BIS Innovation Hub

▶ Project Dynamo

Catalysing innovation for SME growth

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HONG KONG MONETARY AUTHORITY
香港金融管理局

Contents

1. Acronyms

AI	Artificial Intelligence
AML	Anti-Money Laundering
AMLO	Anti-Money Laundering and Counter-Terrorist Ordinance of Hong Kong
BIS	Bank for International Settlements
CFT	Counter-Financing of Terrorism
DCSA	Digital Container Shipping Association
DeFi	Decentralised Finance
DPT	Digital Payment Token
DTT	Digital Trade Token
DVP	Delivery Versus Payment
eBL	Electronic bill of lading
ESG	Environment, Social and Governance
ETR	Electronic Transferrable Record
FATF	Financial Action Task Force
GRI	Global Reporting Initiative
HKMA	Hong Kong Monetary Authority
ICC	International Chamber of Commerce
ID&V	Identity Verification
IMDA	Infocomm Media Development Authority of Singapore
KYC	Know Your Customer
LC	Letter of credit
MAS	Monetary Authority of Singapore
MiCA	Markets in Cryptoassets Regulation
MSMEs	Micro, small and medium enterprises
OA	Open Account
PSA	Payment Services Act 2019 of Singapore
PSSVFO	Payment Systems and Stored Value Facilities Ordinance of Hong Kong
RBAC	Role-Based Access Control
SDK	Software Development Kit
SFA	Securities and Futures Act 2001 of Singapore
SFC	Securities and Futures Commission of Hong Kong
SFO	Securities and Futures Ordinance of Hong Kong
SMEs	Small and medium enterprises
TCFD	Task Force on Climate-related Financial Disclosures
TDD	Test Driven Development
UNCITRAL	United Nations Commission on International Trade Law
USD	U.S. Dollar
USDC	USD Coins (issued by Circle)
VASP	Virtual Asset Service Provider
WTO	World Trade Organisation

2. Foreword

Small and medium enterprises (SMEs) are the lifeblood of most, if not all, economies. According to recent World Bank research,[1] SMEs account for more than 90% of all businesses, contribute to more than 50% of employment globally and play a significant role in the global supply chain. Despite such important roles played by SMEs, they regularly face great difficulties in accessing financing, especially on affordable terms. The same research estimates that about half of these companies have no access to formal credit. In developing countries alone, micro, small and medium enterprises (MSMEs) have unmet financing needs of over USD 5.2 trillion every year, equivalent to 1.4 times of the current level of global MSME lending. The Covid-19 pandemic has only exacerbated the situation, leaving millions of businesses on the brink of bankruptcy. Supporting SME development is therefore a high priority for many governments and central banks around the world.

The 2020 Trade Finance TechChallenge,[2] a joint initiative conducted by the Bank for International Settlements (BIS) Innovation Hub Hong Kong Centre and the Hong Kong Monetary Authority (HKMA), provided insights into the needs of and challenges faced by SMEs when accessing trade finance. Building on these insights, the BIS Innovation Hub Hong Kong Centre has been conducting applied technology research into different potential and innovative solutions for SME finance. As part of the research, Project Dynamo delivered a ground-breaking prototype for a compliant use of single-currency pegged stablecoins[3] /digital tokens and blockchain/smart contracts in supply chain finance for SMEs.

Working with specialised technology providers, the BIS Innovation Hub, jointly with the HKMA, explored the programmability and transferability of such tokens and how they could encourage and facilitate the provision of financing by institutional investors to SMEs in a supply chain. In respect to programmability, the project demonstrated the use of an electronic bill of lading (eBL) as a condition for triggering payment - a "marriage" between the digitalisation of the trade world and the digitalisation of the finance world. In addition, the prototype showcased the use of digital identity[4] for conducting due diligence on the SMEs. The use of Environment, Social and Governance (ESG) conditions for triggering payment was also explored with an aim to facilitate the building of a greener and more socially responsible supply chain.

We hope this project report will provide in-depth insights into the relevant technologies and proposed applications for the central banks, policy makers and standard setters and the banking industry as well as various market participants and stakeholders. By demonstrating the "art of the possible" and drawing out the related legal, regulatory, and commercial considerations, we also hope to catalyse further discussions on the associated benefits and risks of the technologies involved to help promote responsible innovation that would benefit the real economy and make a positive difference.

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1. World Bank SME Finance: Development news, research, data | World Bank

2. Trade Finance TechChallenge (bis.org)

3. Stablecoins are defined by the Financial Stability Board (Crypto-assets and Global "Stablecoins" - Financial Stability Board (fsb.org)) as a specific category of crypto-assets that aim to maintain a stable value relative to a specified asset (typically USD), or a pool or basket of assets, and provide perceived stability when compared to the high volatility of unbacked crypto-assets.

4. Corporate digital identity: no silver bullet, but a silver lining (bis.org)

3. Executive Summary

SMEs are key components in global supply chains as a result of their engagement in global trade.[5] In a typical supply chain, an Anchor Buyer, who is usually a large corporation, often purchases goods and services from its suppliers on an Open Account [6] (OA) basis as an Anchor Buyer tends to have a stronger bargaining power. SME suppliers in a supply chain often face challenges in obtaining finance from traditional funders to support their operations. This is primarily due to a lack of collateral and/or an established credit and operational track record. As such, these SMEs often have to rely on their limited business profit and their own savings to meet their working capital needs.

Through extensive collaboration between the BIS Innovation Hub and Linklogis, Project Dynamo delivered a prototype platform on which an Anchor Buyer and the suppliers along its supply chain use Digital Trade Tokens (DTTs)[7] for making programmable payments. The project explored how the programmability and transferability of such tokens could encourage and facilitate the provision of financing by institutional investors to SMEs in a supply chain. Project Dynamo is one of the first and most advanced attempts on programmability of payments in a trade finance setting. It is also unique and ground-breaking in terms of the various elements it brought together in one prototype. These included the wholesale use of stablecoins/digital tokens, digitalisation of trade and payments, SME finance, eKYC and ESG rating for supply chain by showcasing some of the latest developments in each of these areas and demonstrating how they could be applied together, or separately, to address real-life issues and challenges.

The project also highlighted the important legal, regulatory, and commercial considerations for such a platform to go live. Regulatory clarity and harmonisation across jurisdictions (specifically the regulatory framework for stablecoins and utility tokens across jurisdictions) are vital to facilitate the use of such tokens globally, as trade and payments are global by nature.

The potential benefits of the Project Dynamo prototype can be significant. It can offer a new avenue of financing for SMEs that were previously unable to access traditional financing options and in turn help stimulate economic growth, given the vital roles played by the SMEs in most economies. Leveraging the blockchain technology, the prototype platform also provides immutable, transparent and instantaneously available information for all parties involved in the trade transactions as well as the investors. Particularly for the investors, information on the underlying trade transactions and the performance records of the SMEs will make the credit assessment of the SMEs quicker and easier and in turn encourage them to provide financing to SMEs. This will also open up new investment opportunities for the investors. For the Anchor Buyer, more financially resilient suppliers mean a more resilient supply chain, and the use of ESG conditions for triggering additional payment could facilitate the building of a greener and more socially responsible supply chain.

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5.   Key Trends Report: APEC Global Supply Chains Resiliency Survey - Small to Medium Enterprises | APEC

6.   Open account is defined by the United Nations as a sale where the goods, together with all the necessary documents, are shipped before the payment is due, directly to

       the importer who has agreed to pay the exporter's invoice at a specified date.

7.   Depending on the assets backing the tokens and the applicable jurisdictions, a DTT could be a stablecoin or digital token. See further details in section Project Overview

       and Annex: Regulatory Framework applicable to DTT. The term "DTT" is used throughout the report as a general term referring to stablecoin/digital token.

4. Project Overview

A global supply chain consists of various activities, including the sourcing of raw materials and components, manufacturing, transportation, warehousing, and distribution of finished products across regions and multiple tiers of suppliers, with each tier responsible for providing goods or services to the next tier up.

In a typical supply chain an Anchor Buyer, who is usually a large corporation, often purchases goods from Tier 1 Suppliers on an OA basis as an Anchor Buyer tends to have a stronger bargaining power. Tier 1 Suppliers, who are responsible for delivering the products, in turn outsource certain manufacturing processes to, or purchase parts or materials from, Tier 2 Suppliers on OA or Letter of Credit (LC) terms. Tier 2 Suppliers in turn purchase specialised materials or parts from their own suppliers on similar trade terms, i.e. Tier 3 Suppliers, and the supply chain goes on.

Many of the suppliers further down the supply chain are SMEs and they often face challenges in obtaining finance from traditional funders to support their operations. This is primarily due to a lack of collateral and/or an established credit and operational track record. In the limited cases where some funders offer trade finance products (such as factoring or invoice financing) to the SMEs, such funders often face great difficulties in obtaining real time information on the underlying trade transactions, thus further lowering their willingness to offer trade finance to SMEs. As a result, SMEs often have to rely on their limited business profit and their own savings to meet their working capital needs. These challenges can be particularly acute for SMEs further down the supply chain, which are smaller in size and have limited ability to obtain finance, especially when they trade with less financially credible buyers (i.e. middle-tier SMEs in the chain). Figure 1 below is an example of the typical processes and payment arrangements currently existing in a supply chain.

Figure 1: An Illustration of a Typical Supply Chain, and Working Capital Cycle of a Middle Tier SME (Tier 2 Supplier)

Project Dynamo delivered a prototype platform built by Linklogis, on which an Anchor Buyer and the suppliers along its supply chain use the DTT for making programmable payments. Conceptually the DTT would be issued by Linklogis or its affiliate financial institution, assuming the necessary regulatory approvals are in place. Alternatively, the token can be issued by a commercial bank at the request of the Anchor Buyer on the platform. Figure 2 below illustrates the process of utilising DTT in a supply chain setting:

Figure 2: Use of the DTT in a Typical Supply Chain

Use of DTT for Trade Settlement in Supply Chain
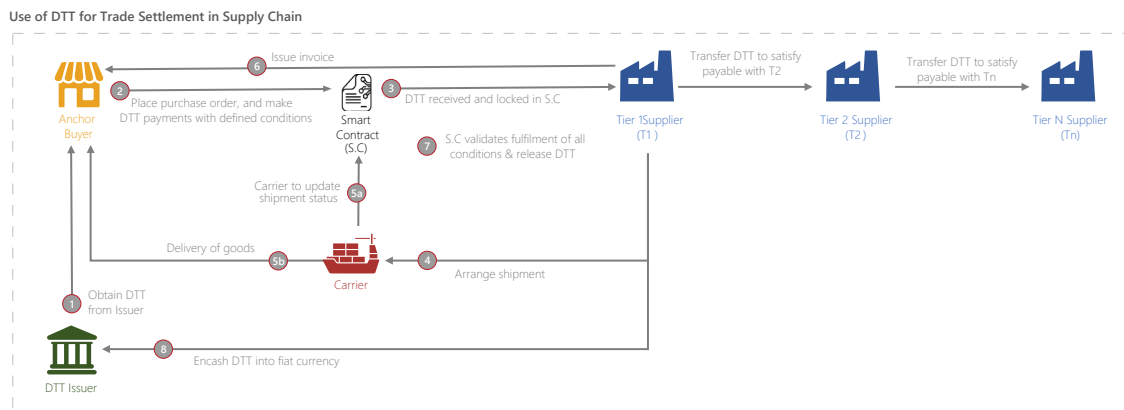
Once the Anchor Buyer enters into a purchase order with the Tier 1 Supplier it is envisaged that the Anchor Buyer would obtain a DTT from the DTT Issuer and make a conditional payment with the DTT (of an amount equal to the contract amount) to the Tier 1 Supplier. The DTT could be programmed by the Anchor Buyer with time-, action-, and data-based conditions:

- An example of a time-based condition is that the payment will only be made to the recipient of the DTT on a certain date.

- An example of action-based condition is that the payment will only be made to the recipient of the DTT when the Anchor Buyer indicates acceptance to the payment.

- Examples of data-based conditions are that the payment will only be made to the recipient of the DTT when an eBL has been issued by a certain trade platform or carrier, or that a bonus will be paid to a supplier when it achieves a certain ESG rating.

Such conditions are coded on smart contracts on blockchain and payments are automatically executed once the pre-set conditions are fulfilled.

