DeFi:
The new frontier of finance

Key trends banks in Asia Pacific should be watching

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We are living in the early days of a paradigm shift to decentralisation

As the rise of digital technology continues to transform every industry, one of the emerging shifts is a move away from centralised systems to distributed architectures with more control at the edges.

A simple yet tangible example is the pandemic-induced shift to remote work[1]. The infrastructure required to support remote work had to be quickly put in place. Technologies such as cloud computing, cybersecurity software, and project management and collaboration tools enabled the mass transition to work-from-home.

Similarly, the rise of mobile technology, social networks and marketplace platforms has enabled more robust peer-to-peer and buyer-to-seller connections. Coupled with distributed ledger technologies such as blockchain and smart contracts, the decentralisation of finance is now possible. Decentralised finance, or DeFi, is a drive towards building an open-sourced financial system where financial products and services are offered on public decentralised blockchain networks.

This paper provides an overview of DeFi, three key trends financial institutions should be watching, and how Visa and our partners might capture the opportunities presented by this new frontier of finance.

1 World Economic Forum, Oct 2021

DeFi and Web 3.0

> **Web 3.0 is the next iteration of the internet that hosts decentralised technologies.**

It is a decentralised online ecosystem built on blockchain technology that aims to give users greater control of their data. Web 3.0 employs the use of decentralised computer networks, distributed applications, and smart contracts to reduce reliance on third party entities who own user data, thereby giving users more control over how and where their data is used.

While DeFi predates the term Web 3.0, the growth of both has been closely correlated due to the use of similar technologies. For instance, by leveraging blockchain and smart contracts, both DeFi and Web 3.0 employ decentralised economic systems and governance structures that are executed through tokens. As their development continues, DeFi will likely continue to be a building block driving the creation and growth of economies in Web 3.0.

	Web 1.0 "Static Web"	Web 2.0 "Social Web"	Web 3.0 "Semantic Web"
What it is	**Global library of static content** One-way static library for businesses to broadcast their content – users could only search for information and read it.	**'Web as a platform' model** The version of the internet that most of us know today – a platform-led mobile experience driven by user generated content. Social networks and platforms enable users to create and share content.	**Internet with no/fewer central intermediaries** Users own their data, and the web processes content in a humanlike and semantic manner.
Key characteristics	› Static pages › Read-only › One-way flows › Centralised ownership	› Dynamic content › Read and write › Two-way flows › Centralised ownership	› End-user empowerment › Read, write, and execute › Multi-way flows › Decentralised architecture
Content	Static websites	Blogs, social networks, web apps	Smart apps
Technology	+ Hardware + Webpages	+ Internet of things + Big data + Cloud computing	+ Blockchain + AI/ML + Smart contract + Decentralised finance + Digital currency + NFT

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Decentralised Finance (DeFi)

Innovations in the financial system

Some form of a financial system has underpinned economies since civilisation moved to agrarian societies and began trading goods. At its core, it enables resources to move from where they are in surplus to where they are needed, matching savers with borrowers, and offering protection from risk. Trust is integral to a functioning financial system as it provides a guarantee that goods and payment will be fulfilled as agreed upon.

For most of history, a centralised financial system has been the best way to build and maintain trust. Guided by rules and regulations, formal institutions instilled greater confidence and enabled more efficient ways to operate than individual peer-to-peer connections. Users trust intermediaries to provide assurance that deposited assets are safeguarded, lenders will earn a return on their assets, sellers will get paid, and buyers have the right to seek recourse from sellers.

However, technological advancements are now opening up new possibilities for the financial system.

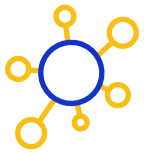
Platforms and mobile technology have enabled significantly greater and more robust peer-to-peer connections.

Blockchain technology and programmable money provide digital ledgers that allow trust to be established through the consensus of multiple users verifying transactions.

When these developments are applied to financial services, the shift towards decentralised finance begins.

Introduction to decentralised finance

Decentralised finance, or DeFi, is a drive towards building an open-sourced financial system where financial products and services are offered on public decentralised blockchain networks.

Centralised network   Decentralised network

While centralised entities provide services like liquidity, asset management, and underwriting in traditional finance, bodies of code called smart contracts govern financial systems and processes in DeFi. DeFi applications strive to fulfil the services of traditional finance, but in a **permissionless** (anyone with an internet connection can participate), **automated** (outcomes are self-executed upon meeting conditions) and **transparent** (publicly available) manner.

