



# The Metaverse

## Opportunities and Challenges for the Financial Services Industry

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# Foreword

The rapid evolution of technology has given rise to a new digital frontier: the metaverse. Originally conceived in Neal Stephenson's science-fiction novel, *Snow Crash*, as a virtual universe inhabited by avatars that engage with one another digitally, the metaverse has become a reality. Loosely defined as a network of immersive space that integrates the physical and computer-generated virtual worlds, the metaverse presents unique and revolutionary ways to communicate, interact, and create new experiences.

As Hong Kong commits to reinforcing its position as a premier international financial centre, the Government and the financial regulators work continuously towards fostering an environment for promoting sustainable and responsible developments of the virtual asset ecosystem in Hong Kong. Against this backdrop, it is useful to better understand the opportunities and challenges presented by the metaverse and its associated technologies, thus facilitating its robust potential integration into the city's financial services industry. Expeditious iterations and improvements of the metaverse have enabled the use of such innovative applications in everyday life. Accordingly, many industry leaders, technologists, and policymakers have viewed the progression of the metaverse as an intriguing and significant milestone in the next generation of digital communications and interactions. Therefore, the impact and deployment of this new technology in the economy have raised an important question that requires careful consideration.

This report offers a novel glimpse into how the metaverse can influence the future development of the financial services industry. It first examines the fundamental elements and technological underpinnings of the metaverse. Different key components that drive the metaverse, such as the network and computing infrastructure, sensing technologies, and artificial intelligence, are addressed in relation to how the metaverse can be integrated into the financial services industry. The discussions have a particular focus on compliance, supervision, and safeguarding the financial system as a whole.

To gain a deeper understanding of metaverse applications by financial institutions, the Hong Kong Institute for Monetary and Financial Research

commissioned a survey and interviews of market participants across different sectors to assess the current landscape and recent developments of the metaverse from firms' perspective. The report analyses the survey results to identify obstacles to broader metaverse employment in the financial services industry, such as data privacy concerns, technological barriers, and consumer protection, while examining the technology's future prospects. Furthermore, this report reviews the role of regulations amid the evolving metaverse developments, and offers an overview of the relevant regulatory initiatives by various jurisdictions in recent years.

The report also explores the potential factors that may foster the development of the metaverse in Hong Kong's financial services industry, drawing on the responses of market participants and international experiences. Some key highlights underscore the importance of nurturing talents and fostering innovative entrepreneurship, public-private collaborations, and the necessity to promote continuous progress of the underlying technologies and infrastructure underlying the metaverse. A strategy for increasing knowledge and awareness about the metaverse is needed to pave the road for greater development, adoption and integration of the metaverse.

As the development of frontier technologies and innovation is at the forefront of Hong Kong's strategic development, we hope that the contents of this report will offer valuable insights in this regard. The research contributes to a rich discourse about metaverse adoption and its relevant technologies specific to the financial services industry. These considerations provide an exciting avenue for future dialogue that will help guide the formulation of prospective metaverse policies and developments.

## Mr Enoch Fung

Chief Executive Officer  
Hong Kong Academy of Finance

Executive Director  
Hong Kong Institute for Monetary and Financial Research

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# Executive Summary

As a new paradigm interconnecting the physical and virtual realms, the metaverse brings the prospect of reshaping the financial services landscape. **‘The metaverse’ broadly refers to a network of immersive virtual worlds, created using a range of frontier technologies to mirror or transform real-world experiences.** Regulators and policymakers across the globe are increasingly conscious of this technology, recognising the importance of achieving a balance between harnessing the potential of the metaverse and effectively managing its challenges to ensure its healthy development in the financial services industry.

This report provides an overview of the metaverse and discusses the broad implications of its development for the financial services industry. Based on a survey and interviews commissioned by the Hong Kong Institute for Monetary and Financial Research (HKIMR) from May to July 2023, the report describes local financial institutions’ engagement and future prospects regarding the metaverse and explores some opportunities and challenges that it presents. The report also explores market participants’ views on prospects regarding the metaverse in Hong Kong, the metaverse talent landscape, and strategies to promote the development of the metaverse in financial services. After reviewing the regulatory initiatives on the development of the metaverse and its related fields internationally and in Hong Kong, the report concludes by offering considerations for the metaverse’s future development into the city’s financial services industry.

**The popular vision for the metaverse is characterised by immersiveness, persistency, heterogeneity, and interoperability. A range of enabling technologies, including network infrastructure, computing infrastructure, sensing**

**technologies, artificial intelligence technologies, and distributed ledger technologies, underpin the construction of the metaverse** to foster seamless and creative interactions, as well as facilitate commercial and financial activities. The development of the metaverse may bring new business opportunities to the financial services industry by driving demand for virtual financial services and enhancing business operations. It can further promote financial literacy through interactive education experiences. However, the metaverse may expose the financial services industry to new risks or magnify existing ones in the digital age. These developments highlight the important role played by regulators in monitoring the responsible development of the metaverse, ensuring financial stability whilst encouraging innovation in the financial services industry.

**Hong Kong’s financial institutions have shown a notable interest in the metaverse but displayed a moderate level of engagement in this field.**

According to our survey’s findings, over 90% of the financial institutions demonstrated a certain degree of knowledge of the metaverse, and 65% reported involvement in the metaverse, ranging from the discussion and planning stage to the implementation of metaverse adoption. Current metaverse applications have generally encompassed marketing and promotion, internal use, talent recruitment, and workplace social events. This finding indicates that **local financial institutions are inclined to leverage the metaverse as an additional channel to promote interactions with the public, customers, and employees.** Nonetheless, the surveyed financial institutions expressed less enthusiasm towards certain applications of the metaverse as an investment tool, sales channel, and revenue stream and the provision of metaverse-specific products and services. These suggest that **the**

**transition to a comprehensive metaverse ecosystem with mature use cases and frequent business transactions among customers will be important factors** driving increased metaverse adoption in the financial services industry.

The future prospects of metaverse adoption are closely linked to the advancement in relevant enabling technologies. **Network technology, display hardware, computing technology, and blockchain technology were highlighted by market participants as crucial components** that contribute to the growth of the metaverse, thus expanding the scope of metaverse applications within the financial services industry. In addition, 85% of the market participants anticipated that the development of the metaverse would have implications for the financial services industry to some degree.

The surveyed financial institutions perceived that metaverse adoption could offer a range of benefits to the financial services industry. The metaverse can **facilitate more engaging branding activities and cultivate better connections with customers**. It also can **provide unique service offerings and serve as a distinct marketing channel**, delivering tailored customer experiences. The metaverse can further benefit financial institutions through the **expansion of customer bases and improvements in operational efficiency**. Nonetheless, this technology also poses potential challenges that need to be effectively addressed or mitigated. The **major challenges** faced by financial institutions **include data privacy issues, limited platform functionalities, and the scarcity of talents and expertise. Limited user adoption and interest, high development and maintenance costs, and difficulties in integrating the metaverse with existing operations and systems** were also cited as relevant impediments to metaverse integration.

The analysis of the metaverse talent landscape in Hong Kong revealed differences between financial institutions and metaverse service providers. Financial institutions displayed a relatively low level of involvement in metaverse talent acquisition. In contrast, the majority of metaverse service providers indicated that they had sufficient talents with specialised skill sets related to the metaverse. **The metaverse service providers also placed emphasis on acquiring a broader range of talents with metaverse-specific skills within Hong Kong and highlighted that talents with expertise in blockchain technology were most sought after by the employers.** As nurturing talents is essential in fostering the increased adoption and integration of the metaverse, regulators and policymakers can play a vital role in addressing the relevant challenges, as well as promoting the sustainable development of talents and skills in the local metaverse industry.

**Appropriate regulatory oversight of the metaverse is useful to ensure market integrity and may instil consumer trust whilst advancing metaverse adoption in the finance services industry.** Several key aspects of the metaverse that can benefit from enhanced regulation and governance were identified by the market participants, including **cybersecurity and data privacy, financial transactions, and user safety and wellbeing**. The market participants also emphasised the need for **intellectual property rights, content moderation, and a code of conduct** to ensure the responsible and secure use of the metaverse.

Regulators and policymakers in some jurisdictions have taken steps to develop supervisory guidance and regulatory measures to oversee and promote the development of the metaverse. In particular, they have placed emphases on four key areas, namely **user safety and wellbeing, intellectual property**

**rights, cybersecurity and data privacy, and financial transactions.** In Hong Kong, although there are no specific regulatory initiatives targeting the metaverse, **current regulatory efforts related to virtual asset-related activities** would also play a crucial role within the metaverse ecosystem in promoting responsible and sustainable development of the digital landscape in the city.

Hong Kong maintains unique characteristics to navigate the development of the metaverse in the financial services industry. In fact, **market participants in the survey considered the defined legal and regulatory framework, business-friendly environment, and robust financial infrastructure and network as key competitive advantages possessed by Hong Kong.** The city's strategic location, connectivity, bilingual environment, and trading system are additional strengths that render it attractive to metaverse stakeholders. Hong Kong, as a premier global business and financial hub, provides an ideal environment to attract and sustain talents and businesses, thereby fostering the healthy development of the metaverse.

Drawing on the market participants' views and the experiences of other jurisdictions, this report proposes **some considerations** intended to ensure a sound and orderly integration of the metaverse into the financial services industry in Hong Kong. These considerations include **nurturing talents and fostering innovative entrepreneurship, and supporting technology and digital infrastructure developments. Increasing knowledge about the metaverse and fostering collaborations among stakeholders and across jurisdictions** will also be essential to establish consistency and interconnectivity within the metaverse ecosystem. Other considerations include **adapting the relevant regulatory framework to keep in view of the latest developments** and **establishing well-defined corporate governance structures for metaverse adoption within financial institutions.** These considerations are important to safeguard consumers and promote robust innovation while ensuring financial stability in the adoption of metaverse applications within the financial services industry.

# Chapter 1

## An Introduction to the Metaverse

### Definition, key components, and potential implications for the financial services industry

#### HIGHLIGHTS:

- The metaverse broadly consists of a network of virtual worlds based on a range of enabling technologies. The popular vision for the metaverse is characterised by key features such as immersiveness, persistency, heterogeneity, and interoperability. This technology holds the potential to transform user experiences and revolutionise various industries, including the financial services industry.
- The metaverse relies on a variety of enabling technologies to interconnect physical and virtual realms, where users, through virtual avatars, can experience various activities such as the exchange of virtual goods and services in the virtual environment. These enabling technologies may include network infrastructure, computing infrastructure, sensing technologies, artificial intelligence (AI) technologies, and distributed ledger technologies (DLTs). As the internet continues to evolve, the popularity of the topic surrounding the future of Web 3.0 and the associated metaverse vision has grown.
- In recent years, the development of the metaverse has garnered interest within the financial services industry. However, as the development of the metaverse is still in the preliminary stages, its implications for the financial services industry remain to be seen.
- The development of the metaverse may provide additional business opportunities for the financial services industry, such as increased demand for virtual financial services and the enhancement of existing business operations. However, the metaverse may also introduce new risks or exacerbate existing risks faced by financial institutions.

The metaverse is widely regarded as a new paradigm that seeks to create a seamless 3D virtual environment that mirrors or transforms real-world experiences. Although the initial development of the metaverse predominantly focused on gaming activities, the set of use cases is expanding in other fields, such as social media, retail, entertainment, education, and financial services. As such, the metaverse has the potential to revolutionise various industries, including the financial services industry, and offer new opportunities for innovation and growth. This chapter provides an overview of the metaverse, its key characteristics and components, and discusses its broad implications for the financial services industry.

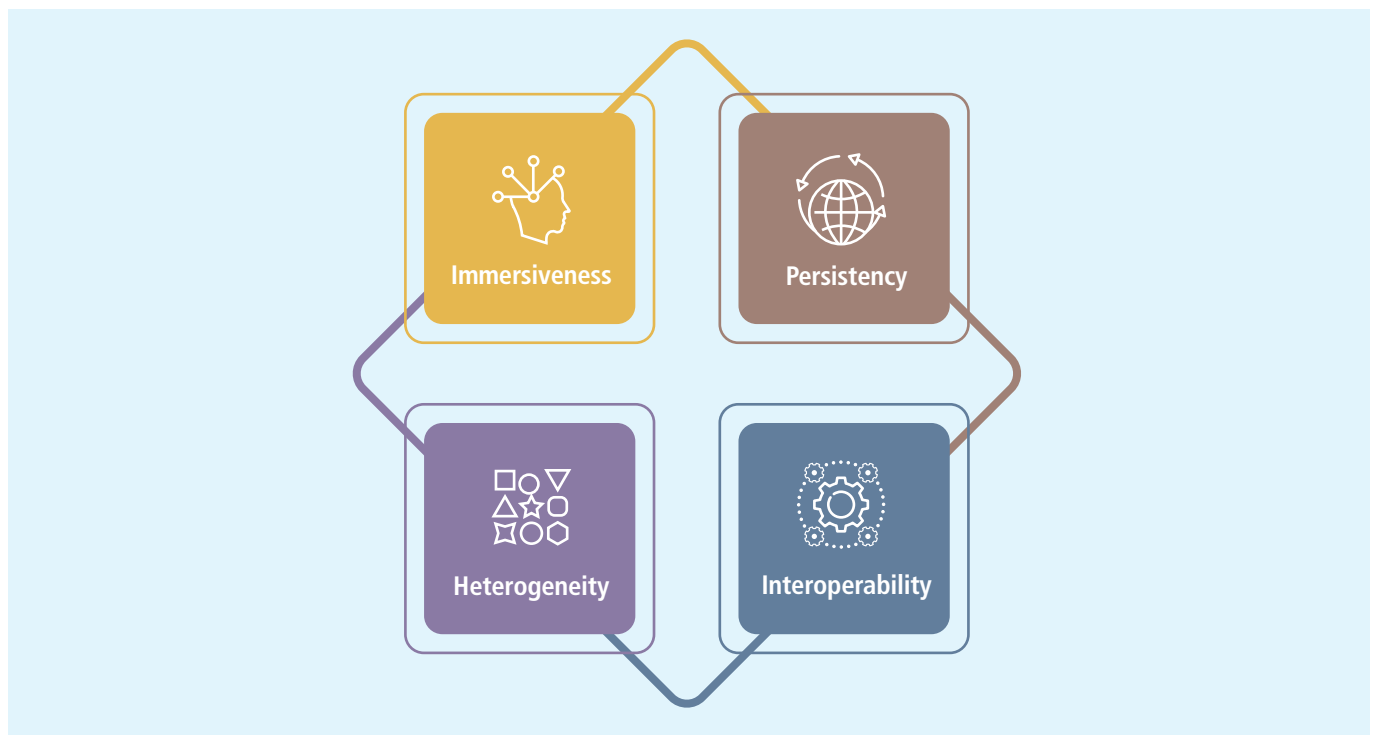
### 1.1. WHAT IS THE METAVERSE?

