Whitepaper

Digital Government Sukuk in the Kingdom of Saudi Arabia

Libeara

A venture by SC Ventures

Digital Government Sukuk in the Kingdom of Saudi Arabia: Libeara Whitepaper

Contents

Abstract

In many countries, issuing and investing in government bonds or sukuk can be cumbersome and complex, involving numerous steps and parties, and typically requiring a considerable financial commitment from the investor. Also, there are typically no liquid and transparent secondary markets for retail investors.

Libeara, a purpose-built platform backed by Standard Chartered Bank, proposes a new approach to the issuance, administration and ownership of public finance instruments, including government sukuk, using a combination of new technology, including blockchain and digital assets, and robust support and understanding of sovereign issuers as well as existing capital markets rules, regulations and market dynamics.

Libeara has built and tested an end-to-end platform enabling the Saudi Government to directly issue Digital Government Sukuk, in minimum denominations of 1-10 Riyal, to the general public.

The platform has been fully tested in a mock environment including customer account opening and digital wallet creation, digital wallet funding, retail subscription of tokens representing public finance instruments, on-chain purchase of mock securities and distribution to retail investor accounts, on-chain token-based coupon payments and maturity, and withdrawal of funds to third-party bank accounts.

Using Libeara, an investor can invest any amount into their country's government sukuk, the safest asset they can buy. The investor can not only see available sukuk offers, view their portfolio, including accrued interest and upcoming maturities, but also sell the sukuk in a transparent market.

The document is structured to first provide brief context for the experienced reader about the Digital Government Sukuk opportunity for Saudi Arabia, as identified by Libeara, before proceeding to a detailed presentation of Libeara's approach and platform design, including technical details.

In partnership with GTN, the leading digital investments infrastructure provider and platform in the region, Libeara is primed to support the Kingdom of Saudi Arabia in the issuance and distribution of a joint institutional and retail Digital Government Sukuk.

Introduction to Libeara

Libeara, a venture backed by Standard Chartered Bank, has built and tested an end-to-end platform for the issuance, administration, ownership and exchange of Digital Government Sukuk.

Libeara aims to improve government funding diversification and retail investor participation by streamlining the overall sukuk issuance and lifecycle processes, allowing direct exchange among asset holders and enabling minimum allocation sizes as small as 1-10 Riyal.

At its core, the Libeara platform provides a mechanism for issuers to issue assets directly to the retail market in an efficient manner, with improvements made to existing process pain points, in particular as relates to duplicate subscriptions, a prolonged closing period, manual administrative requirements, costly capital markets intermediaries, high investment minimums, and an inefficient secondary market. These issues are addressed by streamlining the investor onboarding process, facilitating a direct payment and

settlement process between the issuer and investor, offering a venue for retail sukuk exchange, and automating components of the sukuk lifecycle.

The Libeara platform is able to deliver more efficient sukuk issuance, secondary trading and lifecycle management using recently developed tokenization technology. Libeara's tokenization approach removes dependencies on traditional markets intermediaries while delivering a safer, traceable, auditable, cheaper, more scalable end result for issuers and investors.

The key benefits offered by the Libeara platform are:

- Fully traceable and auditable sukuk holdership
- Automated and streamlined primary issuance system
- Efficient asset servicing during the lifecycle of the sukuk
- Easier secondary trading for investors and asset holders
- App-based mobile access for investors
- Low denomination sukuk issuance
- Decreased transaction costs
- Instant, atomic settlement
- Potentially improved asset liquidity

In addition to the functional advantages, the Libeara platform includes an underlying transaction and ownership ledger that serves as a register of sukuk holders. This ledger, combined with sukuk holder demographic data, offers a unique data source to the Kingdom of Saudi Arabia and policymakers with respect to understanding retail savings activity, specifically with respect to government sukuk.

Libeara Digital Sukuk Issuance & Management Platform

The Libeara platform is designed to support digitization of government sukuk and automation of issuer side administration, enabling issuance directly to the retail public in an efficient and cost-effective manner. The issuance process is modelled after the existing government sukuk process to support existing stakeholders, workflows, laws and regulations, while offering significant time, cost and operational efficiencies compared to the existing process.

The platform supports a preparation phase, in which the sukuk issuance is prepared and legally arranged, a subscription phase, during which prospective investors may apply for the sukuk, and finally, a closing process, in which the subscription period ends, the sukuk are allocated and effectively issued to investors against payment. The entire sukuk lifecycle is managed on the Libeara platform, including coupon payments, maturity and secondary trading.

The Libeara platform provides optionality to issuers, allowing them to decide between the traditional workflow, potentially including placing institutions and other counterparties, which Libeara can support, or direct interface with and issuance to retail investors, which is more cost efficient and streamlined and where Libeara's unique offering can deliver the greatest benefits.

The Libeara platform enables direct retail investor access to government sukuk by tokenizing the instrument such that it may be distributed straight to investors, and investors themselves are able to hold the sukuk in their Libeara digital wallets without intermediation. The Libeara platform handles customer onboarding, including KYC, IDV and AML, account opening, digital wallet creation and management, payment processing, and secondary market exchange activity.

In addition to comprehensive issuer and retail investor facing functionality, which is described in more detail later in this document, the Libeara platform offers rich infrastructure-level functionality to ensure safety, security and flexibility to issuers and other stakeholders. The platform supports enforceable compliance policies, enabling issuers to specify restrictions around subscription, transfer and ownership of sukuk, as well as of coupon and principal use. Sukuk token level compliance policies and programmability have the potential to support government sukuk programs with myriad different aims, including financial inclusion, green infrastructure investment, financial wellbeing, small business support and more, in addition to general purpose public fundraising.

The Libeara platform also supports digital wallet and sukuk token recovery in the event of unintended or unauthorized sukuk purchases or transfers or user loss of wallet access. Oversight and management of sukuk remain in control of issuers at all times.

In addition to managing sukuk offerings and retail investment, the platform provides issuers with transparent real-time insights into marketplace activity, which at scale could represent a valuable new dataset for policymakers.