Figure 3: Illustration of the issuance, transfer, finance and encashment of the DTT

Use of DTT in Deep Tier Supply Chain
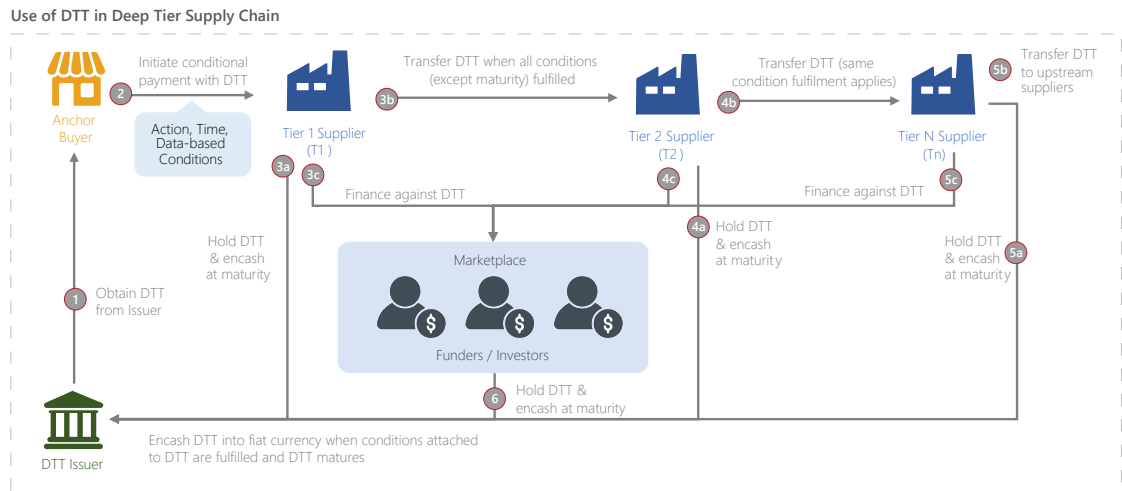
Upon receiving the DTT a supplier could hold, transfer, or finance the DTT:

- *hold* the DTT until all conditions are fulfilled as programmed on the DTT and encash from the DTT Issuer (see 3a/4a/5a); or

- *transfer* all or part of the DTT to an upstream supplier in payment, in whole or in part, for its debts or payables owed to the upstream supplier (see 3b/4b/5b); or

- *finance* all or part of the DTT with a funder (an institutional investor) via the DTT platform before the conditions are fulfilled. In such a case the funder may take on the performance risk of the supplier and the credit risk of the DTT Issuer (the funder does not face the credit risk of the Anchor Buyer as the claim is on the DTT Issuer). It is envisaged that the DTT will be financed at a discount that is commensurate with the associated risks (see 3c/4c/5c).

Three different options for issuance and backing mechanisms have been made available to make the DTT a practical solution. These options have been designed to cater to the various needs and concerns of stakeholders.[8] The options are:

Option	Issuer/Obligor	Backing
Option 1	Linklogis	1:1 fiat currency maintained at a segregated account
Option 2	A licensed bank such as Standard Chartered	1:1 fiat currency maintained at a segregated account
Option 3	A licensed bank such as Standard Chartered	Letter of guarantee issued by a corporate or another bank in favour of the DTT Issuer on a 1:1 basis

- Option 1: Linklogis, a non-bank FinTech company, issues DTTs upon the request of the Anchor Buyers, on the back of an equivalent amount of fiat currency (Option 1 DTTs). The fiat backing of the Option 1 DTTs will be held in segregated accounts maintained with a licensed financial institution for the purpose of supporting Linklogis' ability to pay on encash demand. Anchor Buyers will need to pay the fiat reserves to the issuer (Linklogis in this case) to obtain the DTTs.

- Option 2: A licensed bank, such as Standard Chartered, issues DTTs based upon the demand of the Anchor Buyers on the back of an equivalent amount of fiat currency (Option 2 DTTs). For legal reasons these Option 2 DTTs will probably not be structured as deposit tokens (i.e. transferrable tokens which evidence deposit claims against the bank) but rather as digital assets backed by fiat similar to the Option 1 DTTs, the only difference is that the issuer is a licensed bank. The backing of the Option 2 DTTs will be held in segregated accounts, separate from the assets of the bank. The Anchor Buyers will need to pay the fiat reserve to the issuer (a licensed bank such as Standard Chartered in this case) to obtain the DTTs.

- Option 3: A licensed bank, such as Standard Chartered, issues DTTs upon demand of corporate users (i.e. Anchor Buyers) against receipt of a corporate letter of guarantee or a bank guarantee from such users (Option 3 DTTs). The guarantee will be issued by the original DTT buyer (i.e. the Anchor Buyer) or another bank in favour of the DTT Issuer (i.e. a licensed bank such as Standard Chartered in this case) (Option 3 DTTs). When a holder of Option 3 DTTs encashes the DTTs with the DTT Issuer, the DTT Issuer will make payment of the fiat equivalent of the guaranteed amount and then make a claim on the guarantee against the guarantor. Nature of Option 3 DTTs depends on the individual jurisdictions (see Annex: Regulatory Framework applicable to DTT).

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8. Nothing in this paper should be read as a commitment by Linklogis or Standard Chartered to issue any DTTs. The issuance of any DTTs will be subject to internal approvals and considerations of the issuer.

The availability of these three options provides flexibility in choosing the most suitable solution for the specific needs of each stakeholder.

It is envisaged that KYC due diligence will be conducted on all parties on the platform. RD Technologies provided the automated corporate digital identification and KYC feature of the prototype. The ESG rating methodology was provided by MioTech. Standard Chartered also participated in the project and provided views from the perspective of a commercial bank which can act as a token issuer. In addition, Simmons & Simmons[9] provided views on the regulatory characterisation of Deep Tier Finance structure and the DTTs (see Annex).

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9.   Through JWS Asia Law Corporation (constituent Singapore law practice of Simmons & Simmons JWS) and Simmons & Simmons (HK).

5. Relevant Regulatory and Industry Developments

Digitalisation of Trade Finance

Regulatory and industry developments supporting trade digitalisation have evolved significantly over the past few years. There has been a growing recognition among governments, industry groups, and international organisations that digitalisation is crucial for trade growth and competitiveness. Key initiatives include the followings.

Figure 4: Evolution of International Trade Digitalisation Regulation Efforts
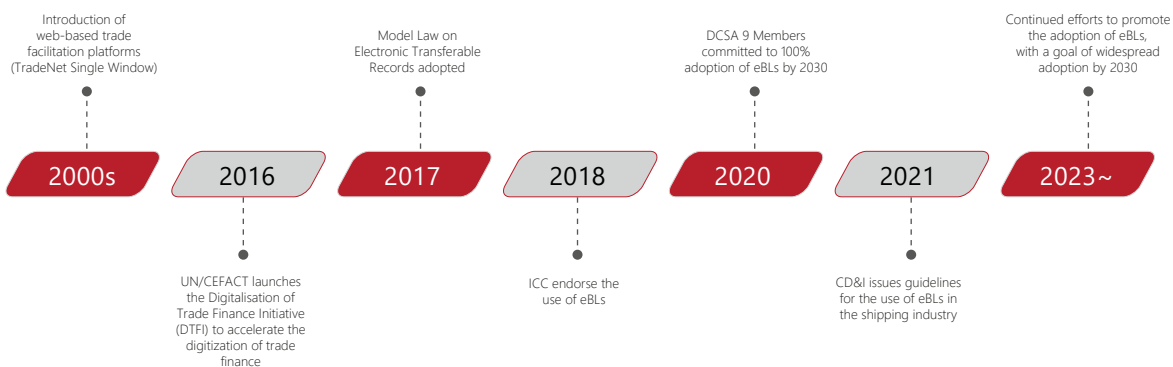
The World Trade Organisation (WTO) launched the Joint Statement on Electronic Commerce in 2016 to promote the use of digital technologies in trade. Over 80 countries, including major economies like the US, China, and the EU, support the initiative. The WTO's Working Group on Electronic Commerce was established in 2018 to develop new rules and agreements to facilitate cross-border e-commerce and promote digital trade. The United Nations Commission on International Trade Law (UNCITRAL) is also working on developing international rules for electronic commerce, including a new Model Law on Electronic Transferable Records adopted in 2017. Many countries, including the US, have implemented their own regulations to promote digital trade, such as the US-Mexico-Canada Agreement which facilitates cross-border e-commerce and promotes the use of digital technologies in trade.

The Digital Container Shipping Association (DCSA) announced in November 2020 that its nine members have committed to 100% adoption of electronic bills of lading (eBLs) by 2030. The members of the DCSA include some of the largest container shipping companies in the world, such as Maersk, MSC, CMA, and CGM. The DCSA has been working to develop digital standards for the container shipping industry, including a standardised data interface and a digital container handover process. The adoption of eBLs is expected to bring significant benefits to the industry, including reduced costs, improved efficiency, and increased security. The commitment to 100% adoption by 2030 is a significant step towards the digitalisation of the container shipping industry and is expected to accelerate the adoption of eBLs in the coming years.

The Digital Standards Initiative, hosted by the International Chamber of Commerce (ICC), is committed to promoting policy coherence and harmonising digital trading standards for the benefit of businesses, governments, and people everywhere. The ICC Digital Standards Initiative aim to resolve key challenges facing trade digitisation efforts, including:

- Lack of coherent standards for developers, executives and policymakers;

- Legal uncertainty regarding the acceptance of digital trade documentation;

- Platform rulebooks that hinder cross-platform title document exchange and utilisation;

- Unclear requirements for foundational trade standards; and

- Insufficient standards to simplify blockchain and non-blockchain based integration.

The Future International Trade Alliance, launched by ICC, DCSA, BIMCO, FIATA and SWIFT in 2022, aim to generate awareness about the importance of common and interoperable data standards and common legislative conditions across international jurisdictions and platforms. The goal is to facilitate acceptance and adoption of an eBL by regulators, banks and insurers and to unify communication between these organisations and customers, physical and contractual carriers, and all other stakeholders involved in an international trade transaction.

In relation to trade, significant regulatory evolution has also taken place on cross-border payments and secure data to address the growing importance of digital payments and protecting sensitive data. Regulatory efforts have been made in the EU and the US to strengthen the privacy rights of citizens and improve transparency and fairness in cross-border payments. The General Data Protection Regulation has been implemented in the EU in 2018 to protect personal data, while the Consumer Financial Protection Bureau of the US focuses on regulating foreign currency transactions and fees. The Financial Action Task Force (FATF) has also provided guidance on virtual assets and digital identity to improve the security of cross-border payments and prevent financial crimes.

Stablecoin

The introduction of single currency tokens (tokens backed by liquid assets in a single currency, also commonly referred to as stablecoins) by banks and non-bank financial institutions is another noteworthy evolution. Regulated stablecoins are generally considered more secure and stable due to strict regulations and capital requirements. While the Financial Stability Board has issued recommendations on the supervision of stablecoins,[10] the regulatory oversight of stablecoins is an evolving area and its treatment can vary by jurisdiction and may not be entirely clear-cut.

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10. Review of the FSB High-level Recommendations of the Regulation, Supervision and Oversight of "Global Stablecoin" Arrangements: Consultative report - Financial Stability Board

For example in April 2023 the European Union adopted the Markets in Cryptoassets (MiCA) Regulation. MiCA defines a cryptoasset as "a digital representation of value or rights which may be transferred and stored electronically, using distributed ledger technology or similar technology". It sets requirements for cryptoasset issuers and cryptoasset service providers. Cryptoasset issuers must provide complete and transparent information about the cryptoassets they issue and comply with disclosure and transparency rules. Cryptoasset service providers must be registered and implement security measures and anti-money laundering compliance.

In Singapore, the regulatory regime for stablecoins is still evolving. Where digital tokens are concerned, the regulatory treatment very much depends on the characteristics of the tokens and the most relevant financial regulatory regimes are those under: (i) the Securities and Futures Act 2001 of Singapore (SFA) and (ii) the Payment Services Act 2019 of Singapore (PSA). The SFA generally regulates the provision of services in relation to "capital markets products" which includes products such as securities (including debentures) and units in collective investment schemes. The PSA regulates the provision of "payment services", which includes the provision of a "digital payment token service" involving "digital payment tokens". Where payment services are concerned, the Monetary Authority of Singapore (MAS) has most recently (in October 2022) issued a Consultation Paper on the Proposed Regulatory Approach for Stablecoin-Related Activities (Stablecoin CP) catering to the rapid development of stablecoins.

Hong Kong SAR regulators are also in the midst of establishing an appropriate regulatory framework for digital tokens. Hong Kong has put in place a licensing regime for virtual asset service providers, known as VASPs, which will come into effect in June 2023. In addition to the VASPs regulated by the Securities and Futures Commission (SFC), the HKMA issued a discussion paper on crypto-assets and stablecoins in 2022 (HK Discussion Paper), followed by the conclusion (HK Stablecoin Conclusion) published in January 2023. According to the HK Stablecoin Conclusion, a licensing regime will be introduced to regulate activities of stablecoin issuers. In addition, the SFC and the HKMA published a joint circular entitled "Joint Circular on Intermediaries' Virtual Asset-Related Activities" on 28 January 2022 which provides guidance to intermediaries which wish to engage in distribution of VA-related products, provision of virtual asset dealing services and provision of virtual asset advisory services.

6. Technical Architecture

Overarching Structure

Four major components of the prototype will be elaborated in this section for better understanding of the technical structure of DTTs, namely *1) the Web-based Application System, 2) the blockchain infrastructure services, 3) the blockchain smart contract functionalities and 4) front-end user interfaces.*

- *The off-chain Web-based Application System*, developed by Linklogis, handles non-blockchain activities and processes, maintaining most of the off-chain data.

- *The blockchain infrastructure* services provide stable, secure, and highly available blockchain services, including user wallets, blockchain transaction data synchronisation, service charge management, smart contract management, open APIs and platform Software Development Kits (SDKs).

- *The blockchain smart contract functionalities* follow the Ethereum public blockchain standard protocol,[11] while retaining its decentralisation and interactivity when applied to user business.

- *Front-end graphical user interfaces* provide intuitive user interfaces for Anchor Buyers, Suppliers, and any third parties.