Rooted in blockchain technology, DeFi protocols originated on the Ethereum network, which embraces programmability at its core. The network enabled autonomy through smart contracts, or codes programmed on the blockchain that can carry out, control, and document relevant actions according to predefined terms and rules. By writing and deploying smart contracts on-chain, any developer can create decentralised applications (dApps) to provide automated financial services where rules and conditions are self-executed and delivery is guaranteed by the network.

Currently, a major drawback of the Ethereum blockchain is the high gas fees (cost to perform operations on the network) due to high demand for transactions relative to its limited throughput. To alleviate this and curate a more suitable environment for mainstream DeFi adoption, alternative layer 1 blockchain networks (e.g. Solana, Avalanche) and layer 2 solutions (e.g. Arbitrum, Optimism) have emerged to enable lower cost, faster transactions.

As alternative networks and solutions gain traction, these options are likely to become new innovation grounds for DeFi services.

Decentralised applications

Current services offered by DeFi protocols largely focus on replicating existing financial service offerings, including but not limited to lending, borrowing, exchanging, insuring, and pricing digital assets.

Lending and borrowing
Permit peer-to-peer loans in an automated and permissionless way
E.g. Aave

Trading
Enable peer-to-peer cryptocurrency trades on decentralised exchanges
E.g. Uniswap

Derivatives
Create synthetic contracts whose values are derived from the performance of other assets
E.g. Synthetix

Insurance
Provide coverage to protect against deposit loss and smart contract failures
E.g. Nexus Mutual

Stablecoins
Create blockchain-based digital currencies that peg their value to underlying assets in order to maintain price stability
E.g. MakerDao-Dai

Lending and borrowing

In traditional finance, consumers typically borrow from centralised and regulated entities such as financial institutions and governments.

In DeFi, lending is conducted in a peer-to-peer fashion where loans are obtained from a collection of funds locked in a smart contract known as a liquidity pool.

This pool is funded by liquidity providers who deposit tokens into the pool to earn interest. As DeFi is permissionless, anyone can act as a liquidity provider and interest rates are driven by asset supply. When asset supply is high, the interest rate is low to entice borrowing, and inversely, when asset supply is low, the rate is high to entice liquidity providers to deposit more capital.

Presently, most DeFi loans are over-collateralised, where deposits are valued more than the actual loans. As crypto assets are highly volatile, this mechanism is used as a risk mitigation tool to prevent loan defaults. Borrowers tend to deposit more volatile assets like Bitcoin and Ether as collateral to borrow more stable assets like stablecoins. However, new types of loans are beginning to emerge. For instance, flash loans are hyper short-term loans that allow users to borrow funds of any amount without collateral, provided they return the amount back in the same transaction. Enabled by smart contracts, this lending option is not available in traditional finance and is often used for arbitrage opportunities by exploiting price discrepancies of a token in two separate pools.

Some examples of DeFi lending protocols are Aave, MakerDAO, and Compound. In particular, Aave is an Ethereum-based non-custodial lending platform that has over $13 billion locked in the protocol as of April 2022[2]. In addition to its permissionless platform, Aave is also attempting to drive more institutional participation in DeFi by launching Aave Arc, a separate deployment leveraging a permissioned liquidity pool where KYC checks are required, enhancing security and visibility in the lending protocol.

2 Defi Llama, Apr 1 2022

Trading

The majority of crypto trading today takes place on centralised exchanges governed by a single intermediary (e.g. Coinbase or Binance).

While centralised exchanges typically employ an order book model to facilitate trade by matching interested buyers to sellers, decentralised exchanges (DEX) leverage a different model with automated market makers (AMM) at its core. An AMM uses liquidity pools to instantly and dynamically fulfil orders without the need of an intermediary to facilitate the trade or open orders from active buyers and sellers.

This enables traders to trade against the pool on demand, in real-time.

Liquidity pools in DEXs are most commonly funded by liquidity providers who deposit the equivalent value of two tokens in the pool. In return, traders pay a fee to the pool that is then distributed to liquidity providers based on their share of the pool. The price of assets is determined by the ratio of available tokens in the pool and the underlying algorithm, though it's often augmented with external price feeds (e.g. oracles).