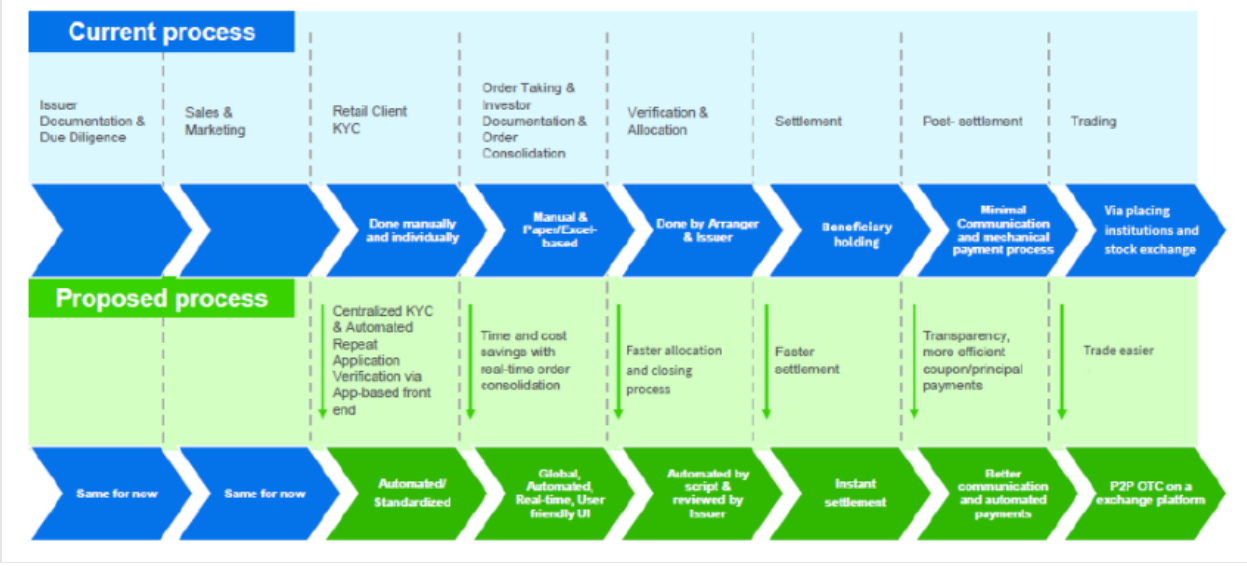

Figure 1: Comparison between the current and proposed processes.

As shown in Figure 1, the platform automates investor verification by embedding KYC & IDV in the App-based front-end. Thanks to the elimination of escrow processes, settlement is faster with Libeara than in the traditional issuance model.

The following sections describe how the Libeara platform implements its functionality for each of the sukuk phases.

Preparation and Issuance

The Libeara Issuer Portal is first used after the issuer has conducted the preparation phase, which happens offline. After the issuer has specified the sukuk terms, the sukuk term sheet is finalised, through an institutional offering, enabling price transparency, and is ready for distribution to the public. The term sheet details are captured in the Libeara Issuer Portal web application, where sukuk token configuration and creation take place. In creating the sukuk tokens and defining terms of the issuance, details are input into the Issuer Portal such as the term of the sukuk, the schedule of coupon payments, and the duration of the initial sukuk subscription period, in line with the sukuk terms. Once all sukuk details have been input, the sukuk is submitted for internal approval by the issuer, and the subscription process is initiated on the specified date.

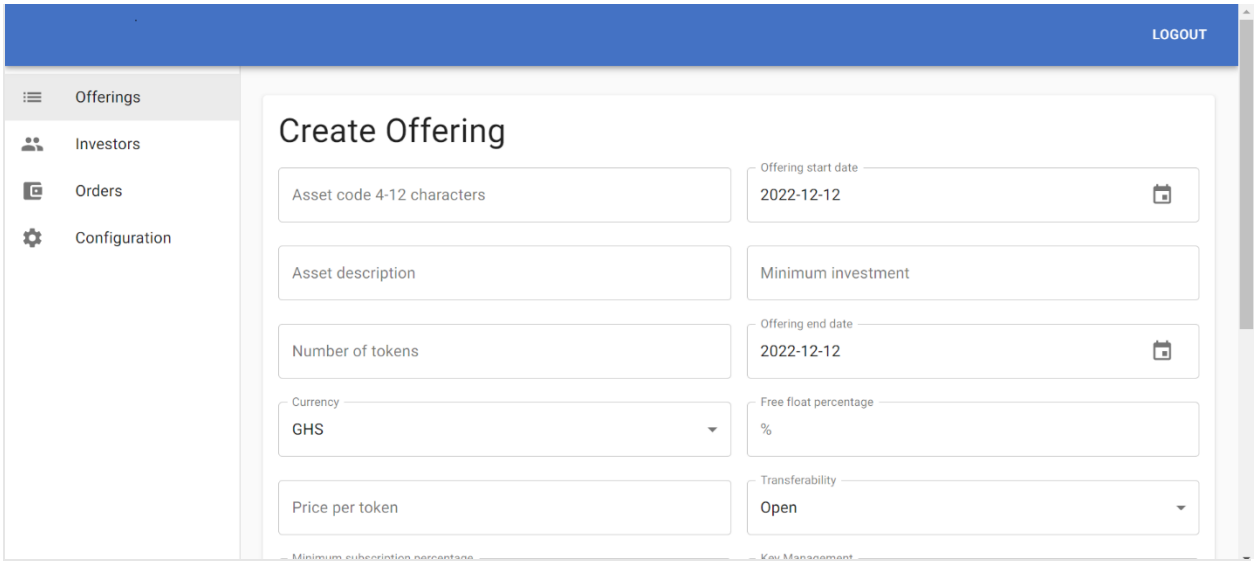

Figure 2: Libeara tokenized sukuk creation dashboard

At launch, the distribution of the sukuk term sheet to the public represents the first interaction between the issuer and the retail market. This, in combination with the sukuk prospectus and other associated media, is used to communicate key details about the investment offering and motivate prospective investors. Libeara is capable of distributing the term sheet and associated materials directly to prospective retail investors, or we can work with existing financial or government institutions to help them do it. The Issuer Portal web application communicates with the Libeara backend as well as the blockchain system of record to 1) establish offering details in the Libeara backend, 2) undertake managed workflow approvals required for the initiation of the subscription period and subsequent sukuk token creation and distribution and 3) mint sukuk tokens at the time of distribution to retail investors. Retail investors interact with Libeara via a mobile application which they can use to subscribe to and manage sukuk investments. Placing institutions can be included in the issuance process to solicit

investors from their customer base, as they do today in the current government sukuk issuance system in some countries, and such efforts can be rewarded through a referral fee system.