Web-based Application System

Figure 5: Architecture of Web-based Application System

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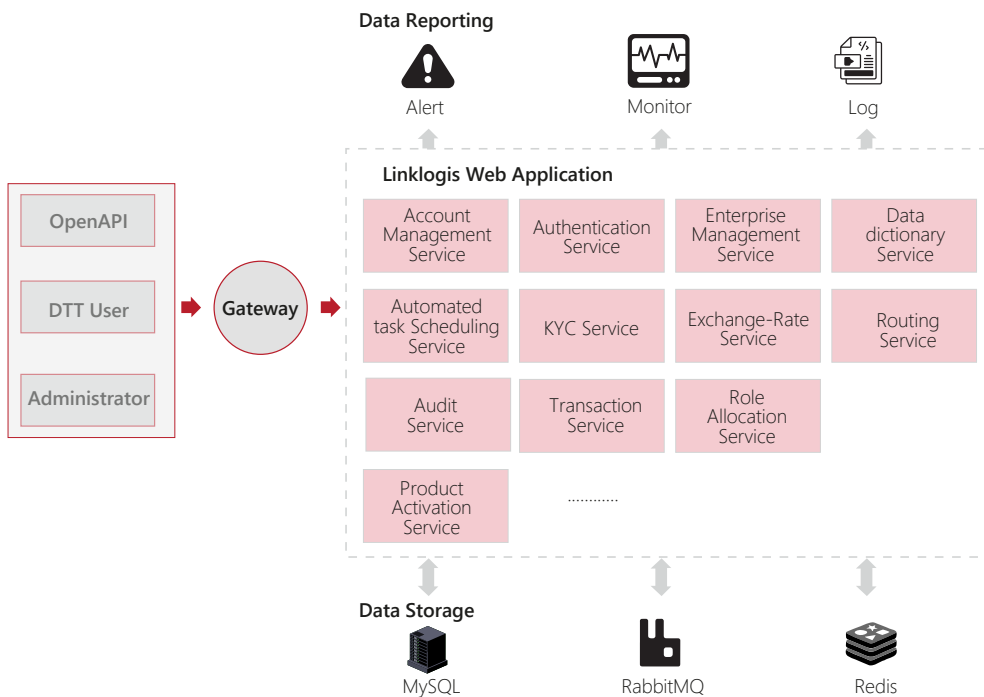
11. Ethereum is a public blockchain protocol that enables the development of decentralised applications (DApps) and smart contracts. It allows for the secure and

    transparent execution of programmable transactions and facilitates the creation of various blockchain-based applications and tokens.

The Web-based Application System (see Figure 5) serves as a web-based, centralised platform for managing user accounts, financial data, and transactions. It provides various functionalities such as automated task scheduling, account management and identity verification to ensure seamless collaboration integration. Scalable, resilient and production-ready technologies are used to facilitate the development and deployment of the prototype. Modern development methodologies such as Scrum, TDD, and SOLID principles were also employed to meet the strict standards required by banks and financial services entities.

The DTT infrastructure supports API modules, enabling technology solution providers to integrate their data source directly with the system. Additionally, a gateway module is implemented to provide request authentication controls and distribute the load evenly.

Blockchain Infrastructure Services

Figure 6: Architecture of the DTT Blockchain Infrastructure
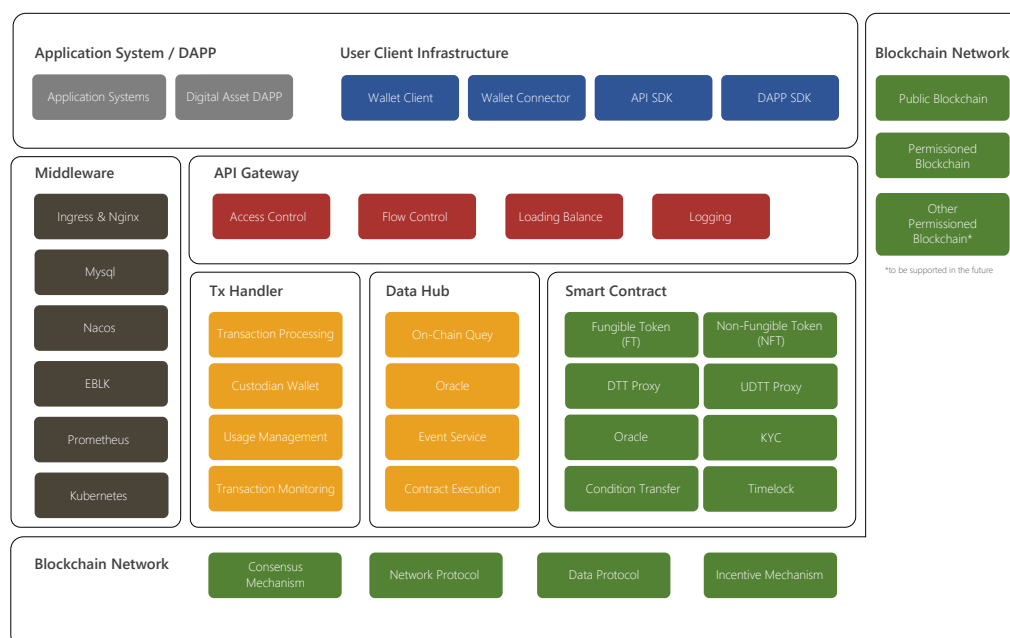
The blockchain infrastructure prioritises high scalability of business access and compatibility with multiple blockchain networks. This architecture is comprised of the User Client Infrastructure, Tx Handler, Data Hub and the necessary Middleware. Currently the DTT prototype is deployed on public Ethereum blockchain, with the possibility of rolling it out on other blockchains including Polygon and any other permissioned chain of choice in future.

The User Client Infrastructure consists of the Wallet Client, Wallet Connector and various SDKs. Using the JavaScript APIs of the public blockchain standard, these components can adapt to multiple mainstream wallet clients and custody wallets. The Tx Handler not only provides stable, secure, and highly available blockchain transaction processing facilities but also adapts to various blockchain networks and manages wallet fees. Serving as a bridge between blockchain data and off-chain data, the Data Hub ensures real-time synchronisation of the latest blockchain block data and provides event services for data users to monitor and receive.

Blockchain Smart Contract Functionalities

All operations pertaining to the DTTs, including issuance (minting), condition configuration, unrealised transfer, condition checking and execution and encash, are programmed on an ERC20 compliant smart contract running on Ethereum.

Smart Contract Functionalities	Descriptions
Issuance (minting)	As the DTTs comply with the ERC20 standard,[12] they have common attributes such as total supply, symbol, name, transfer and balance and can be easily traded and stored in any Ethereum wallet. When the Anchor Buyer requests to buy certain DTTs, such request is relayed to the DTT Issuers - the sole parties with the authority to mint the token - who then trigger the relevant minting action of the smart contract. The tokens are then transferred to the Anchor Buyer.
Conditions configuration	The Anchor Buyer can then initiate a conditional DTT transfer. It uses a user interface to configure the conditions and specify the recipient of the transfer (Tier 1 Supplier). The relevant amount of DTT will then be transferred to a smart contract to hold the amount, which would be released to the recipient of the DTT transfer once all the conditions fulfil.
Unrealised DTT transfer	When a conditional transfer is initiated by the Anchor Buyer, an ERC721[13] token record ('Unrealised token') will also be created with the first-hand holder (Tier 1 Supplier) being the recipient. As discussed in the section *'Unrealised DTT Transfer and Financing Mechanism'*, there are certain scenarios in which the holder of the Unrealised DTT (the Tier 1 Supplier) would seek to transfer the Unrealised DTT to other parties such as the Tier 2 Supplier. When such an Unrealised DTT transfer is done, the holder of the Unrealised token ERC721 token records would be changed from the Tier 1 Supplier to the Tier 2 Supplier.

12. ERC20 is a technical standard used for smart contracts on the Ethereum blockchain, which enables the creation of fungible tokens that can be traded and used as a medium of exchange. Reference

13. ERC721 is a technical standard used for smart contracts on the Ethereum blockchain, which enables the creation of unique and non-fungible tokens that represent ownership of a specific asset or digital asset. Reference

	The decision to adopt ERC721 as the token standard for the unrealised tokens was carefully deliberated. Despite these tokens having an associated face value and currency, the unique conditions attached to each transaction and the varying probability that these conditions will be fulfilled make every unrealised token unique. As such, ERC721 perfectly represents this characteristic of the unrealised tokens.
	Adoption of this solution design considerably extends the interoperability and reach of these assets. This feature allows not only the stablecoin (Realised DTT) to be traded easily using popular Ethereum wallets, but also enables the Unrealised DTT to be traded in the same way. This extension of interoperability can result in a significant cost reduction for building an infrastructure to negotiate these assets.
Conditions checking and execution	The smart contract is programmed to perform automated checking of all Unrealised DTT transactions at all times. Once the conditions are fulfilled the DTT held in the smart contract would be released to the holder of the unrealised ERC721 token (now Tier 2 Supplier) automatically.
Encash (burning)	When the holder of the Realised DTT decides to encash the tokens an equal amount of fiat currency would be transferred from the DTT Issuer to the Realised DTT holder. The DTT would be burnt accordingly.

Front-End User Interfaces

This section explains the roles of various parties on the DTT platform and their respective experiences. To facilitate the easy access to the platform a web-based front-end has been developed for the prototype, allowing for seamless use of the platform via a web browser. The following walkthrough showcases how an Anchor Buyer can make a trade payment through the DTT platform to a supplier, as well as demonstrates how a supplier can transfer, finance and encash their DTT.

Role of an Anchor Buyer

Prior to making a conditional payment, an Anchor Buyer must first initiate a Buy request on the platform to obtain a DTT from a DTT Issuer - see Figure 7 below. The request will then undergo review by the DTT Issuer (whose role is discussed in a later section - *Role of a DTT Issuer*) and can only be used upon approval of the purchase.

Figure 7: Submit Buy Request to Obtain DTT
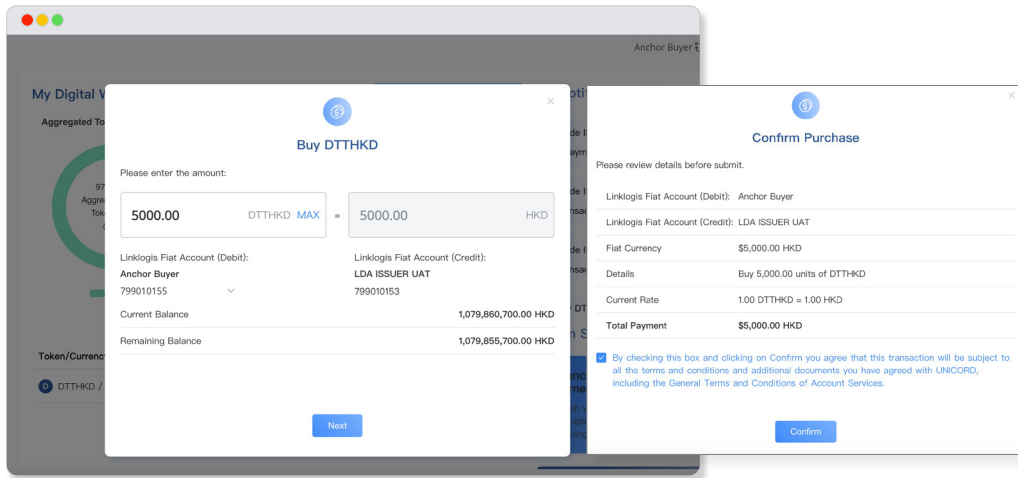
Having acquired the DTT, the Anchor Buyer can proceed to initiate a transaction to the supplier by setting the payment conditions in accordance with the agreed trade terms. The process of setting up a DTT transaction has been made user-friendly with pre-configured use cases available for selection - see Figure 8. Anchor Buyers can simply fill out a brief questionnaire and the necessary details will be auto populated. Alternatively, advanced users or those with unique use cases can manually configure the transaction.

Figure 8: User-Friendly Pre-Configured Options
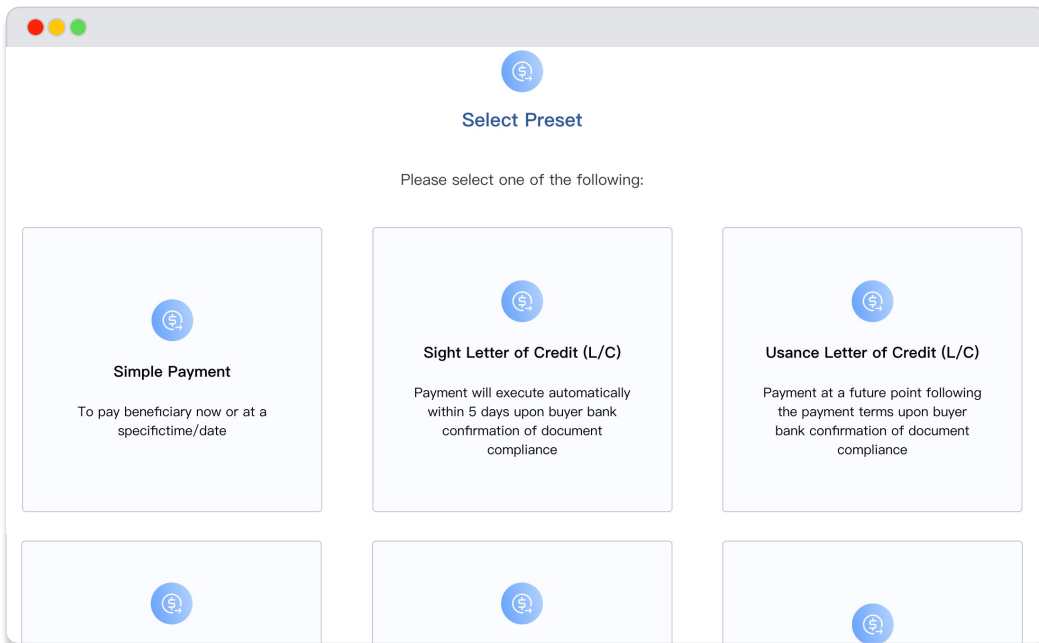
In order to initiate a conditional DTT transaction, it is essential for the Anchor Buyer to provide the following information (regardless pre-configured or self-configuration):

- Corresponding supplier wallet address as recipient;

- Payment amount;

- Conditions - the actions required for payment to realise - eg, acceptance by Anchor Buyer itself or a designated third-party (such as banks, funders, and carriers), ESG/eBL data conditions; and

- Maturity of payment.