The term ‘metaverse’ originated in 1992 in Neal Stephenson’s science-fiction novel, *Snow Crash*.

Stephenson used this term to describe a computer-generated virtual universe populated with avatars.<sup>1</sup> Since then, movies and multiplayer online games have increasingly used varying perceptions of the metaverse, but none of them have provided a complete vision of the metaverse.

As the development of the ‘metaverse’ is still in a relatively early phase, there is currently no common definition of ‘the metaverse’. The broad consensus is that the metaverse is a network of immersive virtual worlds,<sup>2</sup> created using a range of frontier technologies to empower the increasing integration of the virtual and physical environments. The popular vision for the metaverse is characterised by key features including immersiveness, persistency, heterogeneity, and interoperability (Chart 1.1).

**Chart 1.1: Distinctive features of the metaverse**



Source: HKIMR staff compilation.

<sup>1</sup> Stephenson (1992).

<sup>2</sup> ‘Virtual world’ refers to a computer-simulated environment, which is also known as a ‘virtual platform’.

**The metaverse is a network of immersive virtual worlds, created using a range of frontier technologies to empower the increasing integration of the virtual and physical environments.**

### Immersiveness

‘Immersiveness in the metaverse’ refers to the user’s level of engagement and absorption within the virtual world. Through the real-time transmission of multisensory information between physical and virtual realms, users can immerse themselves in the metaverse. They can perceive objects and surroundings in the virtual space through their senses, creating a heightened feeling of presence.

Users’ facial expressions and physical gestures can be mapped onto their corresponding virtual avatars,<sup>3</sup> facilitating real-time communication and interaction with other users and the virtual environment. This dynamic interplay between the physical and virtual worlds increasingly mirrors real-world activities, enhancing the overall immersiveness of the metaverse experience.

### Persistency

The ‘persistency of the metaverse’ refers to the concept that the virtual environment within the metaverse remains consistent and continuous over time. It implies that the virtual world persists even when individual users log off or leave the computer-simulated environment. This feature provides a sense of synchronisation and progression within the metaverse.

In a persistent metaverse, users’ creations and contributions persist over time, allowing subsequent

users to experience and interact with them. This feature enables the virtual environment to evolve and develop, reflecting the collective efforts and interactions of its users. The metaverse thus becomes a dynamic, ever-changing space that is shaped by its users.

### Heterogeneity

‘Heterogeneity in the metaverse’ refers to the diversity and variety of virtual worlds, platform characteristics,<sup>4</sup> and experiences that coexist within the metaverse ecosystem. It emphasises the existence of multiple distinct virtual environments, each offering a unique set of characteristics and purposes.

In a heterogeneous metaverse, users can select the virtual worlds that resonate most strongly with them and tailor their experiences to suit their preferences. Users can seamlessly navigate between different virtual environments, switching between diverse activities and social contexts as they see fit. These options allow users to create a personalised metaverse experience that caters for their individual needs and interests.

### Interoperability

‘Interoperability in the metaverse’ refers to the ability of various virtual worlds or platforms to seamlessly connect and interact with each other. This ability allows users to move and transact across an interconnected network of virtual platforms while retaining their virtual identities, assets, and data. For example, users can use the same avatar or items across different virtual platforms or transfer virtual currency from one platform to another.

Interoperability is essential for creating a unified and interconnected metaverse in where users can access a variety of experiences across different platforms. It fosters the development of standards, protocols, and technologies that enable seamless communication and data exchange in the metaverse.

<sup>3</sup> Virtual avatars are used in the metaverse to represent the corresponding real-life users.

<sup>4</sup> Different virtual worlds have varying software and hardware settings, as well as data transmission protocols.

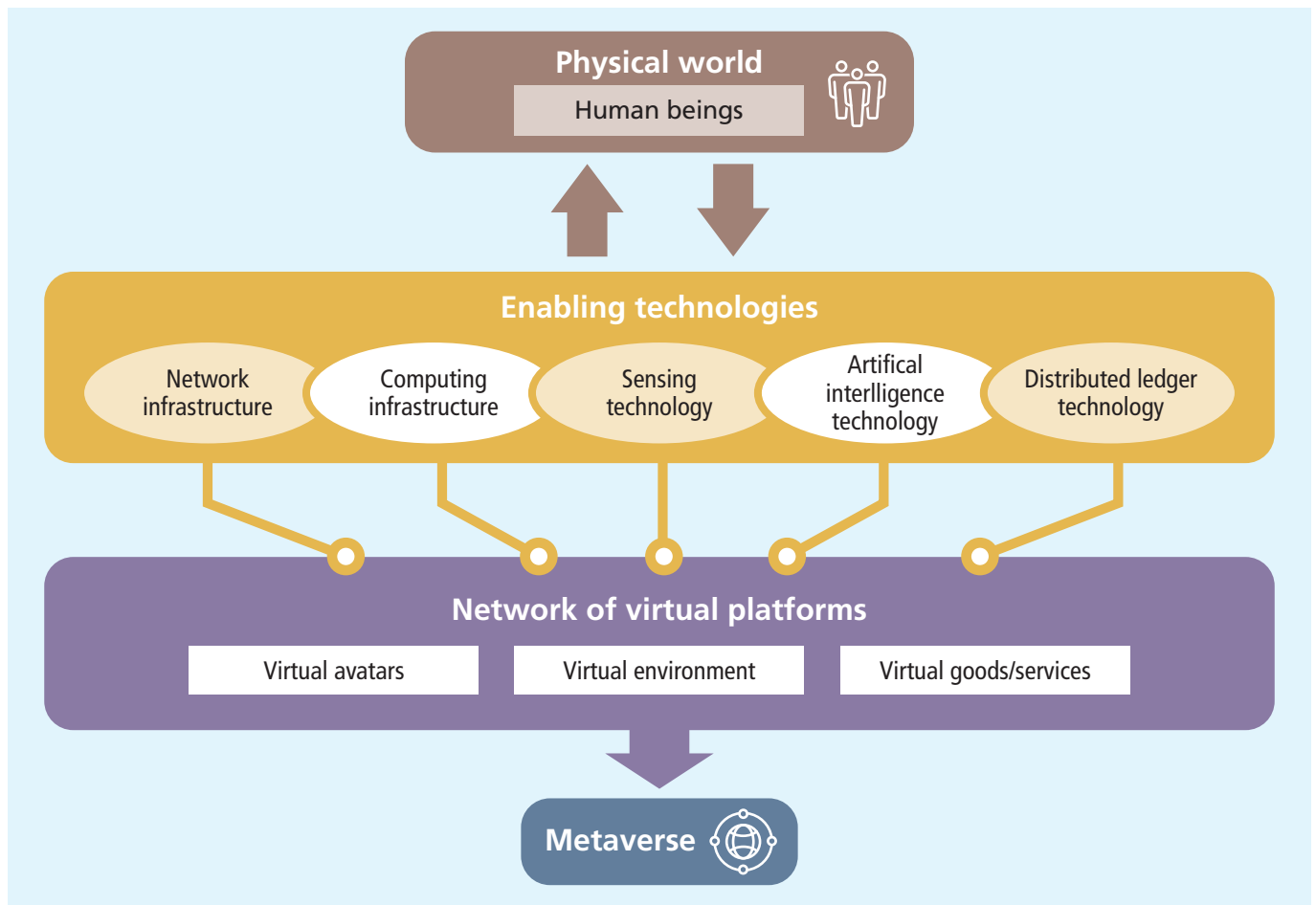
## 1.2. KEY COMPONENTS OF THE METAVERSE

As a network that intertwines the physical world with virtual realms, the metaverse provides users with a seamless experience of interaction and immersion. At its core, the metaverse relies on a multitude of enabling technologies such as network infrastructure, computing infrastructure, sensing technologies, AI technologies, and DLTs. Within the metaverse, users navigate the virtual landscape by embodying virtual avatars, exploring diverse virtual environments, and participating in a dynamic economy where virtual goods and services are exchanged. The metaverse encompasses a variety of virtual platforms that serve as gateways to different experiences, fostering social and economic interactions and creative expression, and facilitating commercial and financial activities (Chart 1.2).

A variety of frontier technologies underpin the current development of the metaverse, encompassing back-end infrastructures such as network infrastructure and computing infrastructure, as well as interaction engines such as sensing technologies and AI technologies. DLTs also play a significant role within the metaverse.

**The metaverse relies on a variety of enabling technologies to interconnect physical and virtual realms, where users can experience various activities in the virtual environment.**

Chart 1.2: Construction of the metaverse



Source: HKIMR staff compilation.

## Network infrastructure

Network technologies, such as 5G, 6G, the Internet of Things (IoT), and software-defined networking (SDN), can enhance communication reliability and availability in metaverse-related activities. 5G networks can support a greater network capacity with lower network latency and higher data transmission rates. 6G networks are expected to further strengthen these capacities through ultra-high data transmission rates, ultra-low network latency, and improved network coverage.<sup>5</sup> These improvements can potentially address the issue of growing network traffic within the metaverse and allow metaverse platforms to serve numerous users simultaneously.

The interconnectivity of IoT devices facilitates the real-time collection and transmission of information, which can enable seamless interactions between users and the metaverse space, thus enhancing users' immersive experience. SDN technology can empower large-scale metaverse networks by using software applications to intelligently and centrally control the network. This technology provides numerous advantages, including enhanced scalability, flexibility, and simplified network management, leading to efficient information transfer.<sup>6</sup>

## Computing infrastructure

Computing technologies are essential for processing vast amounts of data quickly and enable reliable real-time virtual interactions in conjunction with network technologies. Cloud computing is used in the metaverse

### Box 1.1: Potential solutions for metaverse computing needs

Several alternative computing technologies can potentially complement the performance of cloud computing infrastructure in a constructed metaverse. These technologies include, but are not limited to, edge computing, fog computing, and quantum computing.

#### Edge computing

- Edge computing allows real-time data processing and storage within local edge devices instead of a centralised data centre.
- This enables computing resources to be distributed closer to information sources, potentially reducing network latency and congestion within the metaverse.

#### Fog computing

- Fog computing extends the edge computing architecture by introducing an additional computing layer that separates the cloud server from edge devices.<sup>7</sup>
- This can enhance computational power and response speeds to support an expanding set of metaverse applications.

#### Quantum computing

- Quantum computing uses quantum mechanics principles to support complex data computation.
- This may resolve the data processing power limitation of the existing computing infrastructure within the metaverse.

Source: HKIMR staff compilation.

<sup>5</sup> Bin Sulaiman and Kareem (2021).

<sup>6</sup> Moorkattil (2022).

<sup>7</sup> Pandey, Shrivastava, Pathak, Pathak and Sharma (2023).

to store, process, and access data through central cloud servers, supporting data computation and virtual simulation. However, as the number of metaverse users and latency bottlenecks increase, this centralised computation infrastructure may suffer from problems such as latency issues, low graphics quality, and limited scalability. Alternative solutions such as edge computing, fog computing, and quantum computing may offer remedies to mitigate these drawbacks and thus complement the performance of cloud computing infrastructure. More details can be found in Box 1.1.

### Sensing technologies

Sensing technologies, such as extended reality (XR) technology, are considered to be essential for simulating perceptions of the virtual environment and delivering immersive user experiences in the metaverse. XR technology, which includes virtual reality (VR), augmented reality (AR), and mixed reality (MR), generally can be used in hardware devices to fully engage users in the metaverse space.

VR technology creates a virtual environment independent from the real world, which users can experience through visual and auditory senses. AR technology superimposes virtual elements, such as virtual objects and characters, on a real-life environment, enhancing metaverse users' feeling of presence. MR technology builds on the features of AR technology to create interactive virtual elements.<sup>8</sup> Each of these technologies thus offers a slightly different way to engage with the metaverse.

### Artificial intelligence technologies

AI technologies, including computer vision, natural language processing (NLP), and machine learning, can synergise to empower interactions and content

creation within the metaverse. Computer vision can analyse and incorporate visual information from users' real-world surroundings into the construction of the virtual space. NLP can interpret and process written text and the spoken languages used by metaverse users. Machine learning, the backbone of many AI applications in the metaverse, can improve AI-generated outputs by identifying patterns in datasets.

AI technologies offer a wide range of functionalities that can shape the metaverse experience through different channels. One notable example is generative AI, which can dynamically generate new metaverse content, such as virtual environments and objects, based on user commands. In addition, the development of explainable AI<sup>9</sup> is expected to play an important role in addressing difficulties in explaining and validating AI-driven outcomes. This development may enhance the monitorability and transparency of AI applications and inspire the large-scale deployment of responsible AI models within metaverse-related activities.<sup>10</sup>

### Distributed ledger technologies

A distributed ledger is a record of information, or database, shared across a network of interconnected devices in different locations.<sup>11</sup> DLTs operate on a peer-to-peer (P2P) basis, where every node<sup>12</sup> maintains a copy of the shared database. DLTs rely on consensus protocols<sup>13</sup> to manage archives of data, such as user transaction records, ensuring the accuracy and integrity of the information. The underlying distributed ledgers in DLTs can be classified into four common types of structure: private ledgers, public ledgers, permissioned ledgers, and permissionless ledgers. More details can be found in Box 1.2.

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<sup>8</sup> Chenna (2023).

<sup>9</sup> *Explainable AI aims to provide insight into how input variables contribute to the outcomes driven by machine learning algorithms.*

<sup>10</sup> Vishwarupe, Joshi, Mathias, Maheshwari, Mhaisalkar and Pawar (2022).

<sup>11</sup> European Central Bank (2016).

<sup>12</sup> Each node represents a user of the distributed ledger.

<sup>13</sup> A 'consensus protocol' refers to the mechanism that determines which user of a ledger can validate the state of the database whenever new data is submitted to the ledger.

### Box 1.2: The four common forms of distributed ledgers

#### Private ledger

- A private ledger is a distributed ledger system with access restricted to a certain group of nodes, and approval is required to enter this system. In this sense, a copy of the database is only accessible by this group of nodes.<sup>14</sup>

#### Public ledger

- A public ledger is a distributed ledger system that is publicly accessible by all the nodes, and no approval is required to access the records in the database system.

#### Permissioned ledger

- A permissioned ledger is a distributed ledger system that allows a certain group of nodes to choose the consensus protocol used to validate new transactions and, therefore, can control the transaction validation process by only authorising some nodes to become the validator.<sup>15</sup>

#### Permissionless ledger

- A permissionless ledger is a distributed ledger system that ensures that the consensus protocol within the system is not controlled by any group of nodes. This allows every node to compete in a mathematically fair process to validate new transactions.<sup>16</sup>

Source: HKIMR staff compilation.