Via its partnership with GTN, institutional orders can be gathered via GTN's extensive existing customer base and allocated and distributed using GTN's infrastructure.

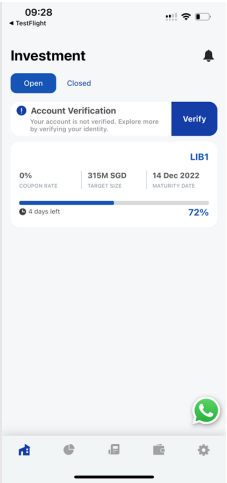

Figure 3: Sample of Sukuk Offering View in Retail App.

Customer Onboarding

Technically speaking, the Libeara platform supports subscription of government sukuk by citizens of any country. However, if desired, Libeara is able to restrict subscription to national citizens or residents or specific countries through configuration of the customer onboarding module.

In the traditional sukuk investment process, customers are onboarded via the placing institutions, where customers are typically registered with securities accounts and have been processed by the institution's know-your-customer (KYC) rules.

In the Libeara model, KYC is a digital process that is handled directly within the Libeara mobile application. Prospective customers can register their information in the application, which is validated against public and private data sources to verify the identity of the user and save it to comply with laws and regulations. Libeara's onboarding process also collects a copy of photo ID and a selfie to confirm the identity of prospective investors, as shown in Figure 4.

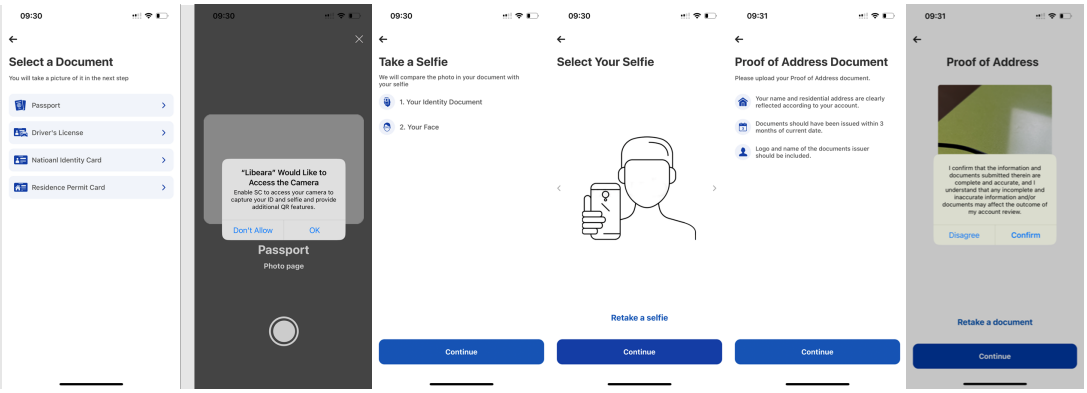

Figure 4: The digital KYC process involving ID upload and selfie.

Libeara's KYC & identity verification (IDV) module is designed to be configurable to local market needs and can be powered by a variety of specialist vendors providing backend data and document validation.

Subscription

Once onboarded, the retail investor is able to participate in the subscription phase.

Traditionally, as with most fixed-income assets, the subscription process follows issuer specified rules that dictate to whom and in what amount sukuk are allocated. For government issued assets, the focus is on providing a subscription process that is fair and equitable for the government's target investors while meeting the funding needs of the sukuk issuance target. The Libeara platform is purpose-built to flexibly support a variety of rules-based approaches.

Prior to subscribing to a sukuk offering, customers are first asked to top-up their Libeara wallet from an existing bank account based on the desired investment amount. Following account funding, investors can initiate the subscription process by placing a request for a specified sukuk allocation amount. This will correspond with the sukuk term sheet, which may dictate a minimum allocation size or investment dollar amount as part of the subscription request. Funds are locked in the investor's wallet in the amount of the subscription request. These funds will ultimately be used to pay for the sukuk upon closing.

Subscription periods are usually open for a set period of time in order to allow prospective investors to make their applications. Following the end of the subscription period, the sukuk is issued against payment and the legal/beneficial owner begins accruing coupons from the sukuk asset. The Libeara platform has been designed to mirror existing retail public finance programs, in which the issuing entity aggregates all subscription requests and processes them according to a rulebook based on the original terms, the application demand, and other determinant factors. With application requests received directly by the issuer, the allocation amounts can be processed easily using existing internal tools, and in the case of oversubscriptions, corresponding funds can be released in customers' wallets immediately.

A platform that is fully digitally integrated within the issuance process, allowing asset rules and behaviours to be codified and then enforced throughout the asset lifecycle, allows new rules and subscription processes to be easily created and executed, with minimal friction between the sukuk administrators and sukuk system operators. This flexibility provides an efficient mechanism for targeting different market segments or different retail sukuk products to help meet specific issuer goals.

Allocation, Closing, and Settlement

A current typical sovereign sukuk closing process is completed over numerous business days using traditional issuance methods.

In the traditional debt issuance process, the subscription phase ends, and the closing phase begins upon the specified date in the term sheet but can be ended early or extended based on demand. The rules-based subscription process is executed against the received applications.

In the traditional process, a multi-day closing period is generally required from when the subscription period ends and the sukuk ownership is officially settled to when the instrument begins to accrue coupons on behalf of investors. This period involves a final confirmation of allocations and a transfer of corresponding cash from the placing institutions holding money for prospective investors to the issuer.

At this point, the issuer registers ownership of sukuk with placing institutions who are subsequently responsible for recording and registering the individual investor ownership details of each sukuk. The Libeara platform greatly streamlines this process, reducing the closing period to a day using a direct connection between issuer and investor and a single consolidated order book. The particular enhancements are elaborated in the Efficiency Benefits section later in this document.

On the Libeara platform, at the moment of sukuk allocation, the money in the user's wallet, previously locked during the subscription period, is exchanged for a tokenised representation of the sukuk asset. This tokenised representation means that the asset owner is recognised by their ability to prove that they "hold" the asset. The technical details related to this ownership is offered through the wallet. More details are provided in the Technical Architecture section.