> **DEXs are quickly gaining traction as more than $1 trillion was traded in 2021, marking an over 800% increase from $115 billion in 2020[3].**

Some examples of DEXs are Uniswap, PancakeSwap, and Curve. For instance, Uniswap is one of the first AMMs to use liquidity pools to facilitate crypto trading, and as of April 2022, has a total value of $7 billion locked on the platform[4].

Other DeFi use cases

Stablecoins are blockchain-based digital currencies that peg their value to underlying assets in order to maintain price stability. Intended to reduce volatility of cryptocurrencies, they employ different mechanisms to maintain stable values; many are backed by an underlying asset (e.g. fiat currency, commodity, cryptocurrency), but some may use algorithms and smart contracts to strive for stability. For instance, Dai, a decentralised stablecoin created by MakerDAO, is backed by collateral assets deposited into the Maker Protocol. Stablecoins are increasingly being used for low-cost cross border remittance payments and new payment use cases such as drip style salary disbursements.

Derivatives are synthetic contracts whose values are derived from the performance of other assets. DeFi derivatives allow users to interact with real-world assets (e.g. fiat currencies, bonds, commodities, stock prices) and cryptocurrencies to hedge price risks and make speculative investments. Synthetix is currently the largest derivatives protocol with over $1 billion of assets locked on the platform[5].

With more than $230 billion of assets locked in DeFi protocols[6], hacks and smart contract failures can result in huge capital losses. **DeFi insurance,** while still in nascent stages, aims to provide coverage against such failures by leveraging a shared-risk approach. Rather than centralised insurance companies providing coverage, DeFi insurance models distribute the risk amongst coverage suppliers, who earn yield over the capital they deposit into the pool. One of the largest insurance protocols with over $510 million of assets locked is Nexus Mutual[7], which began by offering smart contract covers and have since expanded to provide insurance for centralised exchange exploitations.

3 The Block, Dec 2021
4 Defi Llama Uniswap, Apr 1 2022
5 Defi Llama Synthetix, Apr 1 2022
6 Blockworks, Apr 2022
7 Defi Llama Nexus Mutual, Apr 1 2022

The DeFi stack

There are many ways to characterise the roles in DeFi, and the combinations implemented tend to vary.

Largely speaking, some common layers in the DeFi stack include the wallets, aggregators, DeFi primitives, oracles and transaction layers. The space is constantly evolving, so categorisations and projects mentioned may change over time.

Wallets

Enhance user experience in DeFi by focusing on front-end design, support, and usability. For instance, Metamask is a non-custodial wallet that connects to a range of DeFi applications.

Aggregators

Combine primitives or aggregate multiple platforms to offer an array of banking functions. Aggregators are frequently used to obtain higher yields or better exchange rates.

DeFi Primitives

The building blocks or Legos of DeFi applications. Some key primitives are lending, trading, derivatives, and asset management. Primitives can be used independently or in conjunction with one another and can also leverage on other layers in the stack.

Oracles

Provide real-world, off-chain data to be put on-chain. For instance, Chainlink is an oracle that offers market and data feeds to power dApps such as Aave, Compound, and Synthetix.

Transaction Layers

The blockchain networks that process DeFi transactions on-chain. These include layer 1 transaction layers (e.g. Ethereum, Solana, Polkadot) and layer 2 solutions (e.g. Arbitrum, Optimum) that scale up layer 1's.

Asia Pacific momentum

While DeFi is still in its infancy, it is growing quickly.