Different forms of DLTs exist, and each has specific functionalities that can facilitate various operations in the metaverse space. The most common type of DLT is based on public and permissionless distributed ledgers, employed by major blockchains to manage an immutable archive of data in a competitive and decentralised manner.<sup>17</sup> Increasingly, attention has been directed towards DLTs operating with private and/or permissioned distributed ledgers. These DLTs leverage a centralised governance framework, albeit with varying degrees of censorship, and can enhance the security of transactions executed on distributed ledgers.

On metaverse platforms, blockchain technology enables asset ownership and transfer, such as

cryptocurrency wallets, non-fungible tokens (NFTs), and smart contracts. Cryptocurrency wallets are devices, physical mediums, programs, or services that store public and/or private keys for cryptocurrency transactions. They often provide the additional functionality of encrypting and/or signing information. Besides cryptocurrencies, other types of crypto-assets traded on blockchain also hold the potential to facilitate real-time and seamless payments of transactions for metaverse users across different jurisdictions.<sup>18</sup> Blockchain technology can also facilitate the collection and trade of NFTs in metaverse-related activities. NFTs contain unique identification codes and metadata, making them non-replicable. This feature enables users to identify and track the

<sup>14</sup> Konashevych (2019).

<sup>15</sup> European Union Agency for Cybersecurity (2016).

<sup>16</sup> 'Compete in a mathematically fair process to validate transactions' essentially refers to the fact that the consensus protocol in a permissionless ledger allows nodes to freely compete with each other to complete mathematical calculations. Given the pre-designed rules defined in the protocol of the system, all nodes in the network are equal and independent, and the credibility of the system is based on the assumption that the nodes are honest.

<sup>17</sup> Konashevych (2019).

<sup>18</sup> For example, tokenised commercial bank money (e.g. tokenised deposits) traded on blockchain using smart contracts can facilitate the contingent performance of transactions in real-time. Tokenised central bank money (e.g. central bank digital currencies (CBDCs)) can also offer the benefit of enhancing the efficiency of multi-currency cross-border payments. More information can be found at: Cantú, Franco and Frost (2024). Similarly, more information about CBDC arrangements for cross-border payments and settlements can be found at HKIMR (2023a).

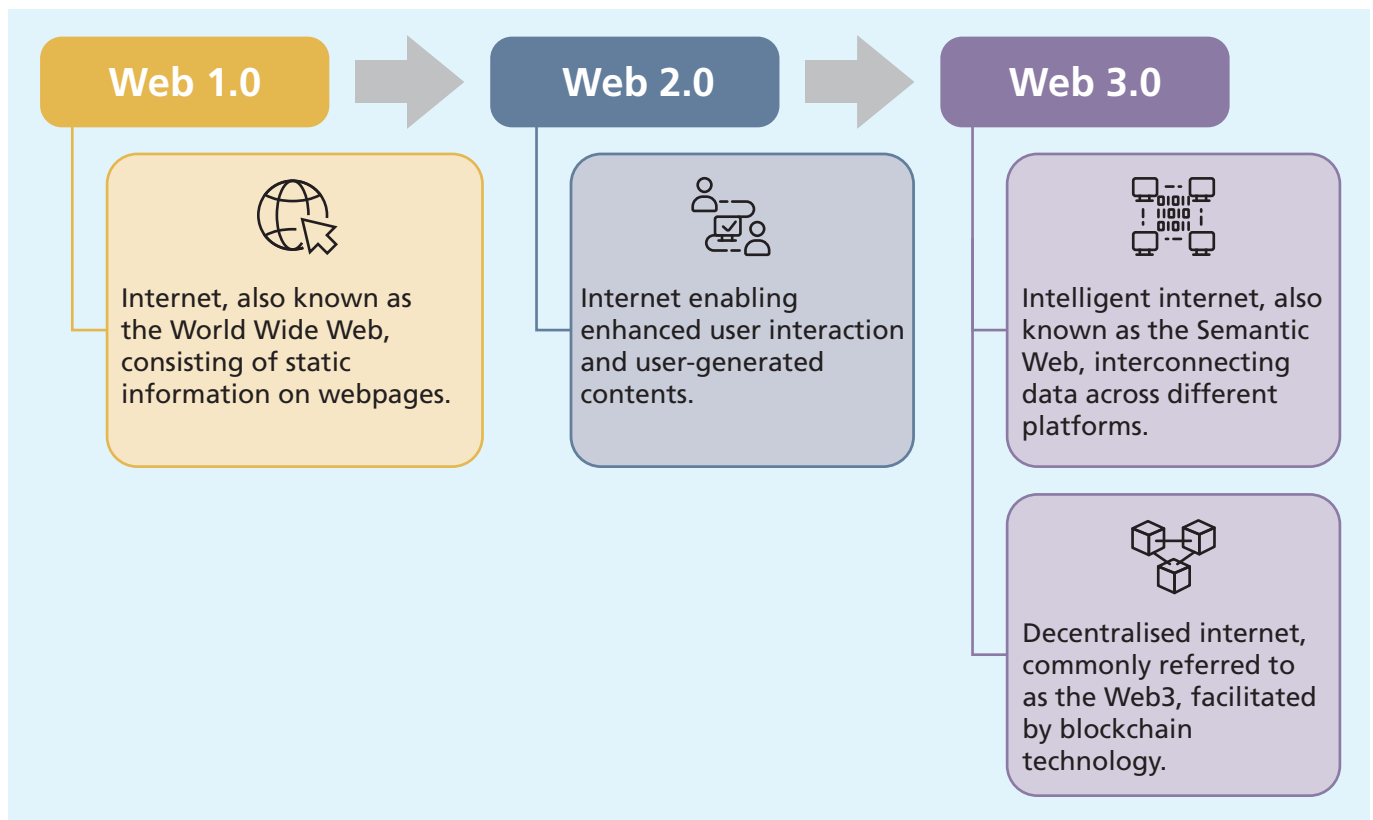
sale and ownership of assets in the metaverse space. Furthermore, blockchain technology underpins the creation of smart contracts, which are programs stored on the blockchain that specify the conditions for automatic execution of an operation in the metaverse.<sup>19</sup> Smart contracts can be implemented to support the direct monetisation of assets and the governance of the metaverse.<sup>20</sup>

On the whole, integrating blockchain technology into the construction of the metaverse entails the transition from the current Web 2.0 era to the conceptual Web3<sup>21</sup> metaverse by developing a decentralised and democratised version of the metaverse.

### 1.3. OVERVIEW OF THE WEB3 METAVERSE VISION

The Web3 metaverse is the vision for the metaverse in the Web3 era, 'Web3' being one of the popular perceptions of the third-generation internet (Web 3.0). The past several decades have witnessed the transition from Web 1.0 to the current Web 2.0 era (Chart 1.3). As the internet has continued to evolve, the future of Web 3.0 has become a topic of intense discussion. Varying perceptions of Web 3.0 have emerged, among which Tim Berners-Lee's and Gavin Wood's visions are the most popular. The concept proposed by Gavin Wood has been envisioned by many people as potentially

Chart 1.3: Evolution of the Internet



Source: HKIMR staff compilation.

<sup>19</sup> Banerjee, Byrne, De Bode and Higginson (2022).

<sup>20</sup> Smart contract-enabled blockchain technology can also give rise to decentralised finance (DeFi), which marks another recent trend in the financial services industry. 'DeFi' refers to an ecosystem of financial applications built on top of blockchain technology that enable P2P interactions without intermediaries and empower individuals to take control of their financial lives. For more information on DeFi, please refer to HKIMR (2024).

<sup>21</sup> 'Web3' is an acronym used to refer to Gavin Wood's vision for Web 3.0, the third generation of the internet.

### Box 1.3: Different phases of internet evolution

To aid understanding of the concept of the Web3 metaverse, the common classifications of the different phases of internet evolution are provided below.

#### Web 1.0

- Web 1.0, also known as the World Wide Web, was introduced by Tim Berners-Lee.
- This is the first-generation internet, consisting of static information on web pages for users to passively consume. There is limited interaction between the websites and the users, such that users are only able to create hyperlinks and send text-based emails.

#### Web 2.0

- Web 2.0, generally described as the second generation of the World Wide Web, was introduced by Darcy DiNucci and has developed over the past two decades.
- This version of the internet provides greater interactivity on top of the features of the Web 1.0 internet. Users can actively engage in content creation and interact with other users through centralised software platforms such as blogs, forums, and social media.

#### Web 3.0

- ‘Web 3.0’ describes the third generation of the internet. Different visions for Web 3.0 have emerged over time. Two definitions of the concept of Web 3.0 are widely used.
- Tim Berners-Lee defined the Semantic Web<sup>22</sup> as a component of Web 3.0, envisioning an intelligent internet where machines can interact seamlessly with other machines and analyse all types of data on the internet, interconnecting data across different platforms.<sup>23</sup>
- Gavin Wood defined Web 3.0 as a decentralised online ecosystem leveraging blockchain technology to offer end-to-end security and trustless interaction, where no third party is required.<sup>24</sup> The acronym ‘Web3’ is commonly used to distinguish this definition from Tim Berners-Lee’s vision for Web 3.0.

*Source: HKIMR staff compilation.*

representing the next stage of the internet evolution. The acronym Web3 is commonly used to represent this definition and distinguish it from Tim Berners-Lee’s vision for Web 3.0. More details can be found in Box 1.3.

Many envision the ongoing development of the metaverse as a transition from Web 2.0 to Web3. The vision for the Web3 metaverse leverages blockchain technology and has the potential to replace the

centralised architecture that governs the Web 2.0 metaverse. The aim of Web3 is to create an innovative, decentralised experience within the metaverse space. Some believe in the potential of Web3 to address the shortcomings of the Web 2.0 metaverse, such as the limitations on content creation, the closed ownership model, and the limited monetisation opportunities. More details about the key differences between the Web 2.0 metaverse and the Web3 metaverse can be found in Table 1.1.

<sup>22</sup> The Semantic Web consists of computers that can analyse all the data on the internet. The Web also consists of ‘intelligent agents’, where machines can interact with other machines to handle different aspects of daily lives.

<sup>23</sup> Shannon (2006).

<sup>24</sup> Wood (2014).

Table 1.1: Key differences between the Web 2.0 metaverse and the Web3 metaverse

	The Web 2.0 metaverse	The Web3 metaverse
Platform structure	Centralised system	Decentralised system
Level of governance	Governed by a central authority	Democratised governance
Virtual identity	Centralised identity	Self-sovereign identity <sup>25</sup>
Content creation	Platform developers	Users; Platform developers
Ownership model	Closed ownership <sup>26</sup>	Users retain ownership of their personal data and assets
Monetisation opportunities	Limited	Improved

Source: HKIMR staff compilation.

**The vision for the Web3 metaverse leverages blockchain technology and has the potential to replace the centralised architecture that governs the Web 2.0 metaverse.**

The vision for the Web3 metaverse revolves around a decentralised system powered by blockchain technology. This technology’s immutable and permissionless nature means that no central authorisation is required to perform any transactions in the metaverse and that the transactions recorded on the blockchain cannot be altered. These characteristics imply that the Web3 metaverse is inherently resistant to censorship, granting metaverse users control over their personal data access and empowering their self-sovereign identity.

The Web3 metaverse, through the use of NFTs and smart contracts, encompasses the features of both

the ownership economy and the creator economy.<sup>27</sup> The ownership economy is an ecosystem that enables users to retain full ownership of their property rights in the Web3 metaverse space. This ecosystem is underpinned by a democratised governance system, where the community of users owns governance tokens that grant voting rights for fair and transparent collective decision-making. The creator economy is an ecosystem where users can freely create, monetise, and trade assets within the disintermediated metaverse environment.<sup>28</sup>

However, the Web3 metaverse vision has generated debates regarding its feasibility. Some observers point out that existing Web3 platforms are not fully decentralised, potentially limiting the realisation of the Web3 vision.<sup>29</sup> The Web3 metaverse vision also may present new challenges related to data privacy, cybersecurity, and financial crime. This highlights the important role played by regulatory authorities in promoting the responsible development of Web3 in Hong Kong. In addition, although blockchain technology is currently essential for the Web3

<sup>25</sup> Dwivedi et al (2022).  
<sup>26</sup> ‘Closed ownership’ refers to ownership centrally controlled by the platform owner.  
<sup>27</sup> Marchetti (2022).  
<sup>28</sup> ‘Disintermediated metaverse environment’ refers to an environment where a trusted third party is not needed to settle trade and transactions, thereby allowing content creators to directly benefit from the contents they generate in the metaverse space.  
<sup>29</sup> Citi (2022).

metaverse vision, some studies suggest that the evolving concept of Web 3.0 may not necessarily depend on blockchain technology,<sup>30</sup> which may present a different vision for the metaverse in the future Web 3.0 era. Given the current early stage of Web 3.0 development, it remains to be seen which metaverse vision will ultimately prevail.

## 1.4. INTEREST FROM THE GLOBAL FINANCIAL SERVICES INDUSTRY

Financial institutions' interest in the development of the metaverse has surged since late 2021. This is evident in the growing number of virtual real estate purchases within the metaverse space and partnerships between metaverse developers and renowned financial institutions worldwide, particularly within the banking sector.<sup>31</sup> According to a global survey conducted in May 2022, over 60% of enterprises within the insurance and financial sector have already launched metaverse initiatives.<sup>32</sup>

The growing interest of financial institutions in metaverse development can be attributed to several key drivers. First, consumers' changing preferences towards digital experiences have prompted increased utilisation of virtual platforms in people's daily routines, unveiling the potential of the metaverse to penetrate into different aspects of human activities in the future. Second, many have envisioned the metaverse as a unique immersive experience with the capacity to

foster a greater sense of social presence and revolutionise the ways in which individuals connect with each other. Subsequently, this vision has attracted increased public interest in the metaverse ecosystem. Third, continuous advancements in related technologies have supported the evolution of the metaverse, thereby stimulating broader attention among business enterprises, investors, and the general public. Moreover, the Covid-19 pandemic and resulting social distancing measures have underscored the importance of reliable digital connectivity and empowered changes in consumption patterns, further accelerating technological advancements and shifts in social norms and trends.

However, the overall interest of the financial services industry in the metaverse seems to be slowing, suggesting the presence of certain obstacles to full metaverse adoption. For example, venture capital investments in metaverse companies have shrunk from US\$4.09 billion in 2022 to around US\$530 million in 2023.<sup>33</sup> Moreover, some pioneering companies in the metaverse space have faced pressure to scale back their investments and expenses in metaverse-related projects.<sup>34</sup>

This waning interest is also evidenced by downturns in the virtual real estate and NFT markets. Studies show that both the sale volumes and prices of virtual lands have experienced significant decreases in the past several years.<sup>35, 36</sup> Similarly, the trading volumes of NFT marketplaces have decreased, with the monthly trading volumes of the top six NFT marketplaces falling from

<sup>30</sup> More information can be found at: <https://www.cnn.com/2022/11/04/web-inventor-tim-berners-lee-wants-us-to-ignore-web3.html>.