Subsequently, the Anchor Buyer must give authorisation to confirm the initiation of the transaction (see Figure 9). Upon submission the DTT transaction will be immutably recorded on the blockchain.

Figure 9: Essential Details of a DTT Transaction

Role of a Supplier

Upon receiving the DTT transaction, the supplier can view its total DTT holdings, including Realised and Unrealised DTT, on its Digital Wallet homepage (see Figure 10). The DTT platform allows for monitoring of the progress of the specific trade by all involved parties, including the sender, recipient, and any named third parties.

Figure 10: Current DTT Holdings and the Details

With these Unrealised DTT transactions held in the supplier's possession, the supplier could consider transferring it to an assignee (i.e. upstream suppliers) in part payment of outstanding debts/obligations, subject to the counterparty's acceptance and willingness to bear the associated risks. The possibility for a successful negotiation of utilising outstanding Unrealised DTT for settlement increases based on the following factors:

- Payment acceptance provided - the Unrealised DTT becomes a Confirmed DTT - removing the risk of it being unfulfilled;

- Creditworthiness of the origin of the DTT transaction initiation; and

- Direct involvement in the fulfilment of the corresponding conditions (refer to section 'Order Transfer').

To reduce the chance of any disputes arising, considerations are recorded and captured on-chain when a transfer is initiated (see Figure 11). Consent to the transfer is required by the assignee before the transaction is executed and becomes irrevocable on blockchain.

Figure 11: Transferring an Unrealised DTT
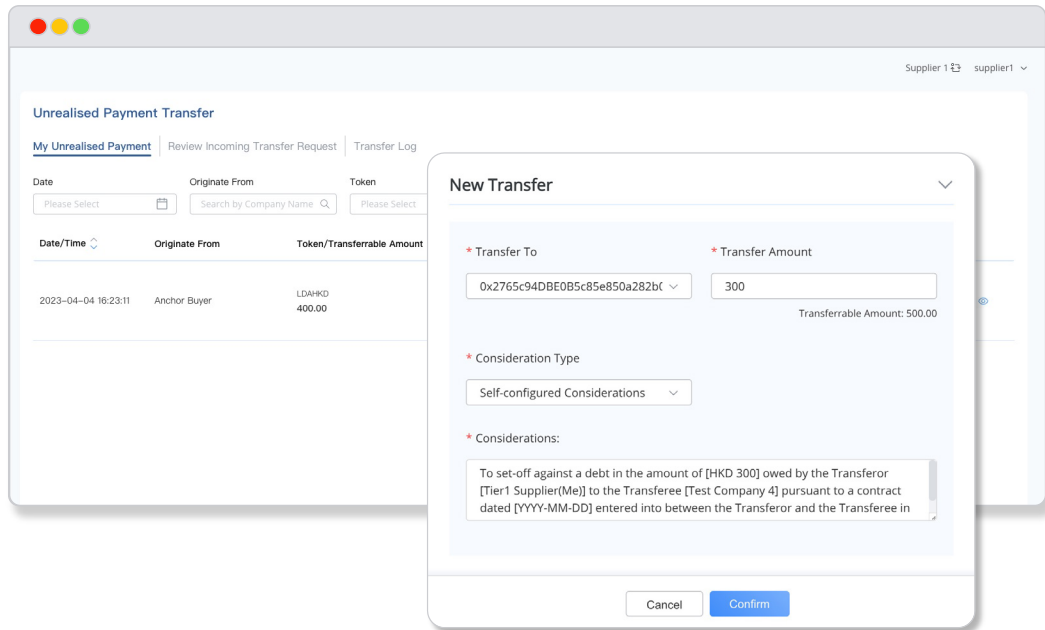
Holding the Unrealised DTT allows suppliers to explore financing options on the platform. By reviewing their current DTT holdings eligible for financing, suppliers can choose to list their desired financing amount and ratio for negotiation and matching with funders. This provides a flexible and efficient financing option for suppliers, with the underlying DTT serving as collateral.

Figure 12: Financing an Unrealised DTT
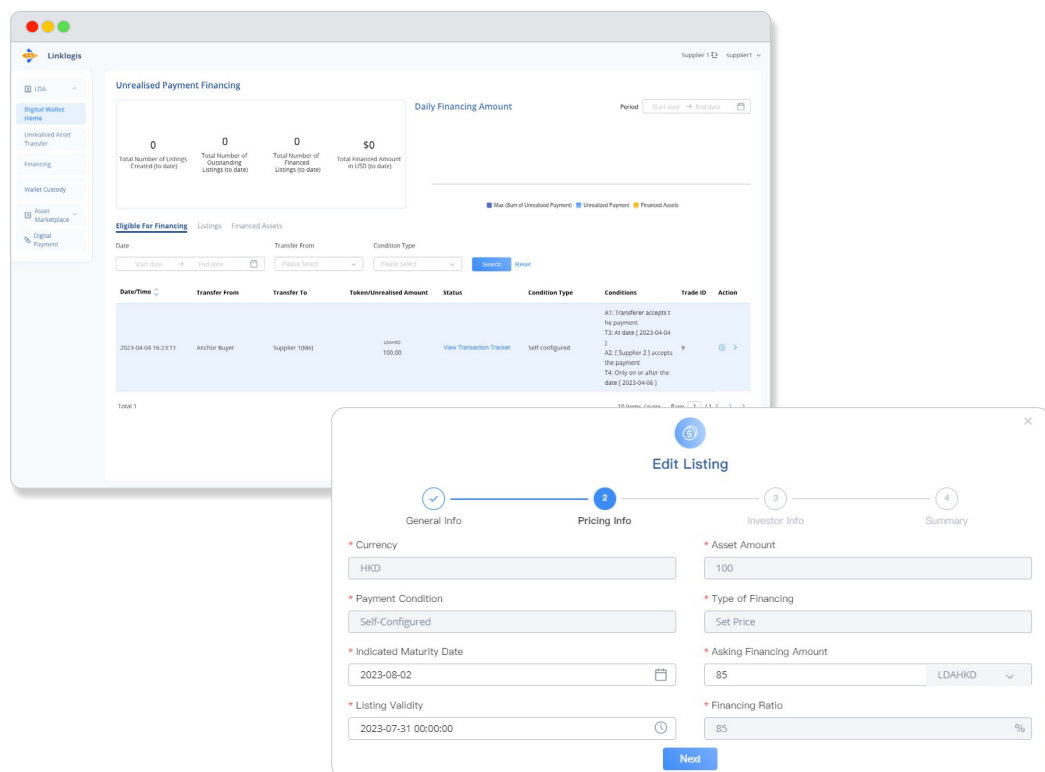
Role of a Third-Party

In order to accommodate diverse trade scenarios, the DTT platform provides flexibility for different parties to perform specific actions on the transaction. As shown in Figure 13, the responsible third party, as indicated in the onset of programming the DTT, can perform partial or full acceptance actions to update the trade progress.

For instance, in a post-shipment payment term, shipping carriers may be responsible for updating the status of shipment of goods on the DTT transaction. Moreover, banks may also be tasked with reviewing documents presented and confirming payment acceptance. In a milestone-based payment term, a third-party surveyor can provide multiple partial payment acceptances at different junctures of the trade journey.

Figure 13: Full or Partial Payment Acceptance of DTT Transaction

Role of a DTT Issuer

As mentioned in the section *Role of an Anchor Buyer*, when the Anchor Buyer initiates a Buy request on the platform, these requests undergo a review process by the DTT Issuer, illustrated in Figure 14. A similar review process is also required when DTT holders are selling (i.e. encashing) their Realised DTT. This step is essential for the DTT Issuer to prevent any misuse, such as by users who have not undergone KYC process, as well as to prevent fraudulent activities or any activities in contravention of the anti-money laundering regulations.

Figure 14: Review Process of DTT Minting or Burning
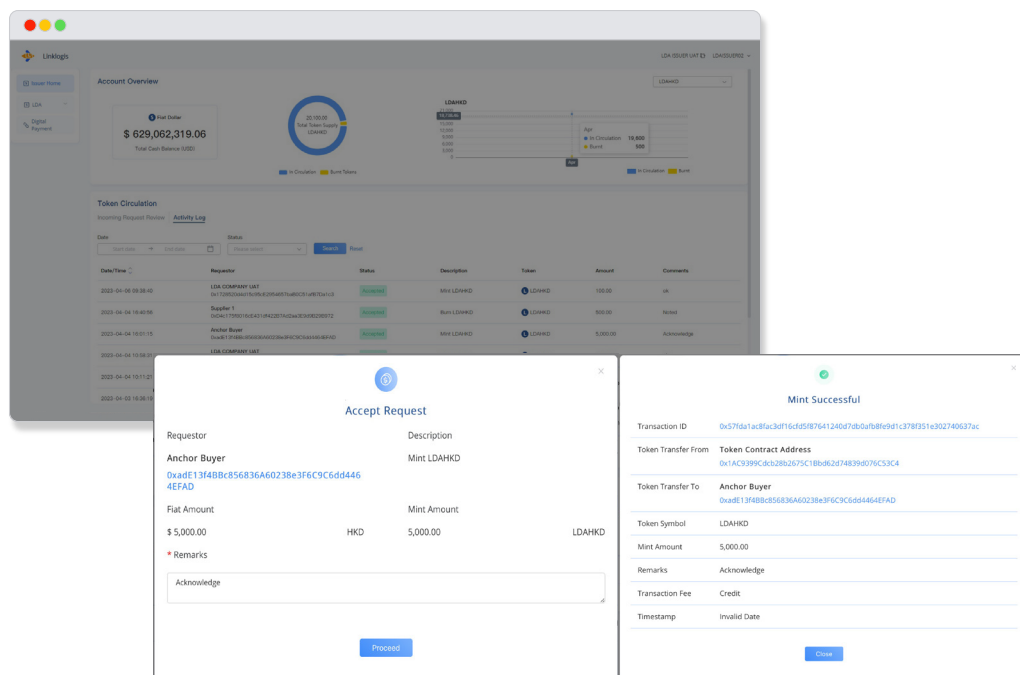
The above illustration outlines the process flow of the Anchor Buyer making conditional payments to the Supplier. It is important to emphasise that the user interfaces designed are generic and can be utilised by all users of the DTT infrastructure. When the Supplier engages in procurement activities its role shifts to that of an Anchor Buyer and it will be able to make conditional payments to subsequent suppliers, thereby continuing the flow. The Anchor Buyer may also act as a recipient of funds, such as in the case of selling to a distributor. In such cases, the Anchor Buyer can utilise the system to transfer or finance its unrealised DTTs.

Whitelisting to Restrict Access of DTT to Verified Parties Only

Unlike typical cryptocurrencies which can essentially be owned and operated by any anonymous wallet holders as long as they have access to the internet, DTTs are only intended to be used only by verified parties who have gone through an identity verification process. This is to ensure DTT is not being used illegally.

In other words, only a certain group of Ethereum wallet addresses, with successful identity verification being validated through the process of KYC/CDD as illustrated below, can have access to DTTs. This is achieved by enforcing role-based access control mechanisms - Role-Based Access Control (RBAC) - on smart contracts. This mechanism helps to regulate and define multiple roles, allowing and restricting data, functions, and other smart contracts to perform different sets of actions and certain operations in a smart contract.

When a wallet attempts to interact with the smart contract, RBAC checks whether the necessary permissions have been authorised for the wallet to perform the requested action and denies such operation if the wallet has not been whitelisted.

KYC/CDD Process

To ensure that the parties accessing DTT have gone through a rigorous verification process, providing a secure and compliant environment for the usage of DTT, RD ezLink, a tool for KYC/CDD developed by RD Technologies, is integrated in the prototype platform.

The tool collects, verifies, stores and shares information and profiles with the consent of corporate customers. The solution is powered by advanced digital technologies such as distributed ledger technology (blockchain), cloud, cryptography, and data analytics. Unlike other KYC utility models, the information and profiles on RD ezLink are owned by the corporates instead of the financial institutions. Corporate profiles are all initiated by, and consented to, by the corporate customer concerned, which is essentially different from other KYC utility models that render the sharing of corporate customers' data mandatory amongst partnering institutions.

Corporate customers can complete their corporate profiles via RD App, including entity details, business details, shareholding structure and authorisation, an improved experience from the traditional account opening process. They can also enrich their profiles by uploading the relevant supporting documents for different financial service application assessments. Before submitting the corporate profiles to the relevant financial institutions, the verification of the corporate profiles and relevant individual profiles of key persons will be completed by RD.