In effect, this means that the transfer of sukuk ownership, from issuer to investor, and the transfer of cash, from investor to issuer, occurs directly through the platform without any intermediary steps necessary. This allows for a fast and efficient closing process, with reduced operational costs and risks, and an optimal user experience for the retail investor. The technical overview contained later in this document provides more details on the wallet and the tokenization process within the Libeara platform.

Ultimately, the Libeara platform allows the closing period to occur in a T+1 fashion, reduced from the existing multi-day settlement window. While the Libeara settlement period can be tightened even further, this time period allows settlement to be validated in an orderly fashion, which is important as the sukuk will start accruing coupons for investors immediately upon completion.

Secondary Market Activity

Unlike traditional capital market infrastructure, the Libeara platform supports retail secondary market trading of government sukuk in small order sizes. Secondary trading can take the form of direct peer-to-peer exchange based on an independently specified price, an independent marketplace within the Libeara platform, or in conjunction within an existing secondary marketplace or exchange.

From a user perspective, the focus is on providing a seamless interface for retail investors to buy or sell the sukuk after the issuance process. Regardless of the back-end market connectivity, investors can place buy or sell orders directly through the platform. More details are provided in the Technical Overview section, later in the document.

Efficiency Benefits

The Libeara platform has shown the potential to offer several efficiencies for retail sukuk issuance, summarised in the table below:

Shorter Marketing Period, Lower Marketing Cost, and Paperless On-Boarding and Subscription Processing	As all information can be distributed instantly across the platform to all parties, retail investors will receive all marketing information directly from their Mobile Application, instead of via various online and physical distribution points. This functionality can effectively simplify and shorten the overall marketing timeline. In addition, by keeping all on-boarding and subscription processes in the App, the overall process is faster, more accurate and less administratively burdensome.

Efficiency Generation through Direct Process	In traditional public finance offerings, many banks and brokers may be involved to ensure the broadest distribution and the most extensive penetration. The Libeara platform by contrast supports direct distribution to retail, driving cost, speed and operational efficiency gains, as well as the option to involve traditional institutional parties.
Man-Hour Savings from Application and Manual Reconciliation of Subscription	Traditionally, orderbooks of retail offerings subscribed by multiple placing banks are generated in separate forms consolidated by teams across banks on a daily basis, which is a manual and time-consuming process. To support current retail issuance processes, placing banks have retail staff handling physical investment applications by retail customers at local branches, a resource intensive and error-prone approach. In the digital issuance process, the centralised platform can handle investor applications directly, capture investor details, and generate the orderbook instantly and automatically.
Transparency	Using the Libeara platform, ownership of tokenized sukuk need not be recorded on a single, centrally managed database. Instead, such assets can "live" simultaneously on many, synchronized ledgers held across a network of traders where each has a complete copy. Furthermore, all transactions on the Libeara platform are visible directly to the issuer and can also be made available to other parties, if desired.
Third-Party Savings	In a digital issuance process, investors subscribe to the retail sukuk via the Mobile Application which can support multiple issuances with the same set of documentation. This is financially efficient given the elimination of lengthy and expensive legal documentation reviews.
Potential Future Savings on Placing Agent Fees	In a conventional sukuk offering, placing institutions may charge investors a handling fee as a percentage of the government retail sukuk application amount. With transactions including application enquiries performed via the Mobile Application, potential handling fees could be reduced substantially.
More Efficient and Liquid Secondary Trading Leading to Direct Investor Insights	With sukuk subscription as low as 1-10 Riyals, the issuer can access a broader investor base (long tail of retail investors) and investors can easily trade the retail sukuk on the Mobile Application, resulting in potential improvements in secondary market trading. Furthermore, the issuer will be able to see real-time demand dynamics amongst investors in a comprehensive dashboard, something not attainable today.

Table 1: Summary of efficiency improvements achieved through the Libeara platform, compared to traditional retail sukuk issuance methods.

Libeara Platform Technical Architecture

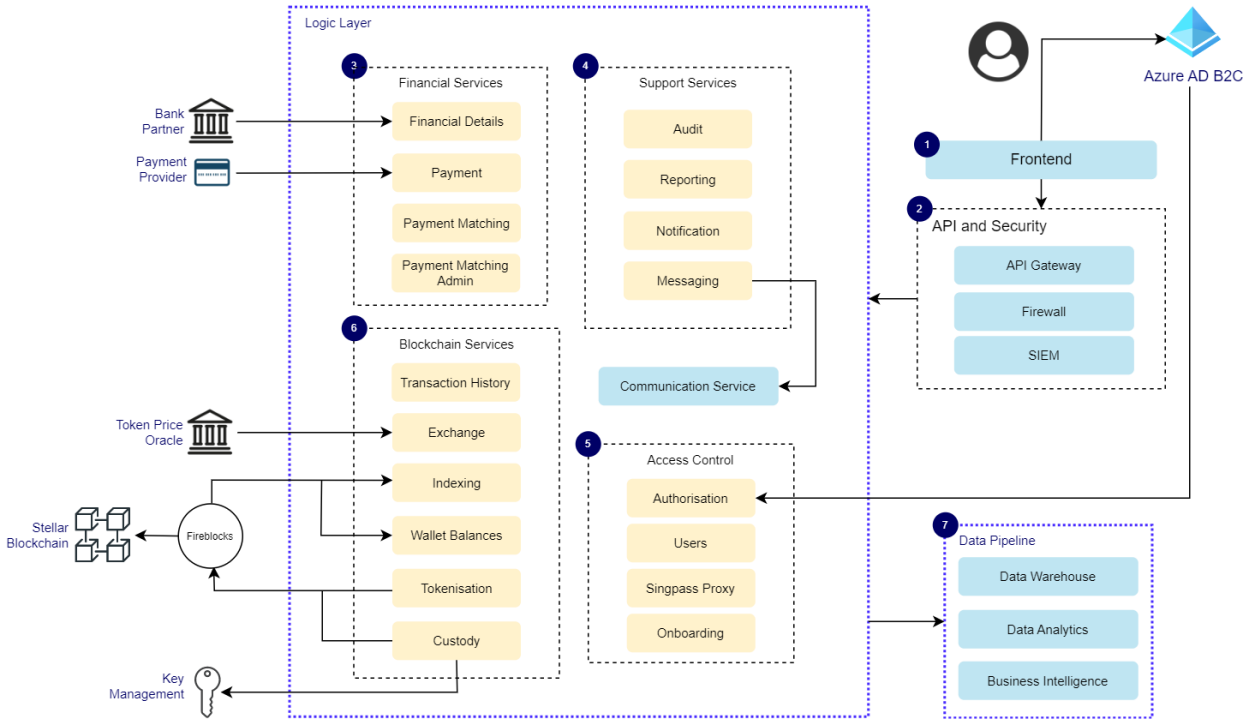

Figure 5: The technology architecture of the Libeara platform

As shown in Figure 5, a public blockchain is used as the underlying main source of trust, given the efficiency, transparency and data provenance capabilities. APIs are the main integration endpoints for external services. A segregated internal database is used to ensure private data is stored separately from public data.