<sup>31</sup> Some examples of renowned financial institutions' engagement in the metaverse can be found at: <https://fintersections.whitesight.net/p/banks-in-metaverse>.

<sup>32</sup> McKinsey & Company (2022).

<sup>33</sup> More information can be found at: <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/venture-capital-funding-for-metaverse-dries-up-80408207>.

<sup>34</sup> For example, in January 2023, Microsoft announced a plan to shut down its metaverse platform, AltspaceVR; in February 2023, it announced a plan to shut down its Industrial Metaverse Core team. Similarly, Meta has faced pressure from stakeholders to scale back on metaverse operations in its hardware unit, Reality Labs, reporting a US\$3.9 billion operating loss in the first-quarter results of 2023, after the reported loss of US\$13.72 billion in the previous calendar year.

<sup>35</sup> The weekly average virtual land sale volume experienced a drop from a peak of US\$1 billion in November 2021 to approximately US\$157 million in August 2022. More information can be found at: <https://cointelegraph.com/news/metaverse-housing-bubble-bursting-virtual-land-prices-crash-85-amid-waning-interest>.

<sup>36</sup> The medium sale price per parcel of virtual land on a leading metaverse platform has declined 90%, from about US\$9,000 in April 2022 to US\$1,240 in April 2023. More information can be found at: <https://www.bloomberg.com/opinion/articles/2023-04-11/mark-zuckerberg-the-metaverse-and-the-sunk-cost-fallacy>.

US\$5.79 billion in January 2022 to US\$1.89 billion in February 2023.<sup>37</sup> Moreover, the valuations of prominent cryptocurrencies and stablecoins in the crypto-assets<sup>38</sup> market have been volatile.

It is too early to conclude whether the interest of the financial services industry in the metaverse is a temporarily slowing down or a permanent decline. Nonetheless, these developments reveal that while the metaverse may provide new opportunities to the financial services industry, its associated risks and challenges should also be taken into consideration.

### 1.5. BROAD IMPLICATIONS OF METaverse DEVELOPMENT ON THE FINANCIAL SERVICES INDUSTRY

The development of the metaverse has the potential to bring business opportunities to the financial services industry. First, it may drive demand for virtual financial services such as borrowing, insurance, and investment activities. Second, the metaverse can reform business operations within financial institutions, including sales, marketing, research and development, customer support, and human resources. As the metaverse continues to evolve, financial institutions can leverage it as an additional channel for brand marketing, advertising products and services, and hosting social events. This will allow them to strengthen connections with existing customers and interact with younger consumers. Financial institutions can also promote the financial literacy of their customers through virtual and interactive education within the metaverse. Additionally, by creating a digital twin of the workplace in the metaverse, financial institutions can reinvent workplace interactions and offer new ways of engaging with employees.

Nevertheless, the development of the metaverse may also introduce new risks or magnify existing risks in the digital age, posing threats to financial institutions

and the financial ecosystem. For instance, transactions in the metaverse may involve the use of NFTs and cryptocurrencies, which have been volatile and prone to threats such as counterfeits, wash trading, and scams. As the adoption of the metaverse expands in the future, financial institutions with increasing exposure to NFTs and cryptocurrencies may amplify the systemic risk in the financial system due to the risks of potential collapse in prices of such crypto-assets.

Data privacy threats may escalate, as the metaverse involves the transmission of new types of personal data. The decentralised nature of blockchain technology in the metaverse may also trigger greater liability risks, making it challenging to enforce intellectual property rights and determine user accountability for illegal activities. These potential risks embedded in the metaverse denote the importance of monitoring the healthy development of the metaverse, ensuring financial stability whilst promoting innovation in the industry.

The broad implications of metaverse development for the financial services industry, especially within Hong Kong, remain uncertain and will depend on several key elements. These elements include the level of user adoption of the metaverse, as well as the advancement of the enabling technologies and relevant infrastructure that support the metaverse's operations, such as the accessibility of 5G internet services and underlying devices for engaging in the metaverse. The availability of talent in metaverse-related fields is also crucial for the future development of the metaverse.

Overall, the metaverse is still in an early phase of adoption, and its implications for the financial services industry remain challenging to predict. The following chapters of this report, which draw on the results of the survey and interviews commissioned by the HKIMR, delve into the current landscape, opportunities, and challenges associated with the metaverse's development within the financial services industry in Hong Kong.

<sup>37</sup> More information can be found at: <https://www.coingecko.com/research/publications/nft-trading-volume>.

<sup>38</sup> This report uses the term 'crypto-asset' predominantly; however, the term may also be appropriate when making reference to regulatory regimes whose official name uses the term 'virtual asset'. See Appendix B for definitions of 'crypto-asset' and 'virtual asset'.

# Chapter 2

## Emerging Use Cases and Future Prospects of the Metaverse in the Financial Services Industry

Exploration of current industry engagement and recent developments

### HIGHLIGHTS:

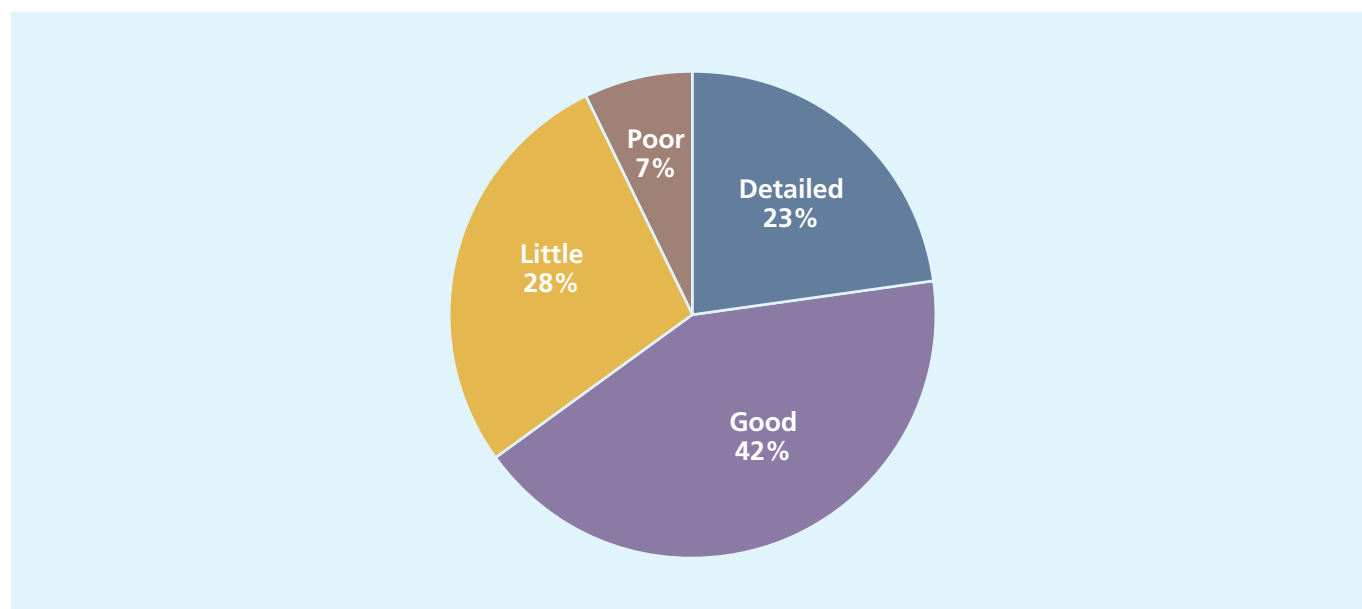
- A total of 65% of the survey respondents from the financial services industry indicated that their companies were involved in the metaverse. The level of engagement varied, ranging from initial discussion to the planning and implementation stages of metaverse adoption.
- Financial institutions in Hong Kong have adopted various metaverse applications to enhance their interactions with the public, customers and employees. The survey respondents expressed less enthusiasm for using the metaverse as an investment tool or a sales channel and revenue stream, as well as providing metaverse-specific products and services.
- The survey findings suggest that the transition to a comprehensive metaverse ecosystem will be an important factor driving mass adoption of the metaverse in the financial services industry going forward.
- Furthermore, 85% of the market participants expected metaverse development to affect the financial services industry to a certain extent. Advances in network technology, display hardware, computing technology and blockchain technology were viewed by the market participants as essential for accelerating the development of the metaverse.

To understand market participants' views on the opportunities and challenges, future roadmap and regulatory landscape surrounding the metaverse, the HKIMR commissioned a survey entitled *Current Landscape and Recent Developments of the Metaverse in Hong Kong's Financial Services Industry* (Metaverse Survey) from May to July 2023. Survey questionnaires were sent to both traditional financial institutions such as banks, insurers and asset managers and metaverse service providers. Interviews were also conducted with a diverse group of market participants, including financial institutions, industry practitioners and metaverse platform builders, to learn about their insights and experiences in this field.<sup>39</sup> The following sections of this chapter review Hong Kong's financial services industry's current engagements and future prospects in the metaverse space as gleaned from the survey.

### 2.1. CURRENT ENGAGEMENTS RELATED TO THE METAVERSE

To assess the financial services industry's familiarity with the metaverse, the financial institution respondents were asked about their knowledge of metaverse-related concepts. Over 90% of the respondents demonstrated a certain degree of knowledge of the metaverse, with 65% indicating either a good or detailed understanding (Chart 2.1). This highlights the noteworthy attention garnered by the metaverse among financial institutions despite its relatively nascent stage of development.

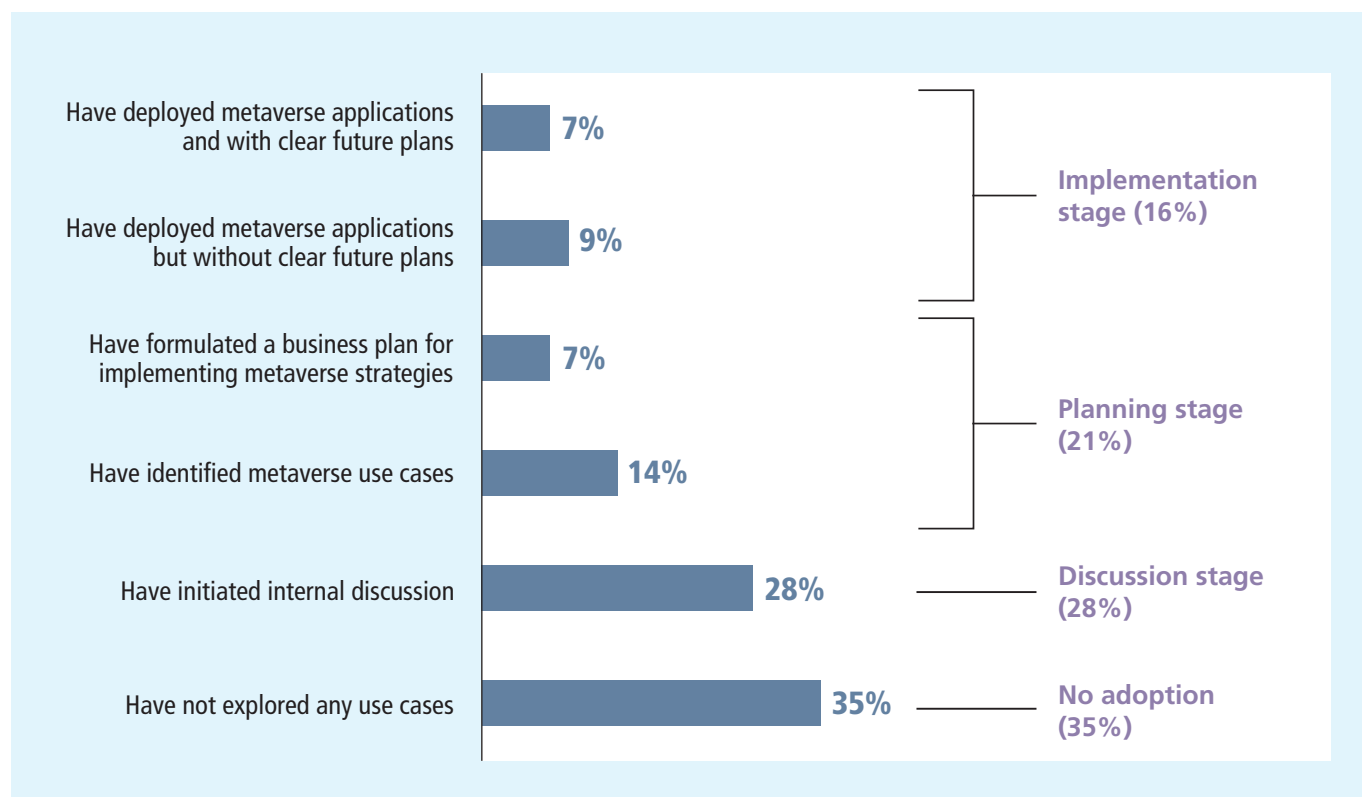
**Chart 2.1: Level of knowledge of concepts related to the metaverse**



Source: HKIMR staff compilation based on the Metaverse Survey.

<sup>39</sup> Full details of the Metaverse Survey can be found in Appendix A.