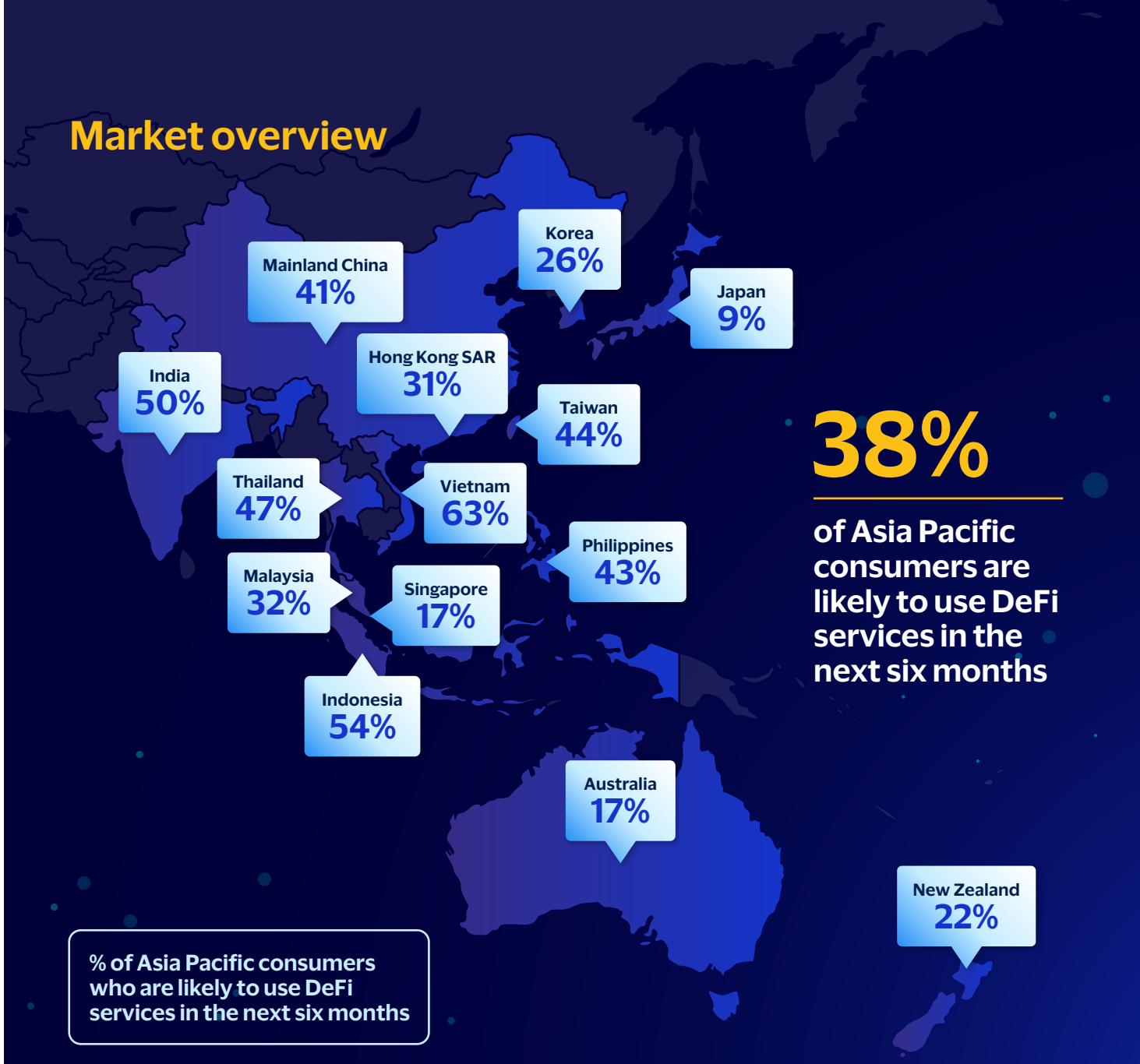
> **The total value of digital assets locked into DeFi services increased from less than $1 billion in 2019 to over $15 billion at the end of 2020[8], and has surpassed $230 billion in April 2022[9].**

Currently, Ethereum remains the largest smart contract enabled public blockchain, though new blockchains such as Solana and Avalanche are rapidly gaining traction[10]. As DeFi development continues across Ethereum and alternative blockchains, new innovations are expected to emerge to provide financial services in an open-sourced manner on the blockchain.

Consumers are beginning to experiment with DeFi services, with 21% of Asia Pacific consumers stating they have used DeFi services before. With this emerging traction, there are large opportunities for innovation and education, as 38% of consumers expressed interest to try DeFi services in the next six months, and 31% of consumers want additional information to learn about the space. Countries such as Vietnam (63%), Indonesia (54%), and India (50%) will likely spearhead DeFi adoption as these markets had the most consumers expressing interest to try DeFi in the next six months[11].