In its initial implementation of the Libeara platform was atop the Stellar blockchain, a permissioned, public network designed specifically for financial use cases. The Libeara platform is blockchain agnostic and can be deployed atop any public or private blockchain, ranging from EVM (Ethereum Virtual Machine) chains (deployment in-progress) to proprietary blockchain networks.

Interfaces

The Libeara platform offers two different interfaces for users. The first is a web application, referred to as the Issuer Portal, used by issuers and arrangers to conduct management and administrative tasks associated with assets. The second is a mobile application, designed for usage by retail investors.

The platform is flexible and designed to support many interface applications, such as integrations with existing legacy desktop systems or existing mobile platform environments. However, the existing interfaces emphasise the opportunity to greatly improve the investor user experience. With a mobile friendly approach, the issuer can engage directly with users in a seamless fashion, delivering an improved user experience capable of engaging a large retail investor base.

Screenshots of the Issuer Portal and Mobile Application are included throughout this document, including in Figures 2, 3, 4, 6 and 7.

Web Platform

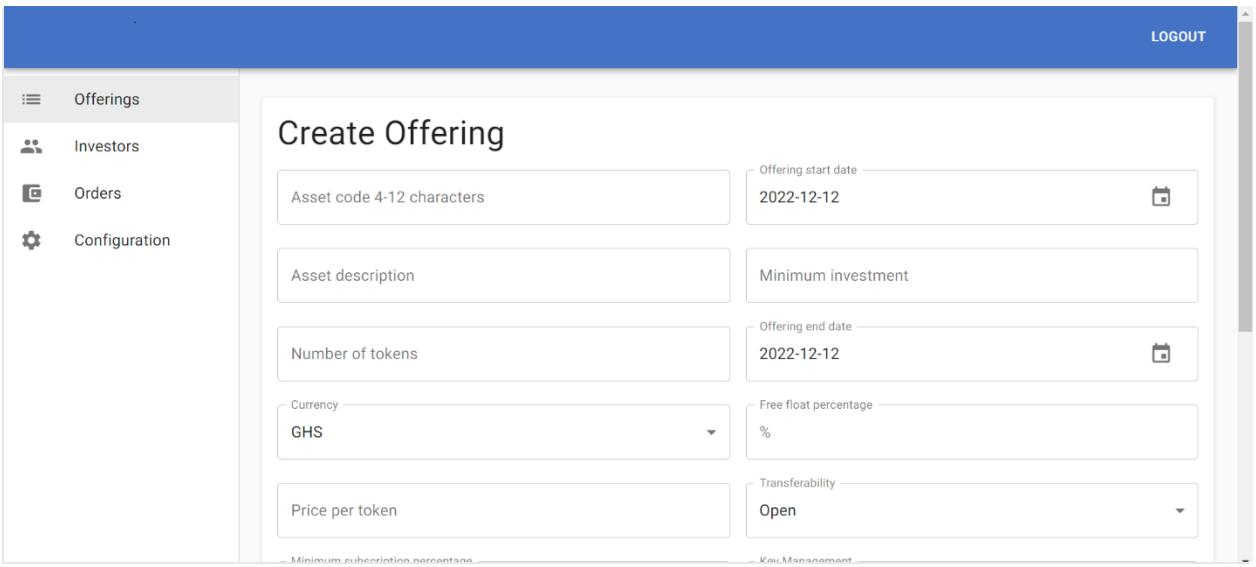

Figure 6: Admin portal view on the web platform summarising the sukuk data.

As can be seen in Figure 6, the Libeara web platform is designed to handle the administrative and management tasks that are conducted by the asset issuers and sukuk arrangers. In the case of a sovereign sukuk, the government issuer would conduct their management activity directly through the web interface.

In a production scenario, existing legacy systems could be integrated as a drop-in replacement for the web platform.

Mobile Platform

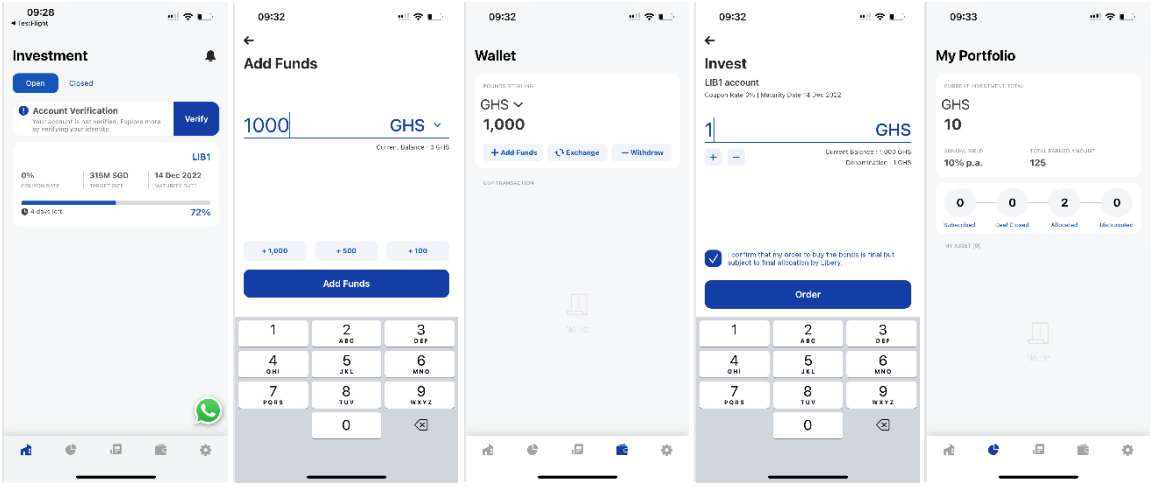

Figure 7: Mobile platform showing the investment, wallet and portfolio views.