Chart 2.2: Stages of adoption of metaverse applications



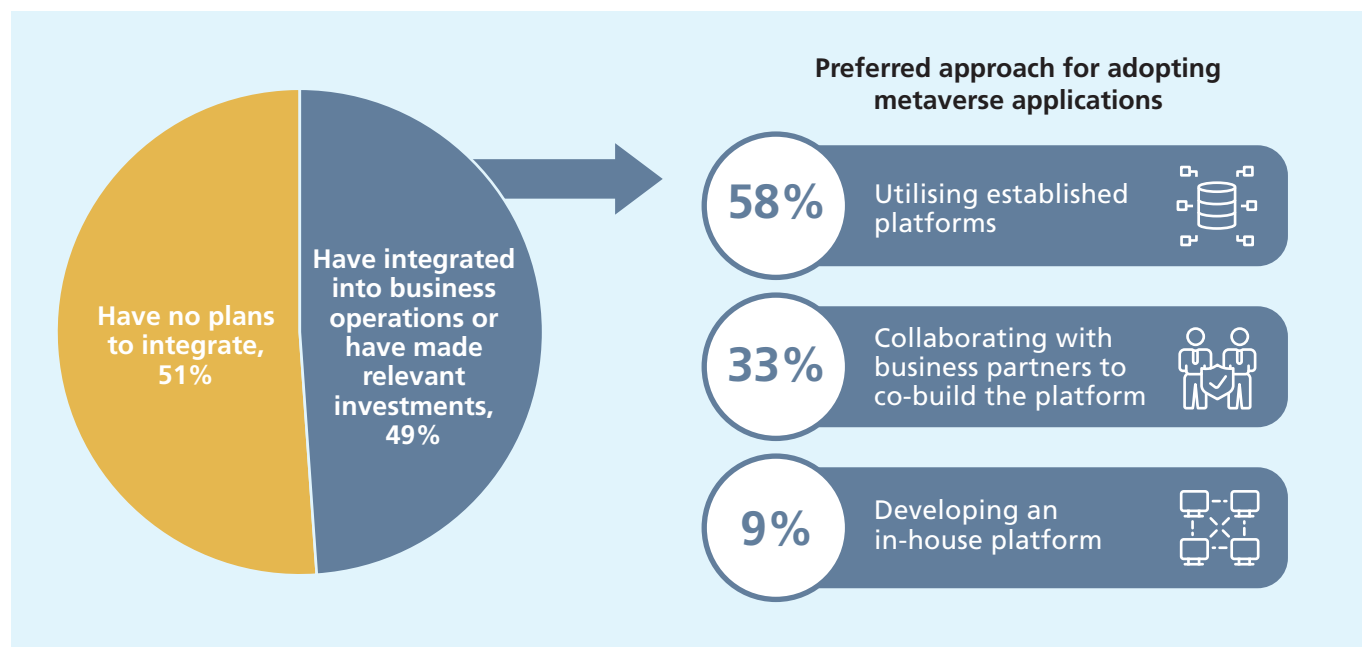
Source: HKIMR staff compilation based on the Metaverse Survey.

To gain deeper insight into this trend, the financial institutions were surveyed regarding their current stage of metaverse adoption. The survey findings showed that 65% of the financial institutions were involved in the metaverse, with varying degrees of engagement (Chart 2.2). This involvement ranged from initiating internal discussions (28% of the surveyed financial institutions) to developing or planning to launch metaverse use cases (21%) and even implementing metaverse applications (16%).

The survey also sought to assess the extent to which the financial institutions had integrated metaverse applications into their business operations. The results indicated that 49% of the surveyed financial institutions had either incorporated metaverse applications into their business operations or made relevant investments in this domain (Chart 2.3). Furthermore, among these respondents, 58% expressed a preference for leveraging established metaverse platforms, while 33% indicated a desire to collaborate with business partners to co-build a

metaverse platform tailored to their specific applications. Only 9% of the respondents indicated an inclination towards developing an in-house metaverse platform exclusively for their company. This low preference for in-house platforms can be attributed to the considerable sunk costs associated with large investments in hardware, software and human capital. These costs often act as a deterrent for financial institutions, prompting them to opt for alternative approaches in the development of metaverse platforms.

**Over 90% of the surveyed financial institutions demonstrated a certain degree of knowledge of the metaverse and 65% reported involvement in the metaverse.**

**Chart 2.3: Financial institutions' integration of metaverse applications into business operations and their preferred approaches**

Source: HKIMR staff compilation based on the Metaverse Survey.

The remaining 51% of the surveyed financial institutions reported that they had no current plans to implement metaverse applications in their business operations. This implies that, apart from those that had not explored any metaverse use cases, as depicted in Chart 2.2, some of the financial institutions at the planning or discussion stage of metaverse adoption also disclosed a lack of current plans to implement metaverse applications in their operations. This finding suggests that while financial institutions in Hong Kong show some interest in the concept of the metaverse, they are cautious about investing in or incorporating metaverse applications into their business operations.

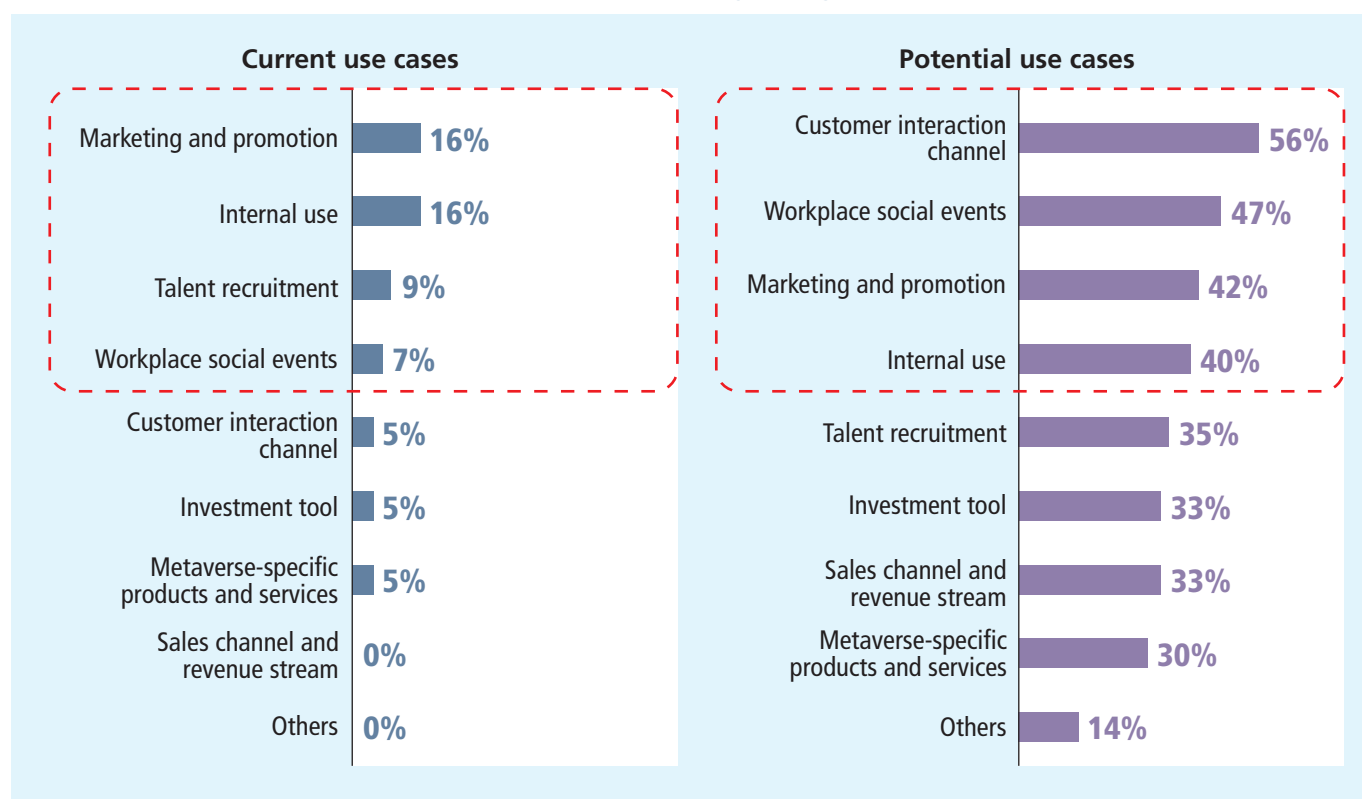
These survey findings were supplemented with insights obtained from the interviews. Some of the interviewees expressed that they did not perceive an immediate need to invest in the metaverse space. They expressed a desire to gain a deeper understanding of the future landscape before committing to a metaverse strategy. One asset and wealth management

firm that was in the discussion stage of metaverse adoption revealed that it had not used the metaverse for any business cases, primarily due to the absence of interest or demand from its clients and the limited direct commercial gains offered by the existing metaverse applications.

Following this, the financial institutions were surveyed about their current and potential use of various metaverse applications. The results suggested that the current use cases of metaverse applications that were popular in Hong Kong's financial services industry included marketing and promotion (16%), internal use<sup>40</sup> (16%), talent recruitment (9%) and workplace social events (7%) (Chart 2.4). These results show that financial institutions are inclined to use the metaverse as an additional channel to interact with the public, customers and employees.

<sup>40</sup> Examples of internal use include virtual onboarding, employee training, virtual workplace and meeting.

Chart 2.4: Current and potential use cases in Hong Kong



Source: HKIMR staff compilation based on the Metaverse Survey.

**Financial institutions are inclined to use the metaverse as an additional channel to interact with the public, customers, and employees.**

Insights obtained from the interviews with the financial institutions highlighted that they were using the metaverse space for brand marketing purposes by offering an immersive gamified experience and establishing a presence in the emerging space. Some of the interviewees also mentioned that they had leveraged the metaverse for internal use to provide employee training and facilitate workplace presentations, as well as to complement physical workplace social events through virtual experiences.

The chart also displays the potential use cases that the financial institutions were interested in exploring in the future. The customer interaction channel emerged as the interviewees' top priority, with 56% of the financial institutions selecting this option. This was followed in popularity by workplace social events, marketing and promotion and internal use, which were chosen by 47%, 42% and 40% of the respondents, respectively.

The interviewees' responses echoed the survey results. The interviewees from the banking and insurance sectors indicated the plans they considered concerning leveraging the metaverse for soft customer engagement in the future, such as establishing an exhibition space for intellectual entertainment and financial education. While acknowledging the current technological limitations in providing metaverse experiences for external stakeholders such as customers, one interviewee

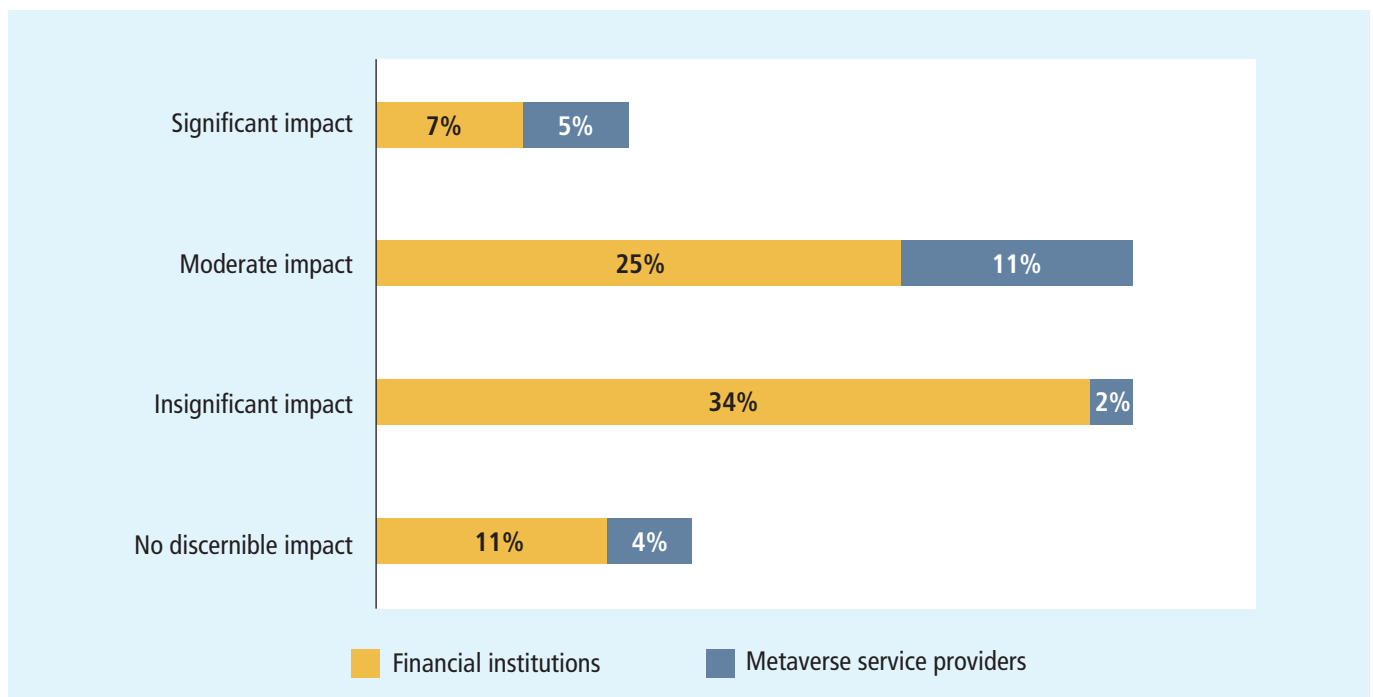
expressed optimism about future customer-facing services in the virtual world.

The survey results presented in Chart 2.4 highlight the low enthusiasm of the financial institutions towards utilising the metaverse as an investment tool,<sup>41</sup> sales channel and revenue stream, and for providing metaverse-specific products and services. Some of the interviewees conveyed their interest in promoting or even delivering financial services and products using the metaverse, but they had concerns about the challenges in the current market impeding the adoption of such applications. They stated that it would be ideal to have a full-fledged metaverse ecosystem with high adoption and frequent business transactions among consumers to justify their provision of financial services in the metaverse. One of the interviewees also emphasised that they were cautious about crypto-asset trading or ownership within the metaverse space because it did not align with their risk appetite at the time.

## 2.2. FUTURE PROSPECTS OF METAVERSE DEVELOPMENT IN THE FINANCIAL SERVICES INDUSTRY

The survey conducted among both financial institutions and metaverse service providers sought to gather insights on the anticipated impact of metaverse development on the financial services industry. The results of the survey indicated that a notable proportion of the respondents considered that the impact would be either moderate (36%) or insignificant (36%) (Chart 2.5). This finding aligns with the data presented in Chart 2.4, which indicate relatively limited current and future plans among the financial institutions to implement metaverse use cases. Several of the interviewees from various financial sectors justified this decision by citing the limited number of mature use cases that could be seamlessly integrated into their business operations to provide a direct revenue stream. As a result, they

**Chart 2.5: Expected impact of metaverse development on the financial services industry**



Source: HKIMR staff compilation based on the Metaverse Survey.

<sup>41</sup> Examples of investment tool include the purchase of virtual real estate and crypto-assets in the metaverse.

