease technical complexities from interoperating with other ledgers. In the case of Corda, support for multiple consensus providers on the same network and the use of a UTXO-style model, will continue help to facilitate interoperability between different blockchain platforms.

### 5.4 Reduced Reporting Demands

Enterprise blockchains such as Corda enable certain nodes to be “read-only” to access certain details from all transactions. There is the potential for live reporting of information to regulators with blockchain technology, – a task currently impossible given existing complexities for reporting regulatory data.

This information does not necessarily mean that all market participants would share all information with regulators. For example, the value and interest rate from a transaction can be shared with stakeholders without sharing counterparty information. This can facilitate the creation of a market which would be transparent to regulators and central banks that shares only the level of detail that is agreed among participants and stakeholders.

## 6 Conclusion

New methods of cash management are emerging daily. As part of their consideration of new technologies, bank treasurers must consider whether their retrospective liquidity management capabilities are sufficiently aligned with active management practices. Our discussions with banks suggest that as the industry moves closer to real-time active management, a blockchain-based solution could create industry value as an alternative to mature technologies.

As technology has advanced, new possibilities for active cash management have come under consideration. These include enhanced matching and netting processes, real-time payment flow management and around-the-clock real time gross settlement. Among the enabling technologies for the possibilities, blockchain provides a particularly attractive solution because securely shared data records across multiple parties can enable reengineering of the related business processes rather than incremental enhancement.

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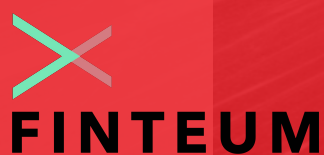


**r3** is an enterprise blockchain software firm working with an ecosystem of hundreds of members and partners across multiple industries from both the private and public sectors to develop on Corda. R3 helps its partners move applications into technical implementation and production with ease and low operational cost. R3's international team is supported by technology, financial, and legal experts drawn from its member base.



Baringa Partners is an independent global business and technology consultancy. We help businesses run more effectively, navigate industry shifts and reach new markets. We use our deep subject matter expertise alongside fresh ideas and pragmatism to help each client improve their business.

Collaboration is central to our strategy and culture ensuring we attract the brightest and the best. And it's why clients love working with us.



Finteum aims to create a global financial market for intraday borrowing. Finteum is an independent London-based startup with liquidity experience. Finteum is collaborating transparently with financial institutions and market stakeholders to drive industry change. Finteum is an Entrepreneur in Residence organisation at R3 and aims to use the power of DLT to build a new financial market that was previously impossible to create.

**corda** is an open source blockchain platform to record, manage and synchronize agreements, designed for business from the start. Only Corda allows you to build interoperable blockchain networks that transact directly, in strict privacy.

It delivers on the promise of blockchain for business: enabling parties who don't fully trust each other to form and maintain consensus about the existence, status and evolution of a set of shared agreements.