The Libeara platform was designed and built to support forward looking markets and has a full-featured Mobile Application for retail users. For users, the Mobile Application is the main point of access and interaction with the government sukuk asset and subscription process for retail investors. From their phone, a user is able to subscribe to the sukuk listing, take ownership of the sukuk asset, process associated payments, engage in secondary market trading, and see the resulting return on investments.

In this way, the Libeara platform and its Mobile Application represent a streamlined, customer-focused experience designed to engage retail investors in support of savings and investing.

The Mobile Application is a combination of a traditional mobile application and a digital asset wallet. Like other digital wallets, it is the software application that provides a customer with a human usable technical interface for interacting with underlying systems that facilitate digital asset investment and administration.

Tokenization, Cryptographic Keys, and Key Management

The Libeara platform is built atop a blockchain network, which allows the platform to achieve the efficiency advantages described above. Invested funds deposited via the Libeara Mobile Application are held in digital wallets owned by each user, and digitized sukuk are instantiated as digital asset tokens on the blockchain.

Digital assets are registered on a digital registry. In the case of the Libeara platform, the registry is a ledger that runs on a public blockchain. In Libeara's initial implementation, this blockchain is the Stellar Network. The ownership of assets is recorded on the ledger as well. Ownership is expressed using strong cryptography with what are known as public and private keypairs, which are used to sign wallet transactions. While there are many considerations and potential risks when employing cryptographic keys for end users, they offer the unique capability to provide direct ownership over a digital asset. Cryptographically secured asset ownership is always expressed through the presence of the cryptographic key, as opposed to ownership being recorded separately. This provides a high degree of interoperability between multiple internal and external services. Regardless of the underlying technology, the cryptographic math that validates a key, and therefore proof of ownership of an asset, remains the same across services and devices.

As such, owning digital tokens is similar to holding stock certificates in a safety deposit box. The deposit box in this case is the digital ledger and the key to the deposit box is held by the user's mobile wallet.

Specific considerations related to financial assets

The tokens issued on the Libeara platform are regulated financial instruments and are therefore subject to specific rules, regulations and sensitivities including related to investor KYC, AML and consumer protection. Unlike traditional securities, the ownership and transaction of which can be opaque, manual and difficult to track, tokenized securities inherit compliance and security benefits from the underlying blockchain protocols on which they are instantiated. The Libeara platform was designed and built to include a number of features intended to ensure compliance and security:

Whitelisting: In order for a user to interact with an asset issued on the Libeara platform, the user's cryptographic wallet must be whitelisted by Libeara. In the context of the Stellar network, whitelisting is achieved through the establishment of Trustlines as described in detail later in this document. It is technically impossible for a non-whitelisted wallet to purchase, hold or otherwise interact with an asset token issued on the platform. In order for a user's wallet to be whitelisted, the user must complete KYC, including IDV, and AML screening.

Compliance Privileges: By virtue of Libeara's platform design, all asset tokens in circulation are governed by protocol-level token compliance policies that give Libeara rights to intervene to prevent or reverse certain types of fraud, theft or loss related to tokens or wallets.

Microservices

Libeara is built using a microservices architecture and is currently deployed atop the Stellar Network, a public blockchain. Libeara platform functionalities include sukuk tokenization, sukuk issuance, sukuk allocation, sukuk investment, wallet creation, wallet whitelisting, wallet funding using fiat, digital currencies or CBDCs, settlement, and asset trading/ownership transfer.

For the initial Libeara deployment, the Stellar Network was used as the main source of trust for implementation of asset tokens, facilitation of transactions and changes in asset ownership. Libeara's platform is designed to deliver the infrastructure required for issuers and investors to interact. Depending on the specific production implementation, the Libeara infrastructure itself can simply be used to facilitate transactions and ownership structures for or with the involvement of licensed participants without conducting any licensed activities. In other configurations, Libeara would obtain licenses in order to facilitate issuance directly on behalf of issuers and interface with retail investors in a regulated capacity. Therefore, Libeara's platform can be used universally as a plug-and-play system in any regulated financial configuration, by Libeara itself or other licensed institutions complying with relevant regulatory requirements.

As shown in Figure 5 above, the Libeara platform consists of a core microservices Orchestration Layer that communicates via API with third party services and frontend endpoints including the Issuer Portal and the retail investor Mobile App. The Orchestration Layer is implemented atop the Stellar Network, with which it also communicates and from which it inherits token deployment, transfer/settlement and security functionality.

When a user interacts with the platform, they are making requests to Libeara's Orchestration Layer, including reading and storing data in off-chain databases, and to interact with Libeara, third-party or other services as necessary. The Orchestration Layer provides the connectivity for each of these components, ensures that all transactions include the correct data and processing logic, and facilitates each transaction with the requisite level of performance, security, and other technical requirements.

Stellar Network Interface

One of the services provided in the Orchestration Layer in the initial Libeara implementation is the technical interface with the Stellar Network. Access to the network is facilitated through the Stellar Horizon API, which provides an interface and web APIs to facilitate access to the Stellar Network. The Horizon API server and many functions in Stellar that are leveraged by the Libeara platform are discussed in the Stellar Blockchain overview later in this document.

As mentioned previously, per architectural design, the Libeara platform can be easily deployed in similar fashion atop other public or private blockchain networks.

Trading Engine

A key functionality offered by the Libeara platform is the inclusion of a secondary market for the trading of government sukuk by retail users.

There are two primary mechanisms for enabling a secondary market on the Libeara platform: trading facilitated through an existing third-party marketplace or exchange and trading occurring directly between users on the Libeara platform. Either mechanism can be supported by the platform, depending on deployment requirements, and made accessible to retail investors directly within the Libeara Mobile App.

When the secondary market is provided independently, the Libeara platform provides a direct integration with the relevant asset exchange. Through such a connection, the Libeara platform enables market trading activity in a streamlined format, with the inherent restriction of asset trading to KYC'ed, whitelisted wallets.