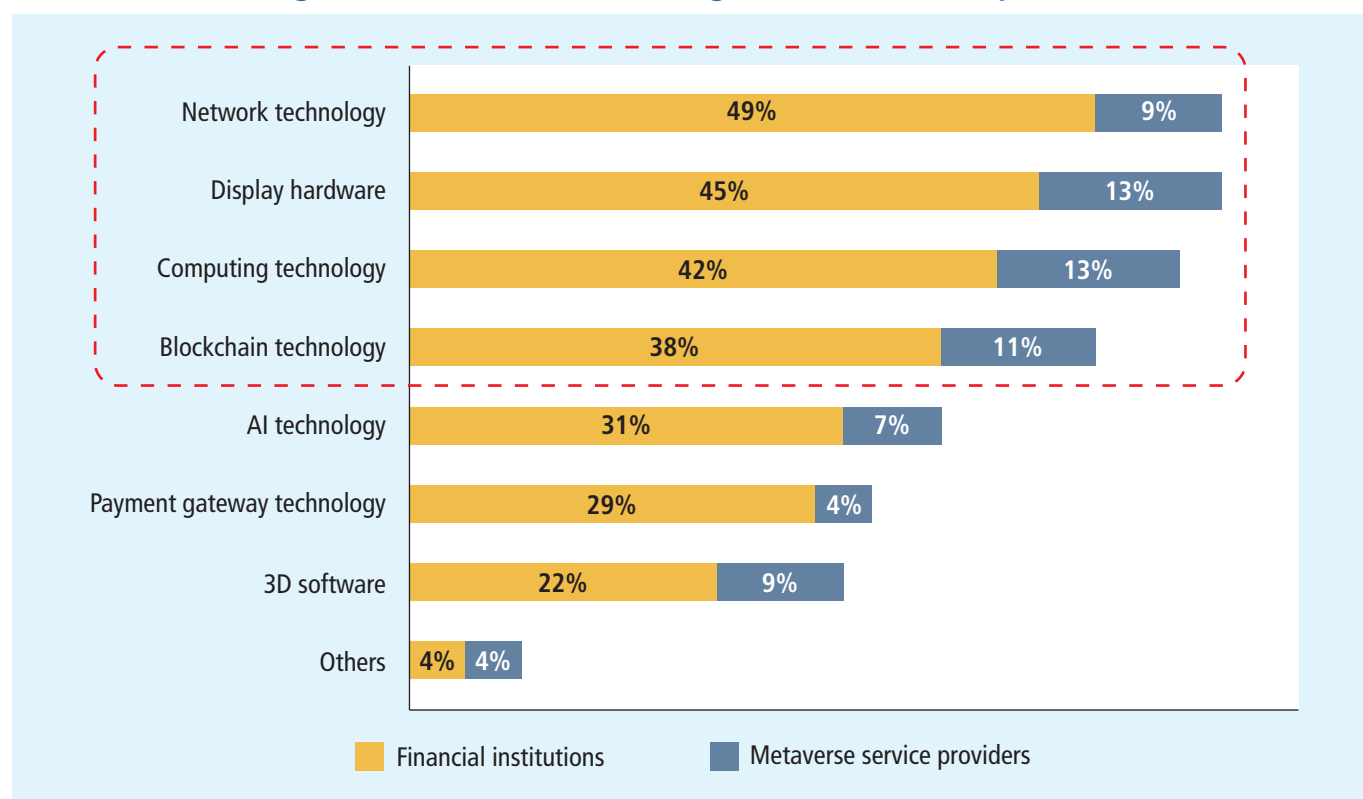
did not perceive any immediate benefits of using the metaverse. One of the interviewees from the insurance sector anticipated that the mass adoption of the metaverse, particularly within the financial services industry, could take a long time to occur. These insights imply that some financial institutions hold a conservative view on the prospects of metaverse adoption within the industry.

The future prospects of metaverse adoption are closely linked to advancements in the metaverse enabling technologies. According to the surveyed market participants, the technologies deemed essential for accelerating metaverse development included network technology (58%), display hardware<sup>42</sup> (58%), computing technology (55%) and blockchain technology (49%) (Chart 2.6). These technologies are considered crucial components in driving the progress and growth of the metaverse. One of the interviewees from the banking sector

indicated their inclination towards utilising relatively mature and widely adopted technologies when considering engagement in the metaverse space. With the development of metaverse enabling technologies, more practical metaverse use cases may emerge, potentially expanding the scope of metaverse applications within the financial services industry.

**Network technology, display hardware, computing technology, and blockchain technology are highlighted as important by surveyed market participants for accelerating the metaverse development.**

**Chart 2.6: Technologies essential for accelerating metaverse development**



Source: HKIMR staff compilation based on the Metaverse Survey.

<sup>42</sup> Examples of display hardware include organic light emitting diodes and VR and AR technologies.

# Chapter 3

## Opportunities and Challenges and Metaverse Developments in Hong Kong

### Adoption in the financial services industry and the metaverse talent landscape

#### HIGHLIGHTS:

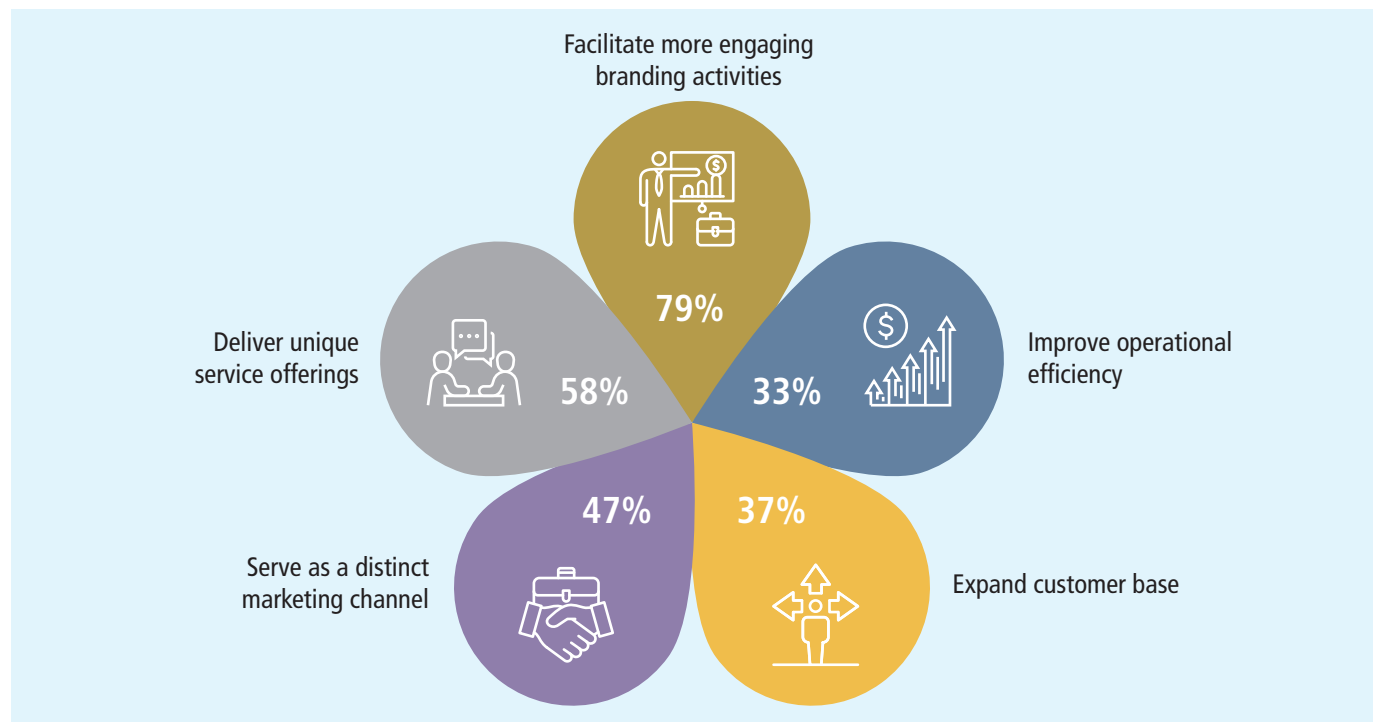
- The financial institutions perceived that metaverse adoption could facilitate more engaging branding activities, deliver unique service offerings, and serve as a distinct marketing channel. They also believed that metaverse adoption had the potential to expand their customer base and improve operational efficiency.
- The major challenges faced by the surveyed financial institutions in metaverse adoption included data privacy issues, limited platform functionalities, and scarcity of talents and expertise. Limited user adoption and interest, high development and maintenance costs, and difficulties in integrating with existing operations and systems were also quoted as obstacles within the metaverse environment.
- The survey revealed differences in talent acquisition between the financial institutions and metaverse service providers. The financial institutions displayed less involvement in metaverse talent acquisition. In contrast, the majority of the metaverse service providers indicated that they had sufficient talents to navigate metaverse development. The metaverse service providers also placed emphasis on acquiring a broader range of talents with metaverse-specific skills in Hong Kong and highlighted that talents with expertise in blockchain technology were most sought after by the employers.

The development of the metaverse presents opportunities and risks for the financial services industry. Financial institutions can leverage the metaverse to foster innovation, enhance customer engagement and provide more immersive financial experiences. However, it is important to acknowledge the associated risks, including privacy and security concerns, regulatory intricacies and the need for robust risk management frameworks. Therefore, striking a balance between harnessing the transformative potential of the metaverse and mitigating these risks is essential for the financial services industry. This chapter delves into the perspectives of market participants regarding the opportunities and challenges associated with metaverse development and examines the talent landscape in the financial services industry in Hong Kong.

### 3.1. POTENTIAL OPPORTUNITIES ARISING FROM METAVERSE DEVELOPMENTS IN THE FINANCIAL SERVICES INDUSTRY

According to the Metaverse Survey, the surveyed financial institutions in Hong Kong anticipated that adopting metaverse applications would potentially bring several benefits to their businesses. Specifically, 79% of the survey respondents acknowledged that adopting metaverse applications could facilitate more engaging branding activities to better connect with customers (Chart 3.1). The metaverse enables financial institutions to design interactive and immersive brand experiences in a hybrid manner, making them more appealing to their target audiences. This can improve connections with customers, ultimately increasing brand loyalty. For instance, one of the interviewees from the asset and wealth management sector underscored that the unique interactive nature of the metaverse experience had enabled greater customer retention and participation than traditional websites.

**Chart 3.1: Perceived benefits of adopting metaverse applications by financial institutions**



Source: HKIMR staff compilation based on the Metaverse Survey.

Of the respondents, 58% identified the metaverse as a platform that provides unique service offerings, and 47% indicated that the metaverse could serve as a distinct marketing channel. As the metaverse continues to develop, it has the potential to deliver personalised customer-facing services, such as virtual consultations with financial advisors. Financial institutions can use the metaverse to improve the ease of information sharing and communication with customers, thereby enhancing customer experience and satisfaction. The metaverse can also offer a new marketing channel for financial institutions to showcase their products and services. For example, one interviewee from the insurance sector disclosed their desire to use the metaverse as a medium to market their insurance products, tailoring product offerings to meet customers' preferences and needs, which would potentially increase the city's insurance coverage.

The survey revealed that 37% of the respondents believed that the metaverse had the capacity to expand their customer base, while 33% expressed the view that metaverse applications could improve operational efficiency. The metaverse may provide an opportunity for financial institutions to widen the customer base by expanding their global reach beyond the physical and geographical limitations. As younger customers are more inclined to engage in virtual entertainment experiences,<sup>43</sup> the metaverse may also act as a channel for financial institutions to reach out to younger customers. The metaverse can improve the operational efficiency of financial institutions in various ways. For example, the metaverse can support virtual employee training and virtual workspace, which can lower operating expenses and facilitate greater flexibility for employees, potentially enhancing labour productivity and operational efficiency.

Consistent with the survey findings, several of the interviewees noted that the metaverse held the

potential to tap into the market of the younger generation. However, some of the interviewees conveyed their concerns about the difficulty of creating a seamless customer journey within the metaverse and effectively converting interested consumers into clients.

### 3.2. KEY CHALLENGES ACCOMPANY METAVERSE DEVELOPMENTS IN THE FINANCIAL SERVICES INDUSTRY

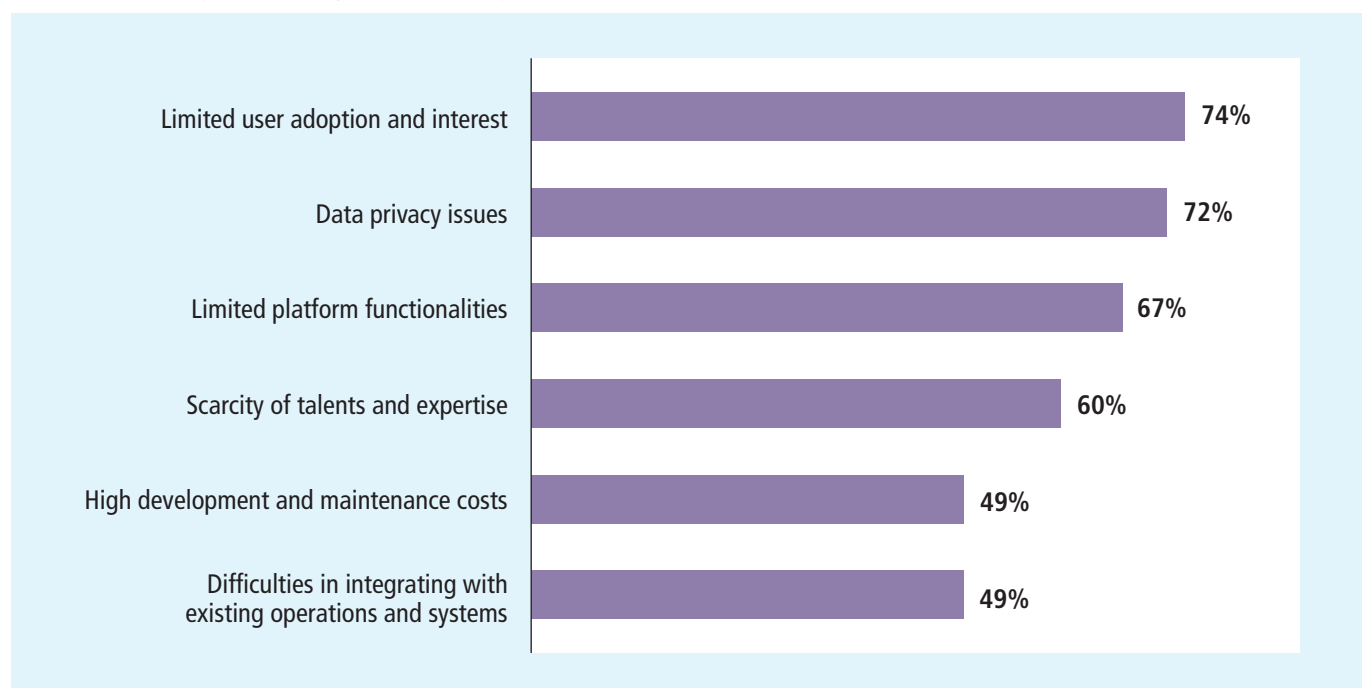
The adoption of metaverse applications presents opportunities for the financial services industry. However, it also brings potential challenges that need to be addressed or mitigated to ensure the seamless integration of metaverse applications within the financial services industry. The financial institution respondents stated that the adoption of metaverse applications entailed challenges that could affect their business decision-making processes. These challenges included limited user adoption and interest, data privacy issues, limited platform functionalities, scarcity of talents and expertise, high development and maintenance costs, as well as difficulties in integrating the metaverse applications with their existing operations and systems (Chart 3.2).