8 DeFi Beyond the Hype, Wharton, May 2021
9 Bitcoin.com, Apr 2022
10 Statistica, Apr 2022
11 Visa and YouGov, May 2022

Market overview



38%

of Asia Pacific consumers are likely to use DeFi services in the next six months

% of Asia Pacific consumers who are likely to use DeFi services in the next six months

Visa and YouGov research on the usage and interest of DeFi services across Asia Pacific, May 2022

Risks and challenges

As DeFi develops, the risk in the space expands as well.

Security risk is often the first to be discussed.

In 2021, over $10.5 billion was lost due to fraud and theft, a 600% increase from the year before[12].

As more value is locked in smart contracts, DeFi becomes an increasingly lucrative space for financial attacks. Hackers tend to exploit the vulnerabilities within smart contract algorithms to launch large-scale and irreversible attacks. For example, over $320 million was lost in the February 2022 Wormhole (bridge between the Ethereum and Solana blockchain) hack as the attacker exploited a security flaw in the smart contract to create wrapped tokens without any deposits[13]. There are also risks associated with losses that result from failed economic structures of some protocols. For instance, the Terra Luna crash that resulted in $42 billion in losses[14] was not the result of an attack on any smart contracts or DeFi application, but rather an implosion caused by the depegging of the algorithmic stablecoin TerraUSD with the cryptocurrency Luna[15].

The decentralised nature and lack of regulations in DeFi services also generate concerns around consumer protection and AML risks.

While centralised entities in traditional finance assume liability risks, protection of assets, and KYC checks, DeFi's decentralised and pseudonymous nature leaves users with few contingency plans if they experience fraud. To establish trust in the system's algorithms, DeFi will need more stringent frameworks to safeguard consumers.

Some additional risks to consider are:

- **High volatility of crypto assets**
- **Source and consistency of liquidity**
- **Governance structure of DeFi platforms**
- **Reliance on externally-sourced data (oracles)**
- **Unstable financial incentives within protocols**

12 Business Wire, Nov 2021
13 CNBC, Feb 2022
14 Elliptic, May 2022
15 Business 2 Community, May 2022

3

Key trends for the future of DeFi

As Visa evaluates the opportunities DeFi presents, we see three key trends that financial institutions in Asia Pacific should be watching.

#1 The acceleration of decentralised services

DeFi's initial growth has been driven by early adopters, mainly individuals with access to the required technological means and knowledge.

There is potential for the DeFi user base to expand to other groups, including currently underbanked individuals, as use cases continue to emerge and evolve, and as the user experience becomes more seamless.

Service providers in this dynamic ecosystem will include Web 3.0-native players, traditional business adopters and a diverse pool of entrepreneurial individuals. However, instead of a parallel relationship between traditional finance and DeFi systems, we anticipate the creation of integrated solutions that could be available alongside traditional product offerings (e.g. investment portfolios).

As Web 3.0 continues to scale, there will be increasing expectations on security, user experience and interoperability for the infrastructure and tools that enable Web 3.0 and DeFi. While DeFi provides an exciting new backend for financial innovation, the current iteration is difficult for non-crypto-native users to navigate and lacks consumer protections. DeFi on and off-ramps will also need to be streamlined to allow consumers to easily interact and transact across on-chain and off-chain platforms. These gaps present opportunities for financial institutions and regulators to participate. Traditional financial players can help bridge these gaps by providing user-friendly experiences and conducting KYC and AML checks to enable safe and secure entry points to DeFi services.

Moving forward,

as DeFi use cases are developed and consolidated, the integration of end-to-end solutions will be possible for financial institutions.

For example, financial institutions may be able to provide asset securitisation and financing for institutional clients within DeFi protocols through valuated and tokenised tangible assets and wealth management services. Additionally, traditional business adopters could provide adapted services for Web 3.0-native organisations and entrepreneurs to strengthen their own product offerings, such as insurance underwriting for DeFi protocols, or risk management and compliance as a service.

#2 Redefining financial business models

With emerging DeFi use cases, business models for financial services will likely evolve to meet consumer expectations for lower fees and higher yield. While the overall impact of these new models remains to be evaluated, financial players can expect to see both benefits and challenges to accompany the shift.