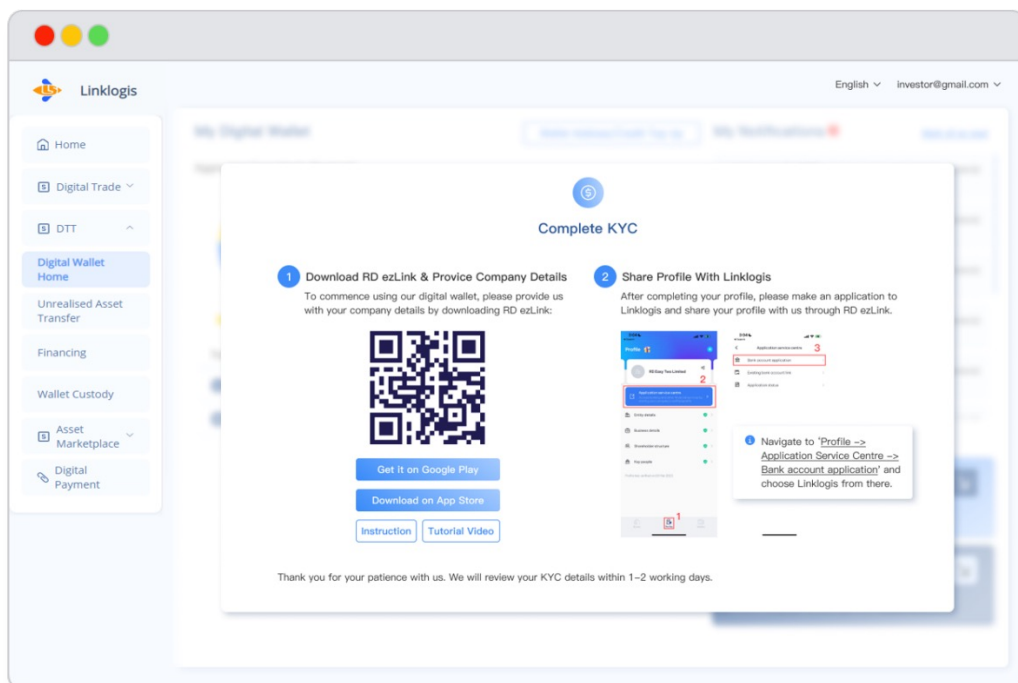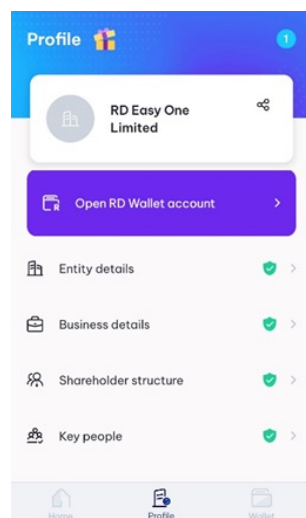Figure 15: Know-Your-Customer (KYC) Required Before Users Can Use DTT

After downloading the RD App, the profile controller (i.e. the principal controller on behalf of the company) is required to perform individual identity verification (ID&V) by uploading photos of their ID cards/passports and selfies in order to perform a facial matching of the ID documentation. The verification will be conducted simultaneously using AI (for facial matching) and the ID&V result will be displayed on the RD App with API connection.

Once the ID&V is complete the profile controller will start building the company profile with initial information such as the entity details. Once such information is provided, the company search process will be triggered, which will be conducted through two approaches:

- For Hong Kong companies, due to the technical limitations by the Hong Kong Company Registry,[14] a manually-supported company search is required. A company search task will be created and the RD Operations staff will kick-start the company search.

- For non-Hong Kong companies, where possible, the request for company search will be submitted via API in order to request the local company search team to perform a company search with the local company registry of that jurisdiction.

The entity details inputted will be verified against the company search results.

While the search and verification are underway, the company profile building process will not be disrupted and the profile controller can continue entering the remaining information, including business details, shareholding structure and key people.

Once all the fields have been completed and the company search and verification have been passed, the profile controller can invite the required number of directors to sign the board resolution and approve both the authority of the profile controller as well as the application to Linklogis.

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14. All the documents available on Hong Kong Company Registry ("HKCR") are in PDF format and there is no API capability.

Figure 17: RD Web-Based Portal
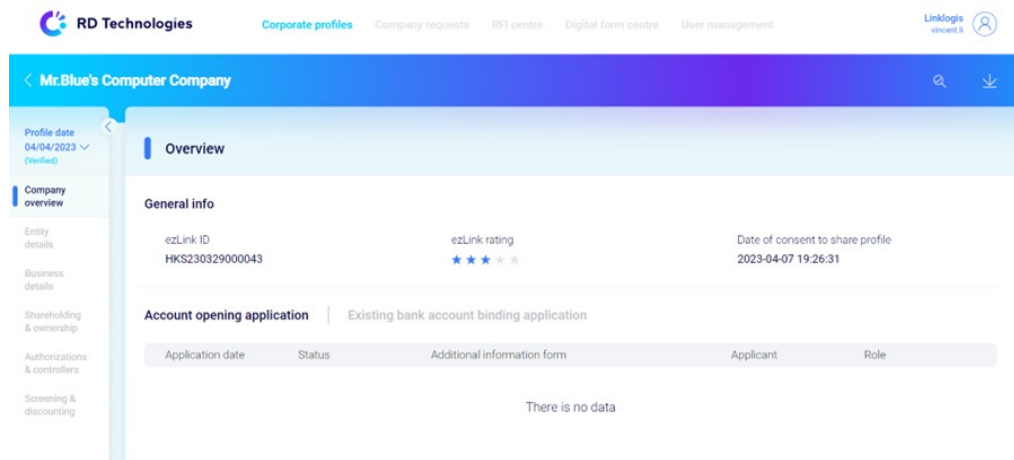
Linklogis, as the DTT platform operator, has been granted access to a web-based portal. On the portal, the platform operator can view the application received via the RD App, including the company profile details or entity details, business details, shareholding structure as well as authorisations and controller details. The results of screening against politically exposed persons and the sanctions lists of the company and its key people are also provided for reference. The platform operator can approve or reject the application based on the information provided. If further information is required, the platform operator can ask the customer for further information through the built-in communication channel titled "Request for Information".

Once the platform operator approves the application and the customer relationship is established, any updates of the company profiles on RD App will be automatically reflected on the RD portal. Linklogis can download the company profiles, together with all the relevant supporting documents (including but not limited to company search evidence from the RD portal) and input the information into Linklogis' own KYC systems.

Data Condition: ESG

The past two years have seen mounting regulatory scrutiny and public pressure on firms over ESG issues as the US Securities and Exchange Commission tabled its first climate-related disclosure rules and the European Union is on track to upgrade its corporate ESG reporting regulation in terms of scope and granularity. Emerging markets are embracing such regulatory trends. At COP27 in Sharm El Sheikh, Egypt in 2022, the Financial Reporting Council of Nigeria announced that they will prepare for the adoption of the sustainability disclosure standards compiled by the International Sustainability Standards Board. China, the world's largest emerging market, is imposing ESG disclosure obligations on its state-owned businesses, many of which are essential to the economy.

While large public corporations stand at the forefront of this wave of policy shift, countless small firms that supply goods to those corporations are not free from ESG disclosure obligations. The potential requirement to disclose emissions caused across a firm's value chain (also known as scope 3 emissions) is prompting large corporations as Anchor Buyers to pay attention to the climate impact of their suppliers, and thereby, incentivising the SMEs to improve their ESG reporting capability, in order to meet the requirements of increasingly sustainability-oriented Anchor Buyers and maintain strong trading relationships.

In addition to meeting regulatory demands, some Anchor Buyers and SME suppliers are driven to adopt ESG initiatives and reporting capabilities for commercial reasons too. It provides such SMEs with a competitive advantage in winning orders from sustainability-oriented Anchor Buyers and promotes their business growth. It also helps them to secure funding from the ESG conscious funding providers. For the Anchor Buyers, screening suppliers with ESG criteria helps reduce the possibility of negative environmental and social impacts of suppliers that might undermine the Anchor Buyers' own resilience and sustainability agenda. It's important to note that considerable investments are needed to achieve robust ESG governance, and a supply chain makes an ideal setting for pioneering such initiatives given there might be strong incentives from both the Anchor Buyers and the suppliers.

One of the approaches adopted for supply chain ESG is to assess suppliers' self-reported information and grant each supplier an ESG rating. The rating will be a key criterion for the supplier selection process. As ESG ratings are heavily influenced by the methodologies adopted by different institutions, it is important to design a methodology that puts emphasis on indicators like environmental qualifications, climate targets and actions, workforce management, and health and safety policies to reflect appropriate ESG concerns.

Currently, there are two predominant challenges facing the introduction of supply chain ESG ratings. One stems from poor data availability; whereby coherent datasets are not readily available to investors due to limited access to technologies for data collection and the substantial cost associated with the collection process. The other challenge is data robustness. Given ESG data collected across suppliers, locations and platforms are not consistent and standardised, there are substantial difficulties in how such ESG data might be effectively processed, adequately benchmarked and verified for authenticity.

## Tackling Data Challenges in Financing ESG Outperformers

The adoption of ESG ratings for a supply chain is explored in Project Dynamo. The selected ESG rating methodology, provided by MioTech, has three pillars (namely environmental, social and governance), which contain 19 topics collectively and over 1,000 indicators. It benchmarks against international mainstream sustainability frameworks like the Global Reporting Initiative Standards (commonly known as the GRI Standards), recommendations from the Task Force on Climate-related Financial Disclosures (commonly known as the TCFD Recommendations), as well as local frameworks such as the ESG reporting rules of the Hong Kong Exchange. In addition, the ratings frameworks differ across sectors and will adjust to company size and geographical location.

Figure 18: MioTech's ESG Evaluation Framework - Three Pillars and 19 Themes

Environmental	Social	Governance
• Environmental	• Labor Management	• Business Ethics
• Management	• Employee Engagement and Diversity	• Risk Management
• Pollutants	• Employee Health and Safety	• Corporate Governance
• Waste	• Community Impact	• ESG Management
• Material Consumption	• Product Responsibility	
• Water Resources	• Supply Chain Management	
• Energy Consumption		
• Greenhouse Gas Emissions		
• Climate Change		
• Biodiversity		

Based on the rating framework, a comprehensive indicator data is derived, and a professional materiality analysis is conducted. The indicator data is mainly derived from the suppliers' self-reported data including data collected through a questionnaire. The indicator data could be benchmarked against those of the peers. The materiality analysis is based on MioTech's holistic and purpose-driven ESG research to ensure that the indicators relevant to supply chain management are assigned higher weights in the rating framework to better demonstrate a supplier firm's sustainability potential.

Figure 19: MioTech's ESG Rating Methodology
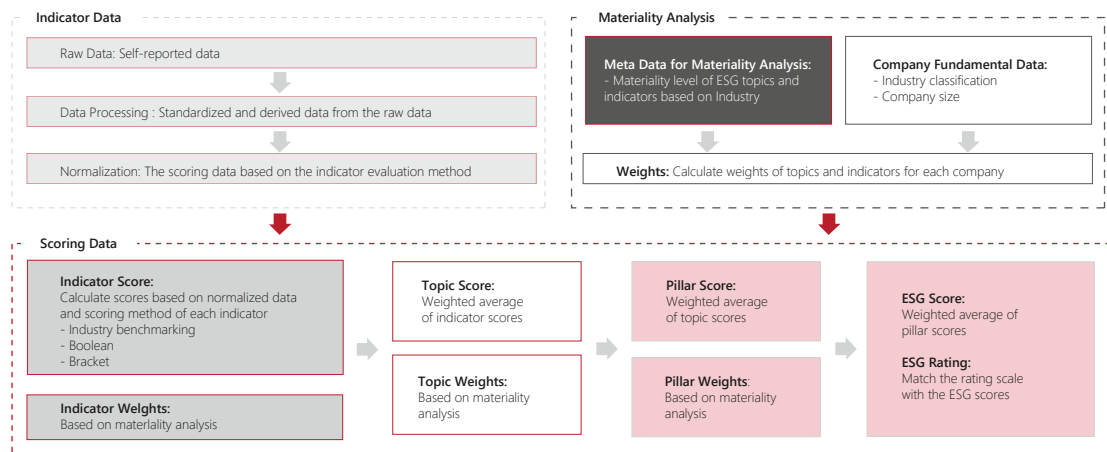
Integrating the Rating Procedures into DTT Conditional Payments

When an Anchor Buyer seeks to use a supplier's ESG rating as one of the DTT payment conditions, an ESG data fetching request is relayed to MioTech via API. MioTech then passes a data filling request to the Supplier.

Figure 20: Setting ESG Data Condition

Upon receiving the request the Supplier will input the requested ESG information on MioTech's platform.

Figure 21: MioTech Platform

When the input from the Supplier is received, MioTech's platform will generate an ESG rating for the firm automatically benchmarked against its industry peers using AI. The ESG rating and underlying scoring report will be automatically updated on Linklogis' platform, thereby making it available to 1) the Anchor Buyer to determine if the Supplier has met the predefined ESG payment conditions and 2) potential funders for assessing a Supplier's financing request.

By adopting the ESG rating as one of conditions when making payments with DTTs, Anchor Buyers could effectively improve the ESG compliance of its supply chain. For instance, they could provide financial incentives to Suppliers who meet certain ESG targets. Such incentives could be programmed on the DTT smart contracts and will be paid automatically to the Suppliers once their ESG ratings meet the pre-set targets.

Data Condition: eBL

The use of eBL can improve cross-border trade by reducing the costs and inefficiencies associated with paper-based processing. In Project Dynamo, eBL related payment conditions, leveraging on Linklogis and Singapore's Infocomm Media Development Authority (IMDA)'s collaboration in IMDA's TradeTrust framework, are explored to demonstrate how digital technology can streamline trade processes.

The TradeTrust framework enables the decentralised management of electronic transferrable records (ETRs) such as eBLs across different countries that are supported by jurisdictions that have adopted the UNCITRAL MLETR.[15] This framework complements the global trade movement by the G7 economies on adopting ETRs in international trade. Through the use of TradeTrust, all parties residing in different geographies who are involved in the trade process can verify the provenance and authenticity of the ETR, as well as transferring its title ownership from one party to another across different digital platforms or systems.