#### Limited user adoption and interest

A significant portion (74%) of the financial institutions acknowledged limited user adoption and general public interest as a major obstacle associated with adopting metaverse applications. The interviews shed further light on the survey findings. Some of the interviewees from the asset and wealth management and banking sectors emphasised several barriers to mass adoption of the metaverse, including the inconvenience and high costs of using VR headsets for entering the metaverse.<sup>44</sup> Given that

<sup>43</sup> Deloitte's 2023 Digital Media Trends report revealed that Gen Zs and Millennials (aged 14–40) are far more likely than those from older generations (aged 41 and older) to express interest in using a VR headset regularly for at least one VR experience. More information can be found at: Auxler and Arbanas (2023).

<sup>44</sup> It is also important to note that digital developments can be accompanied by risks of unfair treatment of consumers. For example, individuals with limited digital access or limited financial literacy may be excluded from accessing the metaverse applications. More information on financial digitalisation can be found at HKIMR (2023b).

**Chart 3.2: Key challenges faced by financial institutions in metaverse adoption**

Source: HKIMR staff compilation based on the Metaverse Survey.

their business strategies largely depend on customer demand, these interviewees raised the issue that insufficient awareness and interest among customers had restrained them from investing in the metaverse. They had not perceived a high level of interest or demand from their client base in general.

The interviewees underscored the importance of a fully developed metaverse ecosystem, characterised by widespread adoption and regular business transactions among consumers. Such a thriving ecosystem is deemed necessary to justify continuous investments and the establishment of new business offerings, such as virtual branches, within the metaverse. A few of the interviewees conveyed concerns regarding the falling market enthusiasm towards the metaverse and the potential loss of public attention over time, which had deterred them from allocating large amounts of resources to metaverse applications.

### Data privacy issues

In terms of data privacy, 72% of the financial institutions identified related issues as a major challenge, which aligned with the evidence gathered during the interviews. Financial institutions are faced with notable difficulties in ensuring secure user data management while incorporating Know Your Customer (KYC) practices in the metaverse space. This had presented a major obstacle for them in adopting metaverse applications. Some of the interviewees expressed concerns about challenges related to client data collection, management, and storage for activities occurring on external metaverse platforms. The potential threat of data misuse by third parties has led to their reluctance in granting access of their internal systems to external platforms. One interviewee from the insurance sector stressed that, when adopting metaverse applications, financial institutions were subject to stricter compliance requirements regarding data privacy. These requirements created compliance difficulties when working with external vendors, who might not meet the same level of compliance requirements.

### Limited platform functionalities

Regarding the capacities of existing metaverse platforms, 67% of the financial institutions viewed limited platform functionalities as a major challenge. Most metaverse platform functionalities are currently not up to the standards required by financial institutions, and the virtual experiences offered by these platforms fall short of the envisioned ideal metaverse. Several of the interviewees from the banking sector underscored the importance of security when selecting a metaverse platform. They expressed that existing platforms still need to be refined to enable the delivery of persistent, immersive and secure metaverse experiences. They also indicated that most of these platforms lack the technical capabilities to support the desired use cases of financial institutions, such as providing financial services within the metaverse. Concerns were raised by some of the interviewees regarding the computational limits of metaverse platforms to accommodate large-scale events, such as workplace social gatherings, where a large number of users would enter the same virtual world simultaneously.

### Scarcity of talents and expertise

The scarcity of talents and expertise in developing and managing metaverse applications was raised as another major challenge, as indicated by 60% of the financial institutions. The interviewees in the financial services industry expressed concerns about the limited number of external vendors possessing the necessary skill sets for the metaverse, while their in-house talents lacked industry experience and the necessary expertise to support the development and management of metaverse applications. They further emphasised the challenges in recruiting specialised metaverse-related skills and talents. To attract employees in this field, some of the companies were offering higher salaries, even to individuals with insufficient metaverse expertise, leading to a decrease in the performance–cost ratio. These hurdles rendered it difficult for the financial institutions to capitalise on the opportunities presented by the metaverse. Furthermore, one interviewee from the insurance

sector revealed that there were knowledge disparities regarding the metaverse among different internal departments, hindering collaboration between relevant stakeholders on metaverse initiatives and applications.

### High development and maintenance costs

The survey results showed that 49% of the financial institutions considered the high costs associated with developing and managing the metaverse as another major challenge. Several of the interviewees emphasised that embracing a metaverse strategy necessitated significant investments and continuous resource allocation for platform development, customisation and maintenance. As the underlying technologies and user expectations evolve at an unprecedented pace, the need for constant upskilling and technical upgrades to keep up with the development of the metaverse ecosystem would lead to a rapid increase in platform management costs. In addition, the limited number of metaverse service providers contributes to higher prices.

### Difficulties in integrating with existing operations and systems

Difficulties in integrating the metaverse with their existing operations and systems were also recognised by 49% of the financial institutions as a major challenge, which was further supported by insights from the interviews. Several of the interviewees indicated that incorporating the metaverse into their traditional operational model would necessitate significant changes across multiple domains, resulting in very high operational expenses. This included areas such as financial planning and analysis, as well as customer identity verification. The interviewees from the banking and insurance sectors raised concerns about potential security risks and the challenges of maintaining the same level of oversight and control in virtual environments as in standard operations. These integration challenges pose additional hurdles for financial institutions in fully embracing the metaverse while ensuring security and operational continuity.

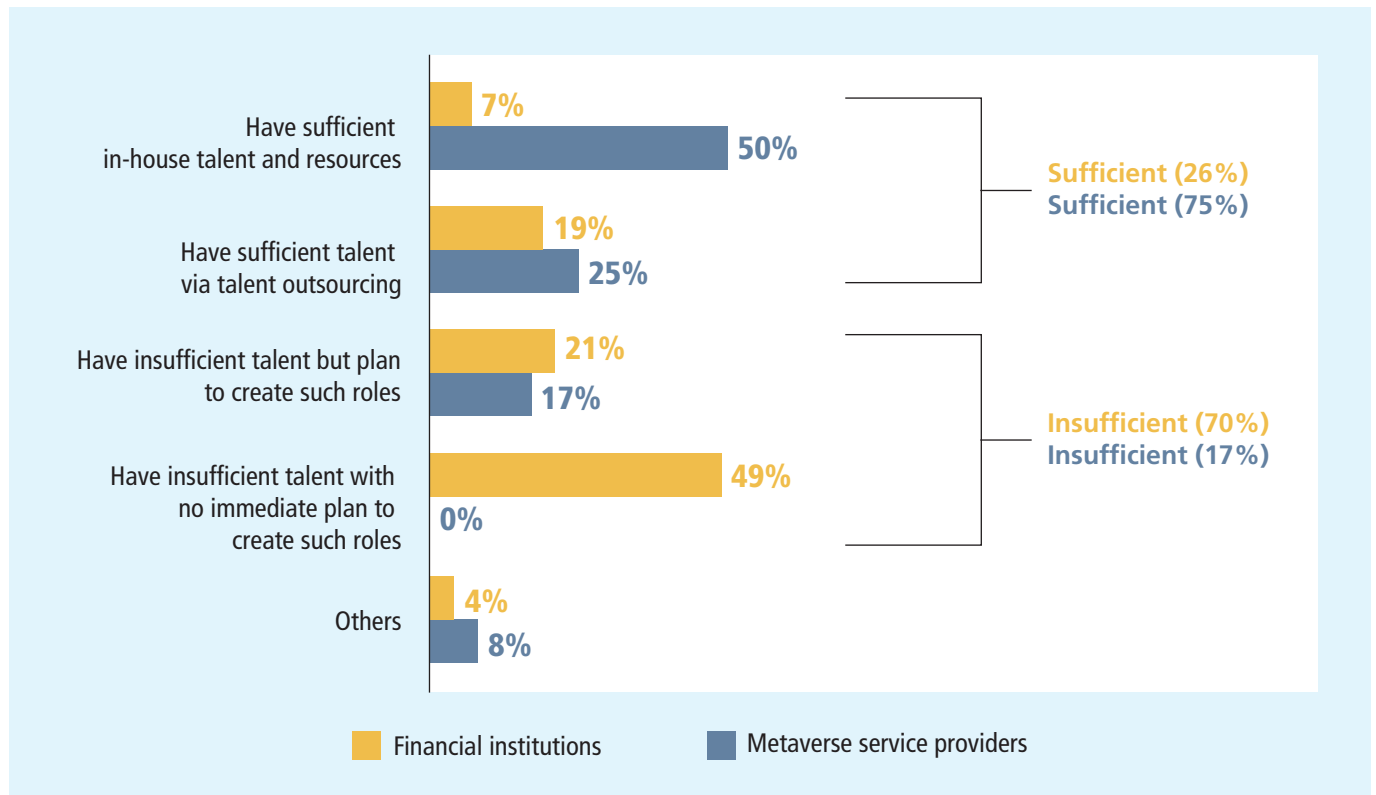
### 3.3. THE METAVERSE'S TALENT LANDSCAPE IN HONG KONG

With respect to the metaverse talent landscape, the Metaverse Survey revealed divergent perspectives between the financial institutions and metaverse service providers. A large majority (75%) of the metaverse service providers indicated that they had sufficient talents, either through in-house resources or outsourcing, possessing specialised skill sets related to the metaverse (Chart 3.3). In contrast, a high proportion (70%) of the financial institutions reported limited involvement in metaverse talent

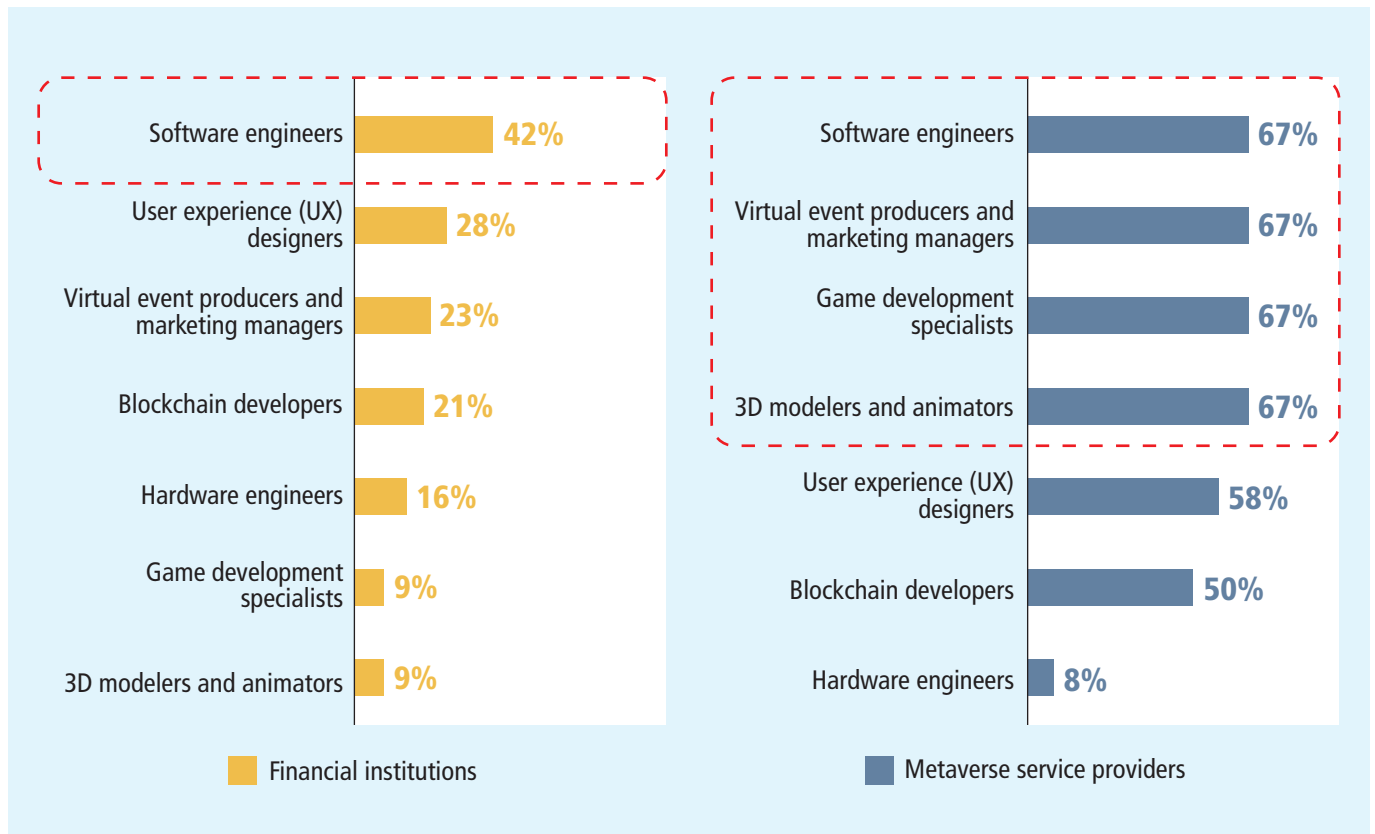
acquisition. Almost half of the financial institutions acknowledged that they possessed insufficient talents and had no immediate plans to create such roles in the foreseeable future.

These survey findings were supplemented with insights obtained from the interviews. According to the interviewees, most of the financial institutions lacked internal talent capabilities and were reluctant to invest in upskilling their workforce or establishing a dedicated metaverse team. This hesitancy stemmed from the high associated costs and the uncertain prospects surrounding the metaverse ecosystem.

**Chart 3.3: Talent demand and the metaverse adoption**



Source: HKIMR staff compilation based on the Metaverse Survey.

**Chart 3.4: Metaverse roles currently employed in Hong Kong**


Source: HKIMR staff compilation based on the Metaverse Survey.