As distributed ledger technology develops, new business models will place stronger emphasis on simplifying and automating processes. Smart contracts will enable ecosystem players to streamline operations and easily scale services to create cost-efficient and more flexible business models. This will demand more engineering talent than traditional operations. New types of lending models using DeFi could impact lending margins, but this may be accompanied by reductions in non-performing assets due to higher collateralisation and improved liquidity ccompared to collaterals in traditional finance. Additionally, traditional players may be presented with the opportunity to earn alternative revenue streams, by providing compliance and risk-management as a service to DeFi-native players as cyberthreats remain material risks in DeFi.

Before entering the DeFi ecosystem, aspiring players will need to assess their current capabilities and potential business models to identify both strengths and gaps, along with potential Web 3.0-native partners.

The results will provide guidance on the investment required for:

Infrastructure
(e.g. establishing own nodes and/or mining facilities, choosing blockchains and bridges, structuring cybersecurity measures)

Skills
(e.g. coding, counter-hacking, UI/UX)

#3 A multi-party approach to risk management

As mentioned before, there are many risks associated with DeFi's open-source nature.

Financial institutions, being established leaders in risk management, compliance and fraud mitigation, have the opportunity to leverage their expertise to provide safe bridges for consumers to transact in DeFi. Unsurprisingly, the demand for consumer protection inflates with every incident of fraud (e.g. yield farming rug pulls), blockchain downtime (e.g. Solana outage), and stablecoin depegging (e.g. Terra Luna crash).

Traditional institutions can first focus on framing a regulatory perspective to provide guidance on fraud mitigation, AML, KYC, counterparty risk and taxation. Additionally, DeFi also opens the opportunity to strengthen risk management processes.

Financial institutions and regulators can conduct permissionless auditing through bounties and ethical hacking to incentivise the community to help identify any vulnerability or bug within a protocol, application, or smart contract.

A safe and secure ecosystem will require efforts from both traditional and DeFi players. The first to collaborate, create, and adopt these standards will likely be best positioned to capture emerging opportunities as the ecosystem continues to evolve.

4

How Visa can help

As a world leader in digital payments, Visa's mission is to connect the world through the most innovative, convenient, reliable and secure payments network, enabling individuals, businesses and economies to thrive.

We're reshaping how money moves across the globe, and that means pursuing a broad array of technologies and partnerships. In that regard, DeFi offers an exciting avenue for us to continue doing what we do best: expand our network of networks to support new forms of commerce.

Working together to shape the future of payments

We see an opportunity for our products and services to act as a bridge between our existing clients, and new clients and blockchain rails.

Our deep experience across functionalities such as engineering, product, strategy, risk and compliance means that we can collaborate with our partners and clients across a spectrum of opportunities – from understanding the key technical components of DeFi, to testing our new use cases.

We are also applying the world-class capabilities of Visa Consulting and Analytics, a global team of several hundred payments consultants and data scientists across six continents, as well as our Global Innovation Centers, staffed with design thinking experts, payments professionals and innovation leaders, to:

- **Discover:** uncover trends in DeFi and explore growth opportunities
- **Collaborate:** research, design, and test solution concepts for DeFi use cases
- **Build:** develop and pilot proof of concepts with payment engineering experts

The bridge between DeFi and traditional finance

As DeFi continues to develop, the use of digital currencies will expand, especially stablecoins and CBDCs. Enabling the ease of buying, holding, selling, and transacting in digital currencies will support participation in DeFi alongside our day-to-day interactions with money.

Buying digital currencies

We're working with wallets, exchanges and financial institutions to enable consumers to buy and transact in digital currencies with their Visa cards.

Enabling financial institutions to offer digital currency services

Visa is expanding our products and partnerships to enable financial institutions and fintechs to easily offer their customers the ability to buy, hold and sell digital currencies.

Spending in digital currencies and enabling digital currencies to be cashed out to fiat

Visa is working with more than 70 digital currency platforms and wallets to enable users to convert and spend their digital currency via Visa credentials at any of our 100 million plus merchant endpoints. In addition, we completed our first USDC settlement pilot in 2021, and are now upgrading our infrastructure to support stablecoin settlement.