Figure 22: Using eBL Data Condition in DTT Transaction

One of the benefits of using eBL is the valuable data points that can be captured and used to make the trade process more efficient and transparent. For example, an eBL can provide information on the location of goods, delivery status, payment terms, and holdership of the eBL, which can be used by anchor buyers, suppliers, and banks to improve their decision making processes. Such information can also facilitate banks and other financial institutions in their assessment of any funding requests associated with a trade transaction. This can benefit all parties involved in a trade transaction, especially the SME suppliers.

Furthermore, the use of eBLs and the TradeTrust framework provides legal certainty and comfort to DTT users. Singapore's Electronic Transactions Act amendments enable the legally accepted creation and use of eBL that are functionally equivalent to paper-based bills of lading. Risk of fraud is also mitigated through the use of distributed ledger technology to verify the authenticity and provenance of the trade documents.

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15.   United Nations Commission on International Trade Law (UNCITRAL) published the Model Law on Electronic Transferable Records (MLETR) in 2017.

The adoption of electronic transferable documents in partnership with TradeTrust has increased efficiency, cutting down the time taken to process bills of ladings from 10-20 days down to just 1 working day. This also translates to lower costs and savings, with McKinsey & Company estimating potential annual savings of USD 6.5 billion in direct costs and enablement of between USD 30 billion and USD 40 billion in new global trade volume.

The benefits of this technology go beyond improving trade financing transactions. It can aid the convergence of physical, financial and document chains, making automation of key processes possible. This is an excellent example of how innovative service offerings can be supported, paving the way for a wider adoption of digital trade in the future.

Nevertheless, it is crucial to note that the adoption of the TradeTrust framework for ETRs is still at a nascent phase and has not been widely accepted by the industry yet. This may pose a challenge for the proposal's success in countries where eBL would be converted and represented through paper ownership.

7. Detailed Functionality Walk-Through

The DTT represents a novel family of payment tokens and built on the Ethereum blockchain. DTT possesses several crucial properties

Property	Explanation
Token Symbol	The DTT token symbol contains a designated fiat currency type (eg DTTHKD or DTTSGD)
DTT Issuer's Responsibility	The DTT Issuer is the only party with minting rights of the DTT token; it can mint DTTs based on backing criteria as elaborated in the subsequent section 'Three Options of Backing DTTs'
	The DTT Issuer is obligated to encash Realised DTTs with a corresponding amount of fiat currency at any given time, subject to applicable law and the rules of the DTT
Transfer	DTTs can be transferred with user-programmed conditions embedded in smart contracts. Conditions can be action-based, data-based and time-based
Unrealised DTT	Before all the conditions are met, the DTT's status remains 'Unrealised'. The Unrealised DTT is locked by a smart contract and cannot be encashed until it becomes a Realised DTT
Confirmed DTT	A specific kind of Unrealised DTT is a Confirmed DTT, whereby all action including performance of supplier's obligation and data conditions for execution are satisfied, except for the time component

Confirmed DTT are useful during transfer and financing because they provide more comfort and certainty to its recipients |
| Realised DTT and Execution | When all action-, data- and time-based conditions have been met, the DTT's status automatically changes to "Realised", such process is known as 'Execution' |
| Rescission | When the conditions failed to be met, the initial transfer transaction of the Unrealised DTT will be rolled back and the initiator will regain the possession of the Realised DTT, such process is known as 'Rescission' |

Status of the DTT

Figure 23: Status & Lifecycle of DTTs

Status of Digital Trade Token

Unrealised DTT – Payment conditions attached to the DTT have not been fulfilled, hence holders cannot encash with the issuer

Confirmed DTT – A subset of Unrealised DTT, where all conditions are fulfilled, except for time condition

Realised DTT – All conditions fulfilled/No conditions attached, available for encash as fiat
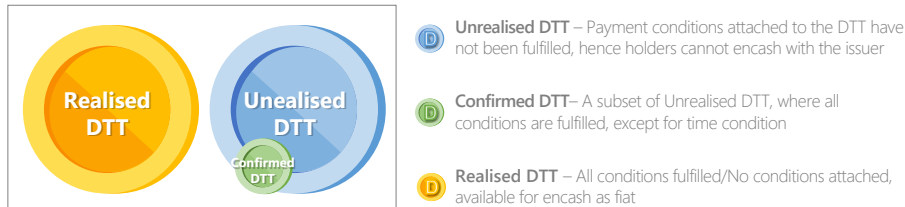
Lifecycle of DTT
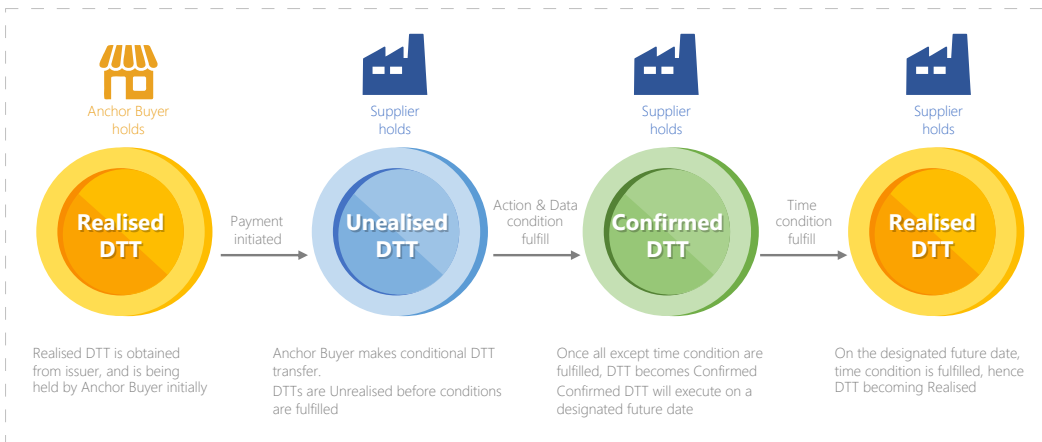
The status of the token will update during its lifecycle as follows:

- When the Anchor Buyer first acquires the DTT from the DTT Issuer there are no predefined conditions attached to the DTT, hence the DTT is known as Realised.

- Once a DTT transfer has been initiated from the Anchor Buyer to a supplier, action-, data- and time-based conditions are programmed onto the token. Until all the conditions are fulfilled, the corresponding DTT amount is locked in the smart contract, resulting in the DTT being classified as an Unrealised DTT.

- As the supplier performs its duty, such as delivering goods or services to the Anchor Buyer, the action and data-based conditions are being fulfilled. However, the time-based condition may remain unfulfilled because the payment may be scheduled to be executed at a usance term, for example 30, 60, or 90 days after shipment. At this point, the Unrealised DTT is classified as a Confirmed DTT, as it is certain that the payment will be executed at a designated future time point.

- When the time-based condition is also met, the DTT becomes Realised. The supplier can encash the token with the DTT Issuer for an equivalent amount of fiat currency that backs the DTTs.

Programmability of DTT Payment

Figure 24: How the DTT Works
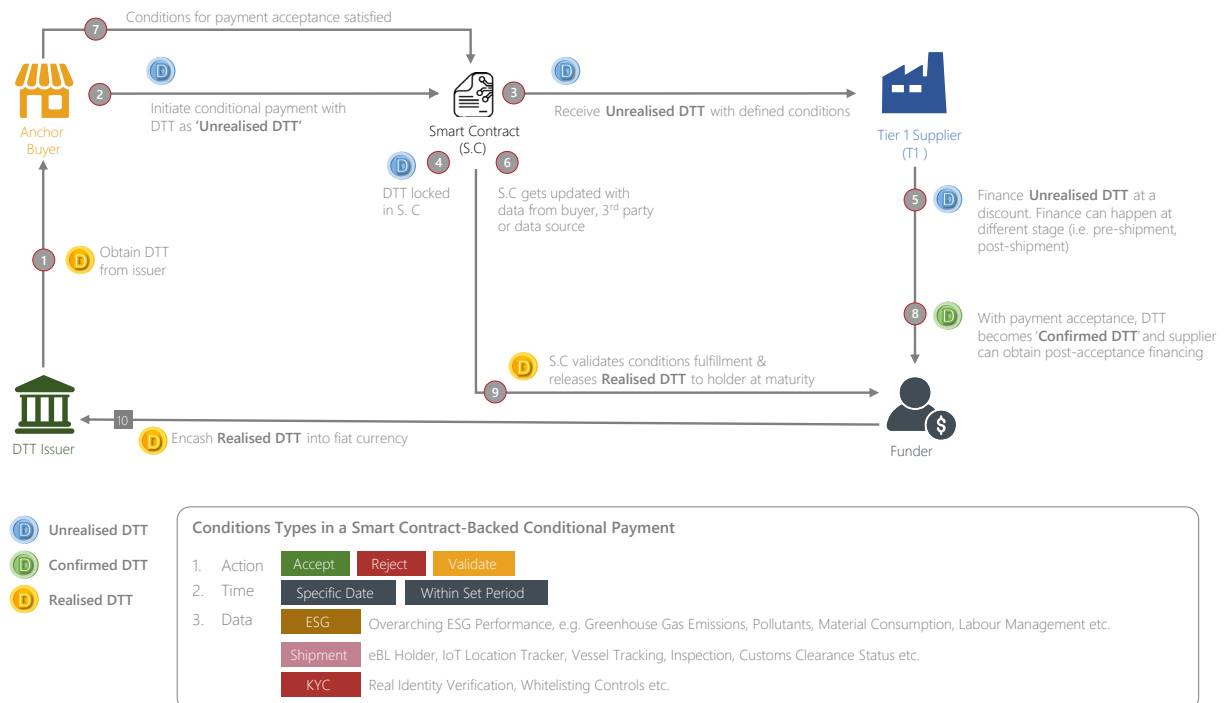
This prototype illustrates the basic programmable payment functionality of the DTT. *Action-, data- and time-based conditions* are coded into smart contracts by the Anchor Buyer on the blockchain.

Action-based Conditions

- Fundamental actions such as acceptance and/or rejection can be used.

- When a DTT transfer is initiated the Anchor Buyer can specify that either the Anchor Buyer itself or any third party specified by the Anchor Buyer, such as the Anchor Buyer's bank, must give an acceptance command on the blockchain to confirm the fulfilment of the DTT conditions. The acceptance can be done on a full or partial basis as specified.

- The Anchor Buyer or any third party specified can post a rejection command on the blockchain, as such the transfer will be immediately rescinded.

Data-based Conditions

In addition to fundamental actions, the Project Dynamo prototype tests several data-related conditions, including ESG-related conditions and eBL (an electronic negotiable document) conditions, which will be elaborated on in subsequent sections.

Time-based Conditions

Project Dynamo provides support for configuring time-based conditions that enable execution on a user pre-specified date, execution within a specific range of time, or setting an expiry date for the transaction, which, if conditions are not met by then, results in the transaction being rescinded.

Multiple Conditions and Rescission of Transfer

Logical operators such as 'and' or 'or' can combine multiple conditions to form more complex conditions.

If there are conflicting conditions, or if any condition cannot be fulfilled, the initiated transaction will be rolled back and rescinded. This approach promotes transparency and efficiency in the process, while maintaining a high level of security and trust in the transaction.

Unrealised DTT Transfer and Financing Mechanism

One of the key characteristics of a DTT is its transferability. The transfer of Unrealised DTTs takes place when a token holder transfers its holding to another party in exchange for a mutually agreed-upon consideration. Both parties must accept the consideration, indicated by signing a transaction with their blockchain identity.

Three major scenarios arise in Unrealised and Confirmed DTT transfers pertaining to SME financing:

Deep Tier Supply Chain

For example, in the case of a multi-tier supply chain as illustrated in Figure 2, where the Tier 1 Supplier purchases raw materials from the Tier 2 Supplier and owes the Tier 2 supplier a debt, assuming the Tier 1 Supplier lacks sufficient cash to pay the Tier 2 Supplier but holds Unrealised DTTs from the Anchor Buyer. In such a case the Tier 1 Supplier may agree with the Tier 2 Supplier to pay in whole or in part its debt with the Unrealised DTT.

In this scenario, it is likely that the Tier 2 Supplier will only accept a Confirmed DTT for payment of the debt, because otherwise the Tier 2 Supplier has to bear the risk of the conditions not being fulfilled and the assessment of the probability of that risk materialising (i.e. the risk of the conditions not being fulfilled) may be difficult.

Once both parties agree to the payment terms, it becomes irrevocable, and the Tier 2 Supplier loses the claim over the debt owed by the Tier 1 Supplier.

Financing

In this scenario, the suppliers who are holding Unrealised DTTs may opt to obtain financing from funders instead of waiting for the conditions to be fulfilled.

Funders are expected to be institutional investors who are able to assess the risks associated with the Unrealised DTTs (i.e. the risks that the pre-set conditions are not met) and who are able to provide financing to the suppliers in accordance with the risks.

These investors may require the suppliers to enter into credit facility agreements and such agreements may include credit protection clauses such as recourse terms to maintain their claims over the suppliers in case the pre-set conditions are not fulfilled.

Order Transfer

In some industries, upstream suppliers (e.g. Tier 2 suppliers) can meet the payment conditions of the DTT even if the downstream suppliers (e.g. Tier 1 suppliers) are not directly involved.