In previously piloted prototypes, Libeara has integrated with existing electronic exchanges and trading platforms, including the HKEX Orion Trading Platform (OTP) in Hong Kong. In the Hong Kong pilot, the trading engine was configured to take user requests via placing institutions, route them to the exchange, and receive updates as trade requests were matched. In addition, the engine was also able to receive trade matches resulting from orders that were placed directly within OTP, such as by existing market brokers or by other market participants. While trade matching services were facilitated by OTP, the token assets issued on the Libeara platform were deployed and tracked on the Stellar ledger, so final clearing and settlement of the asset for executed trades was conducted on the Libeara platform. This approach allowed the platform to retain the instant settlement functionality of the blockchain, greatly reducing the costs and risks of trading for end users, while still integrating directly into the existing exchange infrastructure.

Providing such an interface with the HKEX marketplace allowed the Libeara platform to integrate into the Hong Kong ecosystem with minimal disruption to existing market practices. By maintaining settlement within the blockchain ledger, the direct interface between retail owners and digital assets was maintained, allowing benefits such as the near instant, irreversible, on-chain swap of investor cash for digital assets at the time of issuance and exchange. Because settlement occurs immediately and atomically against payment on the Libeara platform, the need for upfront collateral as margin is reduced and potentially eliminated, ultimately reducing the overall operational burden for market participants. The HKEX integration showcased how existing market infrastructure can be integrated into the Libeara platform to bring connectivity and efficiency between new and existing market participants, while still delivering the advantages inherent in fully digital assets.

Cash Transfers

Cash transfers take two forms on the Libeara platform. Firstly, to begin investing in government sukuk, investors must fund their accounts with fiat. From their account balances, users can make payment for new sukuk or purchase sukuk on the secondary market. Secondly, upon receipt of coupon payments, at the time of sukuk maturity, or in the event of the sale of sukuk on the secondary market, investors receive cash. To facilitate fiat transactions, Libeara integrates with prevailing local payment methods in the countries where it operates via third-party partners. To account for fiat deposits, sukuk

subscriptions, coupon payments, maturities, secondary market purchases and sales, and withdrawals, Libeara uses a fiat representation of cash tracked on-chain on the Stellar Network to process the individual fiat denominated flows between users.

In this way, the Libeara platform facilities and tracks payments in relation to the entire sukuk lifecycle in a transparent, auditable and secure way. Of note, this approach is different from digital deposits held by banks, which are general purpose payment obligations that are the equivalent of general-purpose cash. By contrast, Libeara's approach is more similar to traditional e-money providers. Libeara's simplified approach to digital fiat facilitation supports efficient on-chain payment transactions without the regulatory complexities of providing full bank-like deposits. Using this same architecture, the platform can be easily adapted to potential retail CBDC (Central Bank Digital Currency) integrations at the relevant time.

Sukuk Lifecycle Management

The ongoing activities of the sukuk lifecycle involve various administrative and operational tasks from preparation through closing, coupon payments made to sukuk holders, and ultimate sukuk maturity. These activities are fully managed on the Libeara platform which is, in addition to providing complete end-to-end lifecycle support, designed to meet internal compliance and risk management best practices. Every activity performed by the issuer is enforced through a maker-checker process, a standard compliance practice that ensures each activity has requisite review before proceeding. Additionally, all actions and their associated users are included in a fully auditable log that serves as a compliance record. With the sukuk activities fully digitised, Libeara provides a compliance-friendly platform allowing issuers to easily manage assets over their lifetimes.

Stellar Blockchain

Beneath the Libeara platform's Orchestration Layer in its initial implementation sits the Stellar Network, a blockchain-based, open-source network that facilitates the instantiation and exchange of tokenised assets. Libeara chose the Stellar Network from a range of networks that were considered because of its diverse capabilities, low-fees, governance controls, and energy- and performance-efficient consensus mechanism. Since its launch in 2014, it has processed more than 450 million operations by over 4 million individual accounts.[1]

Below is an overview of the Stellar Network and a description of the ways in which the Libeara platform makes use of its components to support the issuance and management of government sukuk.

Stellar High-Level Technology Overview

The Stellar Network is a blockchain-based distributed ledger designed to operate without a central authority. Copies of the ledger are shared between network participants, known as validators. The Stellar Consensus Protocol keeps the ledger synchronised between validators. The Stellar ledger holds a record of accounts and the balances of assets within those accounts. Validators can submit transactions

[1] See https://stellar.org/learn/intro-to-stellar

that make updates to account balances within the ledger, but every validator in the network will process the transaction to ensure it is valid. Stellar was specifically designed to support regulated financial asset use cases. As such, the network includes native features to define who can issue or revoke an asset, which network users must sign to approve certain transactions, who can own and transact an asset, and token and issuer governance controls -- functions and services allowing a wide range of institutions and use cases to leverage the decentralised Stellar ledger.

Stellar Consensus Protocol

The Stellar Consensus Protocol (SCP) is an algorithm that is responsible for keeping the state of the ledger synchronised between the network participants. Unlike proof-of-work based algorithms, such as that used in the Bitcoin network, the SCP algorithm is an energy- and performance-efficient engine. From a performance standpoint, previous work has shown that transactions per second, a common measure of performance of distributed ledger technology solutions, have numbered into the thousands on Stellar.[2] In terms of energy efficiency, research has estimated the electricity required for a single transaction to be a factor of 10 less than Bitcoin and similar to that required by the Visa Network.[3]

In simple terms, SCP requires that validators agree to operate between a defined set of other validators. To be compliant with the SCP protocol, the set of validators chosen must include nodes that are sufficiently connected to the rest of the network. As validators are responsible for submitting and receiving transactions from each other, as the updates to the ledger are synchronised between the nodes, a global consensus is reached. This consensus mechanism offers fast settlement finality while maintaining a decentralised model of network participation. The technical details of the algorithm have been published in a peer-reviewed paper by the Stellar Development Foundation, available here: https://www.stellar.org/papers/fast-and-secure-global-payments-with-stellar.

Assets and Anchors

By tracking accounts and account balances using a decentralised ledger, the Stellar Network allows many types of digital assets to be created and, most importantly, interoperate within a broad global network. Any asset issued on Stellar can be made accessible to users of the network and can be integrated into services and functionality based on other assets in the network. To support a diverse range of services, Stellar offers tooling including asset transaction APIs, which support functionality such as asset controls and clawback. This functionality allows asset issuers and service providers to implement critical business rules, such as compliance or regulations related to financial assets.