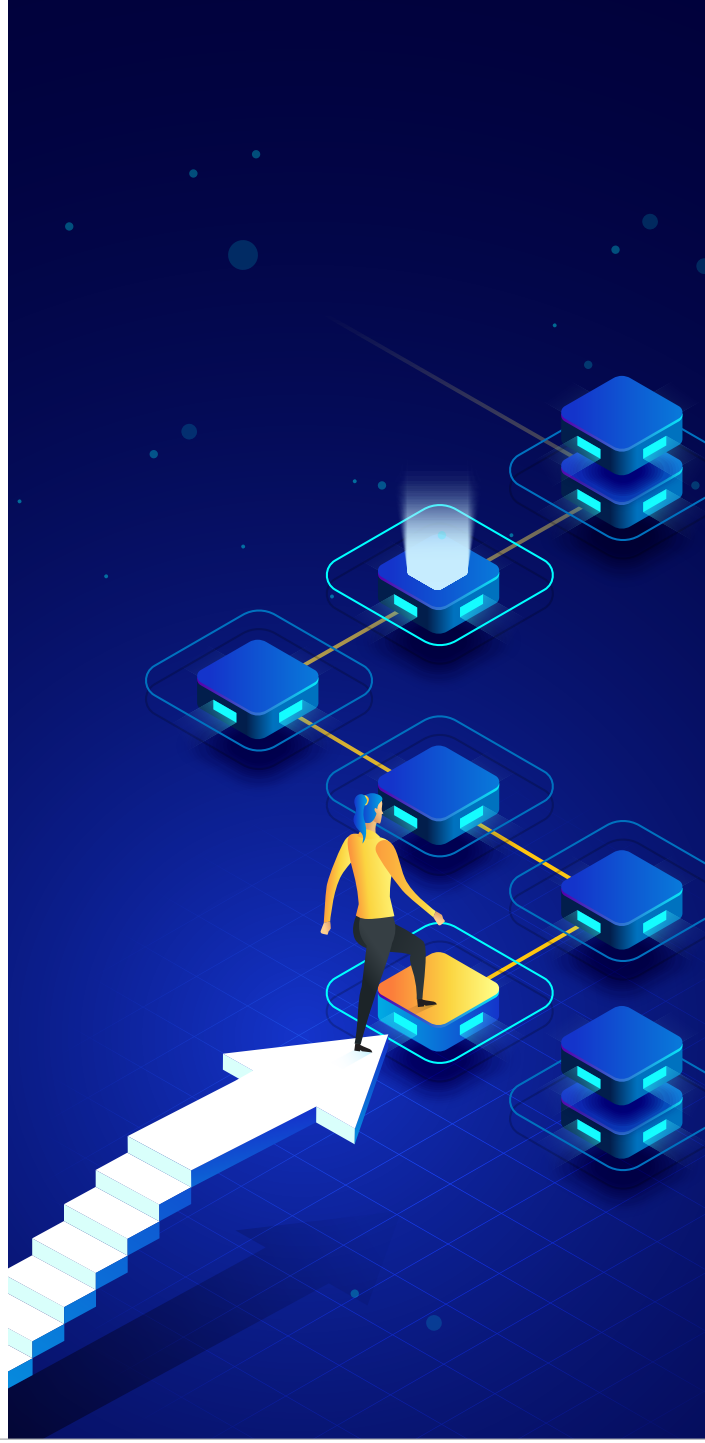
Exploring new frontiers

In the coming years, we expect the number of digital currency networks to increase, and with that, the likelihood that consumers, businesses, and merchants would transact on multiple networks, using different digital currencies.

To enable the ability to make and receive payments across different digital currencies and blockchain networks, Visa is working on a Universal Payment Channel (UPC) hub concept that would connect different blockchain networks by establishing dedicated payment channels between them. These payment channels would be created off the blockchain and leverage smart contracts to communicate back with the various blockchain networks, delivering high transaction throughput in a secure manner.

We're excited by the possibilities that new networks and technologies bring, and want to partner with financial institutions, fintechs and regulators to provide the connectivity, scale, consumer value propositions, reliability and security that is needed to support the growth of DeFi.

Let's shape the future of payments together.



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Visa and YouGov research

All figures, unless otherwise stated, are from YouGov Singapore Pte Ltd. Total sample size was 16,295 adults across 14 markets. Fieldwork was undertaken between 23rd - 30th May 2022. The survey was carried out online. The figures have been weighted and are representative of all adults (aged 18+) nationally in each of the respective markets. The survey was conducted in the following markets: Vietnam, Thailand, Singapore, Philippines, Malaysia, New Zealand, Australia, China, Indonesia, Hong Kong, India, Korea, Japan and Taiwan.