Figure 25: Transfer of Unrealised, Unconfirmed DTT to Upstream Suppliers
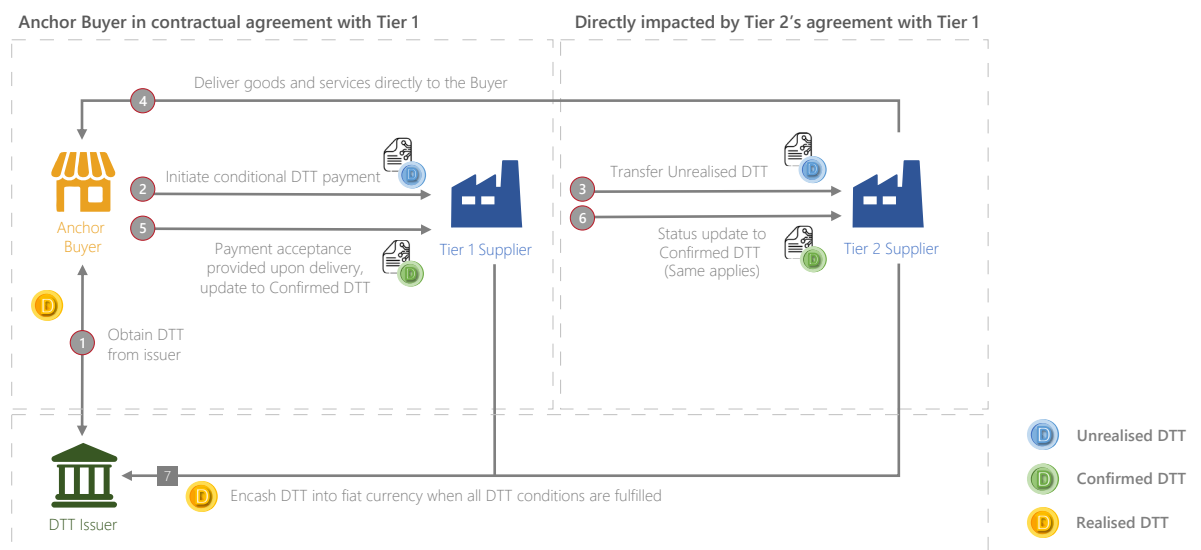
Take a trading company (Tier 1 Supplier) which engages in a business of procuring goods from a manufacturer (Tier 2 Supplier) and exports to an Anchor Buyer as an example. The Anchor Buyer makes payments by using a DTT with specified conditions such as 'goods must reach buyer's location'. Upon receiving the Unrealised DTT, the Tier 1 Supplier can transfer a portion (e.g. 90%) to the Tier 2 Supplier, who manufactures and ships the goods, retaining 10% as profit. When the goods shipped by the Tier 2 Supplier reach the predetermined location, the Unrealised DTT (90%) held by the Tier 2 Supplier will automatically be converted to a Confirmed DTT and the Tier 2 Supplier may encash the DTT into fiat currency from the DTT Issuer when the time condition is also fulfilled.

This use case demonstrates how conditions related to the DTT payment can be transferred and fulfilled by upstream suppliers, providing a solution for cash-flow challenges faced by SME trading companies and enabling them to expand their businesses.

8. Conclusion

Potential Benefits

The potential benefits of the Project Dynamo prototype can be significant. It can offer a new avenue of financing for SMEs that were previously unable to access traditional financing options and in turn help stimulate economic growth, given the vital roles played by the SMEs in most economies. Leveraging the blockchain technology, the prototype platform also provides immutable, transparent and instantaneously available information for all parties involved in the trade transactions as well as the investors. Information on the underlying trade transactions and the performance records of the SMEs will make the credit assessment of the SMEs quicker and easier particularly for the investors and in turn encourage them to provide financing to SMEs. This should also open up new investment opportunities for the investors. For the Anchor Buyer, more financially resilient suppliers mean a more resilient supply chain and the use of ESG conditions for triggering additional payment incentive could facilitate the building of a greener and more socially responsible supply chain. The use of digital identity for conducting due diligence is an additional feature to demonstrate the meeting of potential compliance requirements

Commercial Challenges to the Proposed Issuance and Backing

The commercial challenges of DTTs lie in the uncertainty over its issuance requirements and ability to promote wider adoption due to lack of awareness and understanding and potentially high integration cost. As DTTs involve the use of public blockchain such as Ethereum, concerns over data privacy and volatility of gas fees may come under the spotlight as well.

Amongst the three proposed backing methods, Option 1 and Option 2 DTTs require fully cash-backed issuance, it is anticipated that not all Anchor Buyers may be motivated to adopt these two options. In addition, the DTT may not be issued in all currencies. For example, if the issuer wishes to (or should) be subject to the Singapore regulatory regime on single-currency stablecoins under the New Stablecoin Regime, the DTTs can only be pegged to Singapore dollars or the Group of G10 currencies.

With respect to Option 3 DTTs, challenges in adoption mainly lie in the regulatory obstacles and uncertainty given that Option 3 DTTs are structured to be backed by corporate/bank guarantees. As discussed in the Annex, it appears that in both Singapore and Hong Kong, Option 3 DTTs are unlikely to fall within the stablecoin regimes. In fact, Option 3 DTTs can potentially be characterised as debentures or debt securities and be subject to similar offering requirements as conventional securities.

Adoption Considerations

For the prototype to be adopted in real life it is important to have the endorsement from the regulators, Anchor Buyers, financial institutions and institutional investors who can jointly establish an ecosystem to promote adoption by SMEs. Another hurdle to the adoption of DTTs is the lack of awareness and understanding of programmable payment instruments and their advantages among potential users. This lack of awareness may cause companies to hesitate in participating in the programme and investing in the necessary resources required to make use of the DTTs.

There is also the challenge of potentially high migration and integration costs associated with adopting DTTs. Implementing DTTs into existing systems and processes, and possibly using it to replace existing payment instruments, may require resources, including investments in technology and infrastructure, especially for commercial banks who perform the role of DTT Issuer under the Option 2 and Option 3 DTT scenario, slowing down the initial uptake of DTTs. However, once the adoption hurdle is overcome, from the perspective of SMEs, the integration challenge should be limited as SMEs are provided with a web-based interface that is intuitive to use.

Another area of concern for DTT is the acceptability of the public Ethereum blockchain to potential users. Using a public blockchain implies that all transactions are visible on-chain, even though the identities of counterparties are not directly disclosed (only wallet addresses are available on-chain). However, an address is public information which will be disclosed during the normal course of business (for example, when collecting payments). This transparency could be a problem for privacy-conscious businesses. Such businesses may not want their transactions to be visible to everyone, as they could reveal confidential information or proprietary business information, such as profit margins. Additionally, the volatility of gas fees on Ethereum could be a potential drawback, especially during periods of high blockchain usage.

To address these concerns, other blockchains of choice, such as Polygon[16], could be adopted. This would reduce transaction fees while retaining the benefits of the Ethereum ecosystem. Furthermore, if there is a high demand for privacy, technologies like Polygon Nightfall (link) can be considered. It uses zero-knowledge proofs to ensure that transactions are completely private and confidential. This can be a significant benefit for businesses that are concerned about keeping their transactions and sensitive data secure.

Regulatory and Cross-Border Concerns

Trade and financial activities are cross-border in nature and this will inevitably result in the issuance, transfer and/or use of the DTTs across different jurisdictions. As an example, DTTs which are initially issued in Hong Kong to an Anchor Buyer in Hong Kong, may first be used to pay a supplier in Singapore, and that same supplier in Singapore may then seek to use the DTTs to pay a supplier in Thailand or arrange for financing in the United Kingdom.

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16. Polygon is a layer-2 scaling solution for Ethereum that processes transactions on side chains, enabling it to significantly increases its transactions per second. By reducing the load on Ethereum and utilising various scaling solutions, Polygon may potentially lower gas fees for users.

At present, regulators across the world are at different stages in the development of a regulatory framework for digital tokens (including stablecoins). Where there are regulatory frameworks, they may not necessarily be consistent or well developed, including how digital tokens similar to the DTTs should be characterised (whether as stablecoins or otherwise) and the applicable compliance requirements. The lack of regulatory consistency is very likely to hinder the ability to extract the full value of Project Dynamo as this can result in regulatory uncertainties, difficulties with regulatory compliance and huge compliance cost, including in areas on AML/CFT.

Areas where regulatory clarity and consistency are welcome include:

• legal framework for the issuance of the DTTs (among others, to avoid discrepancies in the quality of stablecoins issued in different jurisdictions as a result of different reserve backing requirements);

• regulatory treatment of the DTTs (particularly Option 3 DTTs), for example, whether it falls under the existing securities framework or a separate regime for digital assets; and

• regulatory certainty on the use of DTTs as a medium of exchange.

There should also be legal certainty in the characterisation of the DTTs, including whether they confer property rights.

Future Work

While this project explored the use of stablecoins/digital tokens for SMEs finance in a supply chain, going forward it would be worthwhile exploring if, and how, the tokens could be used for other forms of trade finance payments and if there are potential use cases beyond trade finance. It is also worth exploring whether CBDCs could be used for the same or similar use cases. The technical complexity of implementing a token using smart contracts may increase with the complexity of the regulations and policies that govern it. Another area of potential future study is whether a non-fungible token (NFT) could be a commercially viable way to represent receivables as an asset class. From a technical perspective, NFT could be easily valued and exchanged by investors using NFT platforms compatible with the ERC721 standards. However, the legal implications around holding and trading such NFTs need to be considered in depth.

9. Annex: Regulatory Framework Applicable to DTT

As part of this project, the BIS Innovation Hub worked with Simmons & Simmons[17] to explore the potential regulatory treatment[18] of the DTTs in Singapore and Hong Kong, with a specific focus on the regulatory characterisation and licensing requirements for the various activities involving the DTTs. Certain regulatory hurdles and areas of uncertainty have been identified.

A Singapore Perspective

DTTs bear certain characteristics which can potentially be characterised in a number of ways under the Singapore financial regulatory framework, for example:

a.   as "debentures" under the SFA; and/or

b.   as "digital payment tokens" (DPT) under the PSA; and/or

c.   as "single-currency pegged stablecoins" (SCS) under the PSA under the New Stablecoin Regime.

Looking at each of the regulatory regimes briefly in turn:

a.   "debentures" under the SFA: "debentures" fall within the definition of "securities" and "capital markets products" under the SFA "dealing in capital markets products" which is defined to broadly mean "making or offering to make with any person or inducing or attempting to induce any person to enter into or to offer to enter into any agreement for or with a view to acquiring, disposing of, entering into, effecting, arranging, subscribing for, or underwriting any capital markets product" is a regulated activity subject to licensing under the SFA, unless an exemption is applicable. Offering of securities in Singapore is also subject to prospectus and other offering requirements unless a safe harbour can be relied upon.

b.   DPT under the PSA: Carrying on business in Singapore providing a "digital payment token service" is subject to licensing in Singapore under the PSA, unless an exemption is applicable. "digital payment token service" includes any service of "dealing in" DPT which is defined to generally mean buying or selling of DPT in exchange for any money or any other DPT. The PSA and notices issued thereunder also set out various conduct of business requirements applicable to DPT service providers.

c.   SCS under the PSA: If the proposals in the Stablecoin CP should be implemented in the future, there will be a new regulatory regime for SCS (New Stablecoin Regime). MAS, amongst other proposals, intends to introduce a new regulated activity of "stablecoin issuance service" under the PSA and impose requirements on MAS-regulated SCS so as to maintain a high degree of value stability (eg reverse asset backing requirements).

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17.   Through JWS Asia Law Corporation (constituent Singapore law practice of Simmons & Simmons JWS) and Simmons & Simmons (HK).

18.   This information is provided for reference only, on a non-reliance basis and should not be considered legal advice. It is not intended to represent a definitive view of the regulatory position in either Singapore, Hong Kong or any other jurisdiction.

Issuance of Option 1 DTTs

In many aspects, Option 1 DTTs are akin to USD Coins (USDC) which by way of background involve the following arrangements:

a.   USDC provides a fully collateralised USD stablecoin and is based on the open-source asset-backed stablecoin framework developed by CENTRE. It is designed to maintain price equivalence to the USD.

b.   A USDC is fully backed by an equivalent amount of USD-denominated assets held by Circle with US regulated financial institutions in segregated accounts.

c.   Institutions in supported jurisdictions can open a Circle account to exchange USD for USDCs and/or encash USDCs for USD. Circle commits to encash 1 USDC for 1 USD, subject to its terms and conditions, applicable law, and any fees where applicable.

d.   When a USDC holder sends USDCs to another address, it automatically transfers and assigns to the owner of that address (a Holder), and any subsequent Holder, the right to encash USDCs for USD so long as the Holder is eligible to, and does, register a Circle account.

Currently, USDCs are characterised under the PSA/ SFA as follows:

a.   in a set of FAQs on PSA, MAS has stated that USDC is an example of SCS which, based on its characteristics at the time of the response, is considered a DPT under the PSA; and

b.   there has been no official statement by MAS on whether USDCs may be characterised as "debentures" under the SFA, but it is generally believed that the regulatory intent is not to regulate USDC as "debentures".

Given that Option 1 DTTs are intended to be structured similarly to USDCs in many respects, Option 1 DTTs should most likely only be regulated by MAS as DPTs under the PSA. If so, under the current PSA, an issuer of the DTTs will need to consider if it requires a PSA licence for providing the regulated service of dealing in DPTs for merely issuing the DTTs.