Beyond support for common compliance and regulatory functions, Stellar provides specific requirements and expectations for issuers and service providers that deal with fiat currencies, known as Anchors. Any provider in the Stellar Network that provides a connection to traditional financial or banking rails, such as domestic RTGS systems or bank-account backed stablecoins, is considered an Anchor in Stellar and is required to adhere to a high quality of service. The SDF encourages licensed and

[2] See https://www.lumenauts.com/blog/how-many-transactions-per-second-can-stellar-process.

[3] See https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=9059429&fileOId=9059655.

regulated entities to operate as Anchors, requiring adherence to Stellar ecosystem standards among other expectations.[4]

The Libeara platform utilises Stellar's asset transaction features to ensure that digital sukuk comply with regional and international securities regulations.

Trustlines

To support regulated financial asset use cases, Stellar developed a mechanism called Trustlines, which allow controls to be placed on asset ownership and transferability. On the Stellar Network, Trustlines must be established between an individual wallet and an asset before that wallet may hold the asset. Trustlines thereby prevent undesired interaction, ownership and transfer of assets by users that do not meet the suitability requirements of the issuer. Furthermore, Trustlines serve as a safeguard to users by preventing unapproved, potentially malicious wallets from attempting to interact or transact with them.

The Libeara platform ties Stellar's Trustlines mechanism to Libeara's in-app user onboarding to ensure that only investors who qualify are able to invest in and own government sukuk.

Conclusion

Sukuk Tokenization

Emerging applications of strong cryptography have allowed for new methods in modelling digital financial assets, chief among these being tokenization. As showcased by the innovations delivered by the Libeara platform, tokenization represents an opportunity to improve the way in which assets are distributed, managed, and custodied between issuers and customers.

With specific respect to direct issuance by a sukuk issuer to the retail public, through a process such as the one supported by the Libeara platform, placement process flows and full sukuk lifecycle administration can be materially simplified using tokenization, thus reducing complexity and cost. Paired with other technologies such as mobile applications for KYC, more efficient trading and settlement mechanisms, and data analytics, integrated with immutable ledgers for transparency, tokenization offers a powerful value proposition for asset issuers and investors alike.

Public Networks and Ecosystems

The Libeara Orchestration Layer has initially been deployed atop the Stellar Network, a public blockchain-based distributed ledger. The Orchestration Layer also supports connections to other distributed ledger networks and other technologies as desired.

Traditional databases implemented as centralised ledgers can easily support the sukuk issuance use case, as they have done in the past and continue to do. However, these databases are often constrained to the remit of a single organization, limiting their interoperability and appeal in a broader ecosystem.

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[4] See https://github.com/stellar/stellar-protocol/tree/master/ecosystem and https://www.stellar.org/learn/anchor-basics.

When made broadly available, such as in an open market exchange, centralised solutions generally become more expensive to operate and administer. As a result, they are typically optimised for assets and counterparties that can bear the higher cost burden, such as assets with large institutional volumes or with highly complex or risk-prone structures, and large institutional investors.

For a broadly distributed, government-issued, retail sovereign sukuk, a decentralised ledger provides the unique capability for the sukuk to be made available to all types of investors at extremely low minimum investment denominations. From a user perspective, this allows for improved access to the safest asset class in a given country, with important implications for financial inclusion and national financial wellbeing. Furthermore, characteristics like small asset denominations, irreversible and near instant settlement, security, transparency and auditability have the potential to unlock new, innovative use cases beyond those explored in this document, including Birthright sukuk, Diaspora sukuk, personal pension-like sukuk and more.

On-Chain Payments

As assets become instantiated in digital forms, managed in digital ledger representation and transacted between numerous counterparties in increasingly rich economic ecosystems, the need arises for a digital equivalent of payment. Existing payments infrastructure, while incredibly stable and efficient in serving its customers, requires a great deal of technical complexity that hampers accessibility, cost efficiency and the overall value proposition for certain types of transactions, especially low value payments.

For these reasons, the Libeara platform implements the basic on-chain cash equivalent described earlier in this document, the Libeara Cash Token, allowing digital government sukuk to be exchanged directly within the asset ledger.

If a generalised form of digital currency were eventually available for portability into the Libeara platform, it could quickly be accommodated as a means of risk-free delivery-versus-payment settlement.

Operational and Data Governance

As an end-to-end, standalone digital government sukuk platform, the Libeara platform is designed to be operated under the direct auspices of the issuer. The recommended model is for an application dedicated to the sukuk issuance, where data around sukuk holders and exchange activities is made available directly to the issuer.

In addition, while the Libeara Platform uses a public blockchain to maximise scalability and increase efficiency, customer identifying information is not placed on-chain nor otherwise made publicly visible. While the transaction data is available to all node participants, the user identifying information is kept in a secured and private fashion such that only the issuer has knowledge of asset activity. As a result, the most advantageous aspects of a public blockchain are utilised while maintaining complete need-to-know principles across all data streams. Furthermore, with each investor opening a cryptographic wallet through the mobile wallet application, control of each investors' assets is directly maintained by that investor. The platform does not have control over assets beyond the legally agreed upon issuance and clawback arrangements.

The Libeara platform can also be run on a private or permissioned blockchain for purposes of retail access, secondary market activity, auditability, speed and cost efficiency.

Similarly, the Libeara platform can and is expected to be deployed on other public blockchains in the future, providing even greater power through interoperability.

Final Comments

The Libeara platform represents a new potential direction for sovereign sukuk market infrastructure. Financial products that are built on forward-looking digital platforms are likely to include distributed ledger technology and be implemented in tokenised forms. These products and the underlying ledgers associated with them will be optimised to provide access and interoperability across a broad ecosystem of partners and service providers. To integrate these systems within a financial market landscape, whether in permissioned or public form, will require balancing the needs of legacy technology systems with the innovative capabilities offered.

Through their partnership, GTN and Libeara bring the financial and technology infrastructure, institutional access and direct-to-retail distribution necessary to support the Kingdom of Saudi Arabia in delivering direct retail access to government sukuk in low denominations, thereby unlocking financial inclusion, national financial wellbeing and powerful new policy implementation tools.