Additionally, once the New Stablecoin Regime is implemented as proposed, this may require the DTT issuer to be licensed for the new regulated activity of "stablecoin issuance service" for the issuance of the DTTs if the amount in circulation should exceed, or is anticipated to exceed, SGD 5 million in value and/or be subject to various other requirements (for example, reserve asset-backing requirements, timely redemption, disclosure and prudential requirements). There are however certain features which are unique in the DTTs (for example, the ability to encash a DTT only after it is realised) which are not necessarily present in SCS such as USDC (or appear to be anticipated in the Stablecoin CP) and further consideration may need to be given as to whether the DTTs necessarily fall within the New Stablecoin Regime.

Issuance of Option 2 DTTs

The backing mechanism of Option 2 DTTs is very similar to that of Option 1 DTTs with the only change being the identity of the Issuer, from a Fintech firm to a licensed bank. Hence, the regulatory considerations set out above on Option 1 DTTs should similarly apply to Option 2 DTTs except that:

a. Under the current PSA, MAS licensed banks are exempt from the requirement to hold a PSA licence for providing the regulated service of dealing in DPTs, although certain PSA conduct requirements still apply.

b. If the New Stablecoin Regime should be implemented, it seems that MAS licensed banks will be exempt from licensing requirements under the PSA for the issuing of SCS, but certain other requirements (such as reserve asset backing requirements) may still be applicable.

c. MAS licensed banks may need to consider if MAS approval is required for broadening their existing activities (e.g. under Section 30 of the Banking Act 1970 of Singapore).

Issuance of Option 3 DTTs

In the case of Option 3 DTTs, the regulatory characterisation is likely to be different in a number of ways from that of Option 1 and Option 2 DTTs given the different nature of backing (i.e. in the form of a guarantee).

For the purposes for the current PSA, the regulatory position for Option 3 DTTs should only be the same as that for Option 1 and Option 2 DTTs assuming the exchange rate of Option 3 DTTs to fiat is not fixed and may vary when used, traded or offered by third-party service providers.

If the New Stablecoin Regime should be implemented as proposed, a key difference from Option 1 and 2 DTTs is that the guarantee will very likely not satisfy the proposed reserve asset-backing requirement applicable to SCS issuers. This is because in the Stablecoin CP, while there may be discussions that "cash equivalents" may be acceptable, this is limited to "any deposit placed with a banking institution or deposit-taking institution, or any cheque, draft or other item drawn on a banking institution or merchant bank that is payable immediately upon presentation or that is in the process of collection". Ordinarily, this should not include a guarantee which represents a contingent obligation and this would be consistent with FSB's recommendation that for global stablecoin arrangements that use a reserve-based stabilisation method, the composition of reserve assets should consist only of conservative, high quality and highly liquid assets.[19] Since the Option 3 DTTs will likely not meet the proposed reserve asset-backing requirements, it may be that Option 3 DTTs will be regulated as a DPT under the PSA even after the New Stablecoin Regime is implemented.

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19.   See Recommendation 9 in Review of the FSB High-level Recommendations of the Regulation, Supervision and Oversight of "Global Stablecoin" Arrangements: Consultative report

For the purposes of the SFA, with a guarantee backing, the risk of Option 3 DTTs being characterised as "debentures" under the SFA increases. This is because when an Option 3 DTT token is encashed, assuming that the relevant conditions to payment are satisfied, the obligor will be required to make payments and only then can it make a claim on the guarantee. This brings the characteristics of Option 3 DTTs closer to that of conventional debt instruments, one key consequence being that prospectus requirements may apply to the offering of Option 3 DTTs.

Other Activities in Relation to DTTs

Since the DTTs are mostly likely characterised as DPTs, there are other licensing requirements under the PSA that may apply to related activities/services.

For instance, the DTT platform operator, may (if it not already licensed) also be subject to licensing requirements under the PSA if such activities constitute the provision of any service of "dealing in" DPTs or "facilitating the exchange" of DPTs.

Other activities/services relating to the DTTs can also be subject to licensing requirements under the PSA, for example:

a. depending on the transaction flow, relevant entities may be providing a "domestic money-transfer service" or "cross-border money-transfer service" which are both subject to licensing under the PSA, unless exempt; and

b. once the PS Amendment Act 2021 of Singapore comes into effect (the date of which is unknown), relevant entities carrying out any of the following activities may also be subject to licensing requirements under the PSA unless exempt:

    i.   the service of accepting DPTs from one DPT account, for the purposes of transmitting, or arranging for the transmission of, the DPTs to another DPT account;

    ii. the service for arranging for the transmission of DPTs from one DPT account to another DPT account;

    iii. the service of safeguarding DPTs where the service provider has control over the DPTs (eg a custodian); and

    iv. the service of inducing or attempting to induce any person to enter into, or to offer to enter into, any agreement for or with a view to buying or selling any DPTs in exchange for any money or other DPTs.

A Hong Kong Perspective

Similar to the position in Singapore, DTTs can potentially be characterised in a number of ways under the Hong Kong financial regulatory framework, for example:

a. as "virtual assets" under the amended Anti-Money Laundering and Counter-Terrorist Ordinance (AMLO). The amended AMLO came under force on 1 April 2023;

b. as "stored value facilities" under the Payment Systems and Stored Value Facilities Ordinance (PSSVFO); and/or

c. as stablecoins under the HK Stablecoin Conclusion.
    Looking at each of the regulatory regimes in turn:

a. virtual assets under the AMLO: As highlighted in paragraph 2.8 of the Financial Services and Treasury Bureau's public consultation on legislative proposals to enhance anti-money laundering and counter-terrorist financing regulation in Hong Kong, the definition of virtual assets[20] applies equally to virtual coins that are stable (i.e. the so-called stablecoins) or not and irrespective of the purported form of underlying assets. With that said, the VASP licensing regime aims to only regulate virtual assets exchange. As a result, it does not capture functions in a typical stablecoin arrangement, including (i) issuance and redemption of tokens; (ii) execution of transactions; (iii) token custody and operation; (iv) value stablisation and reserve management; (v) validation of transactions; and (vi) fund transmission; [21]

b. stored value facilities under the PSSVFO: In accordance with the PSSVFO, a facility is a "stored value facility" if both of the following conditions are satisfied:

    i.   the facility may be used for storing the value of an amount of money that (1) is paid into the facility from time to time; and (2) may be stored on the facility under the rules of the facility; and

    ii. the facility may be used for either or both of the purposes: (1) as a means of making payments for goods or services under an undertaking[22] (whether express or implied); (2) as a means of making payments to another person (other than payments mentioned in (1) above under an undertaking[23] (whether express or implied) given by the issuer of the facility.

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20.   Virtual assets generally captures a cryptographically secured digital representation value that:

•   is expressed as a unit of account or a store of economic value;

•   either functions (or is intended to function) as a medium of exchange accepted by the public as payment for goods or services, or for the discharge of debt, or for investment purposes; or provides rights, eligibility or access to vote on the management, administration or governance of the affairs in connection with any cryptographically secured digital representation of value;

•   can be transferred, stored or traded electronically; and

•   satisfies other characteristics prescribed by the SFC.

21.   Paragraph 4.1 of the HK Discussion Paper.

If a stablecoin falls under the definition of a "stored value facility" for the purposes of the PSSVFO and constitutes the issue of a stored value facility in Hong Kong, it will be subject to a mandatory licensing regime administered by the HKMA (i.e. the issuer will need to comply with the PSSVFO and other regulatory requirements) unless any of the exemption provisions apply. The above criteria of taking stored value by a facility issuer and the same issuer giving an undertaking in the manner as described above will need to be met in order for a facility to be a stored value facility. Depending on the facts and circumstances, a stablecoin arrangement may involve different entities carrying out respective functions of stablecoin issuance and wallet operations and there may not be any undertaking by the issuer to use the stablecoin as a means of payment for any third party. This may render the stablecoin arrangement not a stored value facility even though when viewed in totality, it operates in a manner similar to that of a stored value facility;[24]

c. stablecoins: The HKMA states it will give priority to regulating stablecoins that purport to reference to one or more fiat currencies. The HKMA further adds that the focus would be on purported reference of a stablecoin irrespective of the underlying stabilisation mechanism of that stablecoin (in-scope stablecoin). Given Option 1 DTTs are akin to USDC in various respects, we will focus on the new licensing regime as the Hong Kong Stablecoin Conclusion has proposed. Once the proposals set out in the HK Stablecoin Conclusion come into force stablecoin issuers will need to be licensed. The HKMA proposes to introduce the new licensing regime between 2023 to 2024.

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22. In accordance with the PSSVFO, the relevant undertaking referred to in this regard is an undertaking that, if the facility is used as a means of making payments for goods or services, the issuer, or a person procured by the issuer to accept such payments, will accept the payments up to the amount of the stored value that is available for use under the rules of the facility.

23. In accordance with the PSSVFO, the relevant undertaking referred to in this regard is an undertaking that, if the facility is used as a means of making payments to another person (recipient) (other than payments mentioned in footnote [12]), the issuer, or a person procured by the issuer to make such payments, will make the payments to the recipient up to the amount of the stored value that is available for use under the rules of the facility.

24. Paragraph 4.2 of the HK Discussion Paper.

The new licensing regime will cover four aspects:

i. governance: establishment and maintenance of the rules governing an in-scope stablecoin arrangement;

ii. issuance: creation or destruction of in-scope stablecoin;

iii. stabilisation: stabilisation and reserve management arrangements of an in-scope stablecoin, regardless of whether such arrangements are provided by the issuer; and

iv. wallets: provision of services that allow the storage of users' cryptographic keys, access to the users' in-scope stablecoin holdings and the management of such stablecoins (each a regulated activity, collectively, regulated activities).

As set out in the HK Stablecoin Conclusion, entities that are involved in the following activities will require a licence under the proposed licensing regime:

i. conducting a regulated activity concerning in-scope stablecoin;

ii. actively marketing[25] a regulated activity to the public of Hong Kong; or

iii. taking into account matters of significant public interest, the HKMA is of the opinion that the entity should be regulated.

It is important to note that any entity conducting a stablecoin-related activity in which the stablecoin concerned purports to reference the Hong Kong dollar will need to obtain a relevant licence and is subject to regulatory requirements, regardless of whether the regulated activity is carried out in Hong Kong or actively marketed to the Hong Kong public. If the stablecoin concerned purports to reference a currency which is not Hong Kong dollars (eg pegged to Singapore or other G20 countries), the licensing regime will only apply if one or more of the regulated activities are carried out in Hong Kong or if actively marketed to the Hong Kong public

Issuance of Option 1 DTTs

Any person that carries on one or more regulated activities, including the issuer of Option 1 DTTs will trigger a licensing requirement under the new licensing regime proposed by the HK Stablecoin Conclusion. The fact that Option 1 DTTs have both unrealised DTT and confirmed DTT should generally not make a difference to the analysis.

Subject to the facts and circumstances, on the basis that the issuer will not be giving an undertaking (whether express or implied) to use Option 1 DTTs in any manner described above, Option 1 DTTs are unlikely to fall within the definition of stored value facility under the PSSVFO.

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25. Active marketing is an offence under Section 115 of the SFO. It provides that any person, either by itself or through another person on its behalf, actively markets services which if provided in Hong Kong will constitute a regulated activity to the public in Hong Kong will need to be licensed. In practice, the SFC will not grant a licence under Section 115 of the SFO. Please refer to this FAQ for further explanation on active marketing.

Issuance of Option 3 DTTs

The regulatory position for Option 3 DTTs is different from Option 1 DTTs and Option 2 DTTs. This is because pursuant to the HK Stablecoin Conclusion, it will not be possible to launch stablecoins backed by a guarantee. The HK Stablecoin Conclusion provides that the value of the reserve assets of a stablecoin arrangement must meet the value of the outstanding stablecoins at all times, and the reserve assets need to be of high quality and high liquidity, such that stablecoin holders should be able to redeem the stablecoins into the referenced fiat currency at par within a reasonable period. It is therefore unlikely that the HKMA will approve a stablecoin backed by a guarantee after the licensing requirement comes into force.

If Option 3 DTTs fall outside the definition of stablecoins, then one possible regulatory characterisation is that it is a "debenture". The term "debenture" is defined in the Securities and Futures Ordinance (SFO) as including "debenture stocks, bonds and other debt securities of a corporation, whether constituting a charge on the assets of the corporation". Given the holders of Option 3 DTTs can present the Option 3 DTTs and request the issuer to redeem these Option 3 DTTs, Option 3 DTTs bear the same characteristics as a "debenture".

"Debenture" also falls within the definition of "securities" under the SFO. Accordingly, any person who carries on a business, or holds itself out as carrying on a business in Hong Kong will need to be licensed to deal in securities (Type 1). In addition, any person either by itself offshore or by someone on its behalf which actively markets Option 3 DTTs to the Hong Kong public will also need to be licensed but in practice, the SFC will not grant a licence to an offshore entity.

Other Activities in Relation to DTTs

Since the DTTs are mostly likely characterised as virtual assets, there are other licensing requirements under the AMLO that may apply to related activities/services.

For instance, the DTT platform operator may also be subject to licensing requirements under the AMLO if such activities constitute the carrying on of a business of operating a virtual exchange.

Other activities/services relating to the DTTs can also be subject to licensing requirements under the AMLO, for example, depending on the transaction flow, relevant entities may be providing a remittance service, which is defined as "a service of one or more of the following that is operated in Hong Kong as a business (a) sending, or arranging for the sending of, money to a place outside Hong Kong; (b) receiving, or arranging for the receipt of, money from a place outside Hong Kong; (c) arranging for the receipt of money in a place outside Hong Kong".

10. Project Participants

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