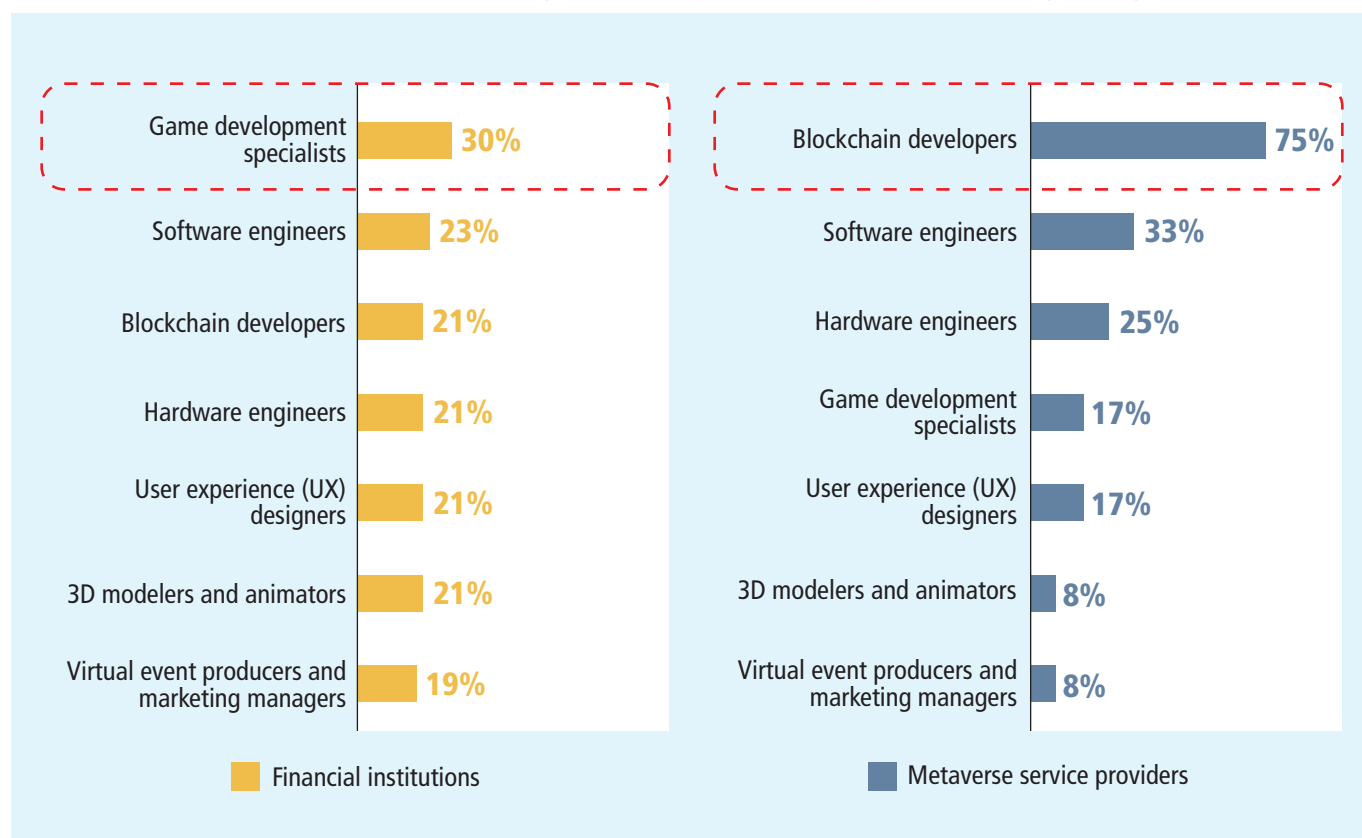
When examining the employment of metaverse talents in Hong Kong, a distinction emerged between the financial institutions and metaverse service providers. This observation was substantiated by the survey results, which indicated that financial institutions overall displayed less interest in acquiring metaverse talents. Instead, they exhibited an inclination to prioritise the recruitment of software engineers (42%), who usually possess transferable skills (Chart 3.4). This corresponds with the current state of the metaverse landscape, where most financial institutions are still in the early stages of adopting metaverse applications and remain cautious about building in-house capabilities.

In contrast, the metaverse service providers adopted a different approach, placing more emphasis on acquiring talents with metaverse-specific skills, due to their business needs. Notably, they expressed

strong interest in hiring professionals specialising in a diverse range of fields, including software engineering (67%), virtual event production and marketing management (67%), game development (67%) and 3D modelling and animation (67%). User experience design and blockchain development were also significant areas of employment focus for over half of the metaverse service providers, while the financial institutions emphasised these less (28% and 21%, respectively).

The Metaverse Survey asked the market participants about the types of talents most sought after by the employers in Hong Kong. The results indicated that 30% of the financial institutions highlighted game development specialists, whereas 75% of the metaverse service providers identified blockchain developers as the most sought-after talents (Chart 3.5).

Chart 3.5: Metaverse roles most sought after by the employers in Hong Kong



Source: HKIMR staff compilation based on the Metaverse Survey.

**The metaverse service providers placed emphasis on acquiring a broader range of talents with metaverse-specific skills in Hong Kong, and highlighted that talents with expertise in blockchain technology were most sought after by the employers.**

Consistent with these findings, some of the interviewees highlighted that the talent pool in Hong Kong needed more diversity and that they faced difficulties in hiring individuals with specialised skills related to metaverse development. Specifically, they emphasised the challenges encountered in hiring 3D software specialists and professionals proficient in blockchain-related fields. The low supply of such

talents has contributed to the elevated cost of talent acquisition in Hong Kong. Consequently, the interviewees shared that they had resorted to outsourcing certain operations to other regions.

When examining the challenges associated with metaverse talent acquisition, the survey respondents identified several significant hurdles, including a limited talent pool with relevant skill sets (69%) and insufficient industry awareness (60%) (Chart 3.6). These survey findings were supported by the results of the interviews.

The interviewees from the asset and wealth management sector highlighted that as the metaverse was a relatively new concept encompassing a range of frontier technologies, there was a local scarcity of relevant talents meeting industry demands. Given the limited metaverse talent diversity within Hong Kong, some of the interviewees had predominantly sought talents from Europe, where a thriving tech scene offers abundant blockchain-related and creative talents.

The unclear career path associated with the metaverse was reported as another major challenge by 45% of the survey respondents. Some of the interviewees mentioned that limited career development and job opportunities in related industries, such as gaming, had deterred metaverse-focused talents from entering the Hong Kong market. Consequently, there was a shortage of metaverse knowledge and expertise in Hong Kong due to challenges in attracting and retaining talents.

Over 40% of the respondents highlighted strong competition from other industries and constant changes in the market landscape as obstacles. Some of the respondents emphasised the need for more supportive measures to facilitate metaverse talent acquisition.

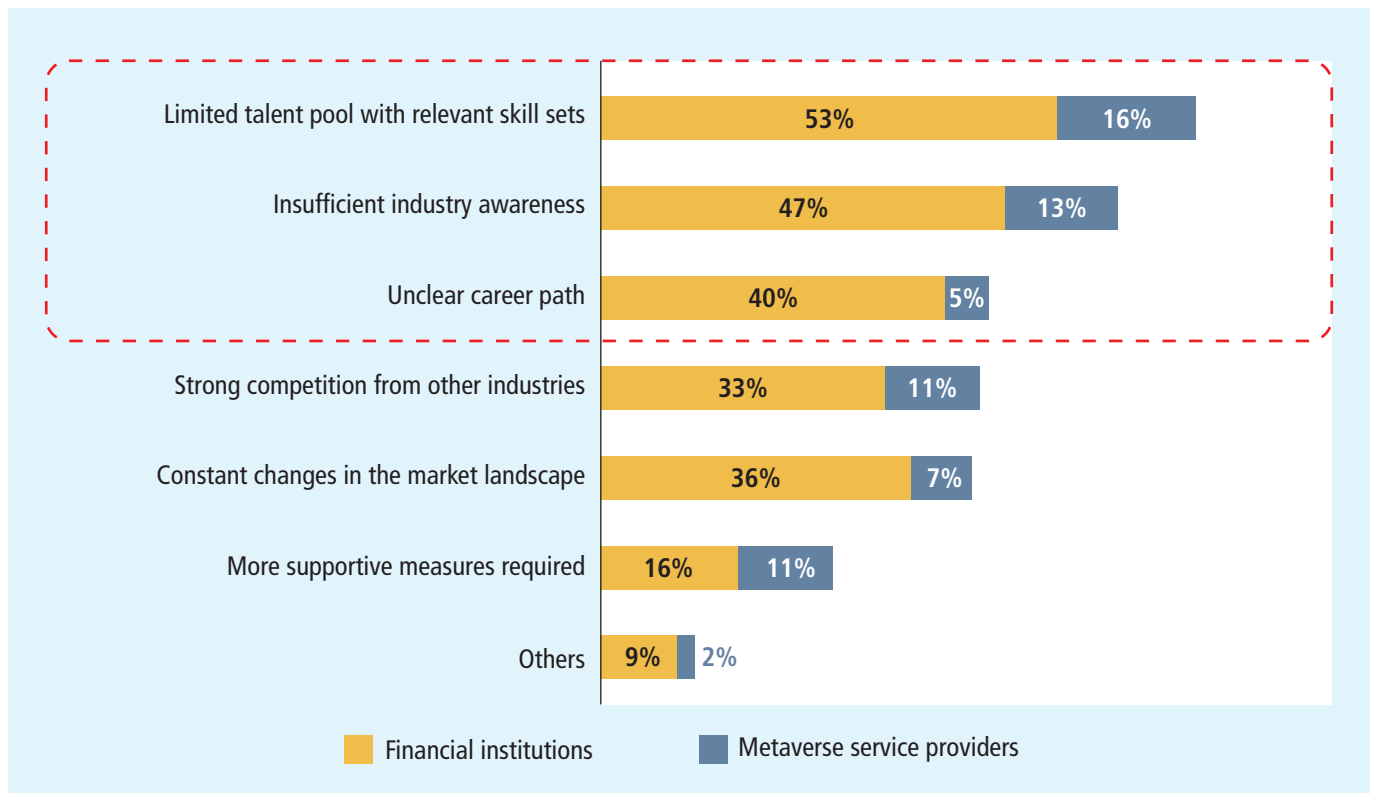
The metaverse presents numerous opportunities and challenges for the financial services industry. Achieving a balance between harnessing the transformative potential of the metaverse and effectively mitigating associated risks are vital for the industry's success. Both

financial institutions and regulators have crucial roles to play in ensuring the sustainable advancement of the metaverse. These may include regulating and governing key areas within the metaverse and fostering the development and attraction of talents in related fields.

The next chapter mainly examines regulatory initiatives concerning the fields related to the metaverse both internationally and in Hong Kong. This analysis aims to offer a comprehensive overview of the existing regulatory landscape on the metaverse, ensuring a thorough understanding of the current regulatory environment.

**Regulators and policymakers have a role to play in fostering the development and attraction of talents in related fields within the local metaverse ecosystem.**

**Chart 3.6: Key challenges in metaverse talent acquisition**



Source: HKIMR staff compilation based on the Metaverse Survey.

# Chapter 4

## The Role of Regulation in Metaverse Development and Recent Initiatives

Key regulating areas, regulatory proposals and supervisory guidance

### HIGHLIGHTS:

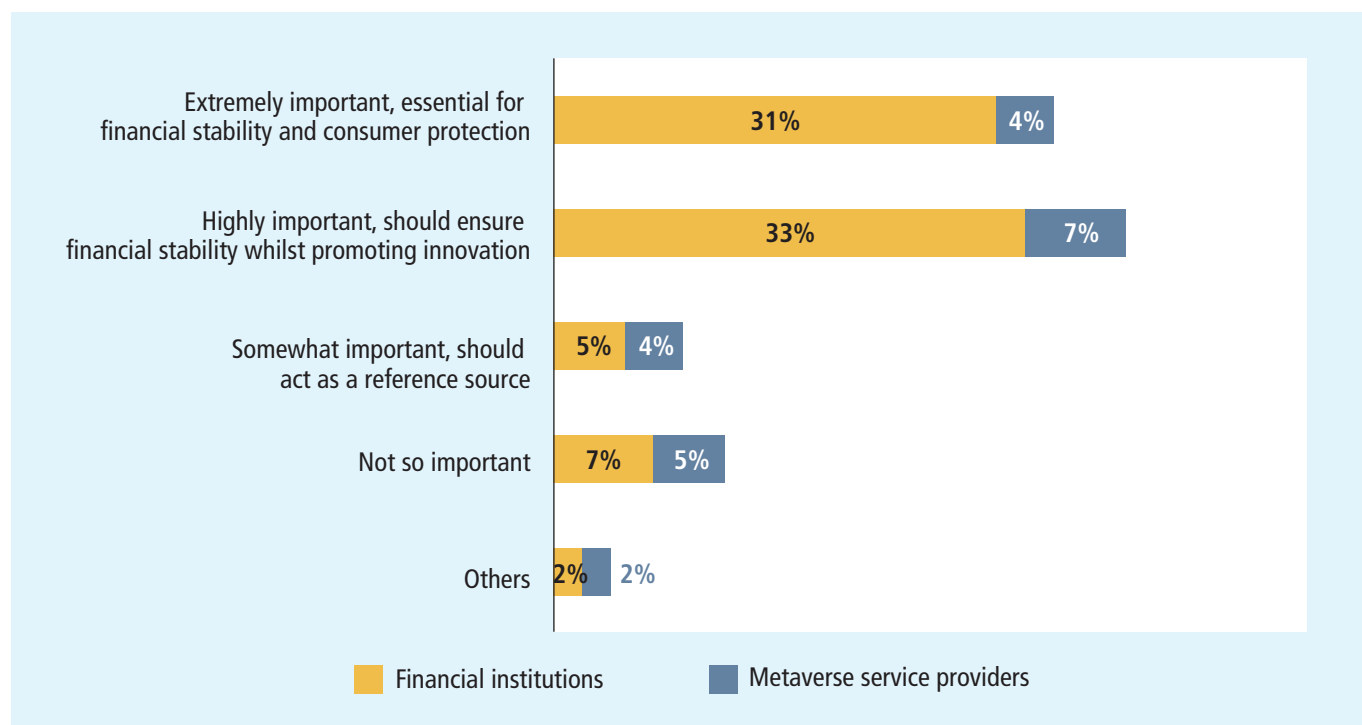
- The market participants identified several key aspects of the metaverse that can gain from enhanced regulation and governance, including cybersecurity and data privacy, financial transactions and user safety and well-being. The need to address aspects of intellectual property rights, content moderation and a code of conduct within the metaverse environment was also acknowledged.
- Regulators and policymakers in some jurisdictions have taken steps to develop regulatory proposals and supervisory guidance to oversee and promote metaverse development. In general, they have placed emphases on four key areas, namely user safety and well-being, intellectual property rights, cybersecurity and data privacy and financial transactions.
- In Hong Kong, although there are no specific regulatory initiatives targeting the metaverse, current regulatory efforts have been made on regulating virtual asset-related activities. These activities play a crucial role within the metaverse ecosystem in promoting responsible and sustainable development of the digital landscape in the city.

Regulatory developments are of strategic importance in maintaining a fair and safe environment to facilitate metaverse adoption among financial institutions. In this chapter, we present valuable insights from market participants on the essential regulatory aspects of the metaverse, focusing on promoting its healthy development. We also examine international and Hong Kong-specific regulatory initiatives in relevant fields to provide a comprehensive understanding of the current regulatory landscape.

### 4.1. KEY REGULATING AREAS FOR ENSURING HEALTHY METAVERSE DEVELOPMENT

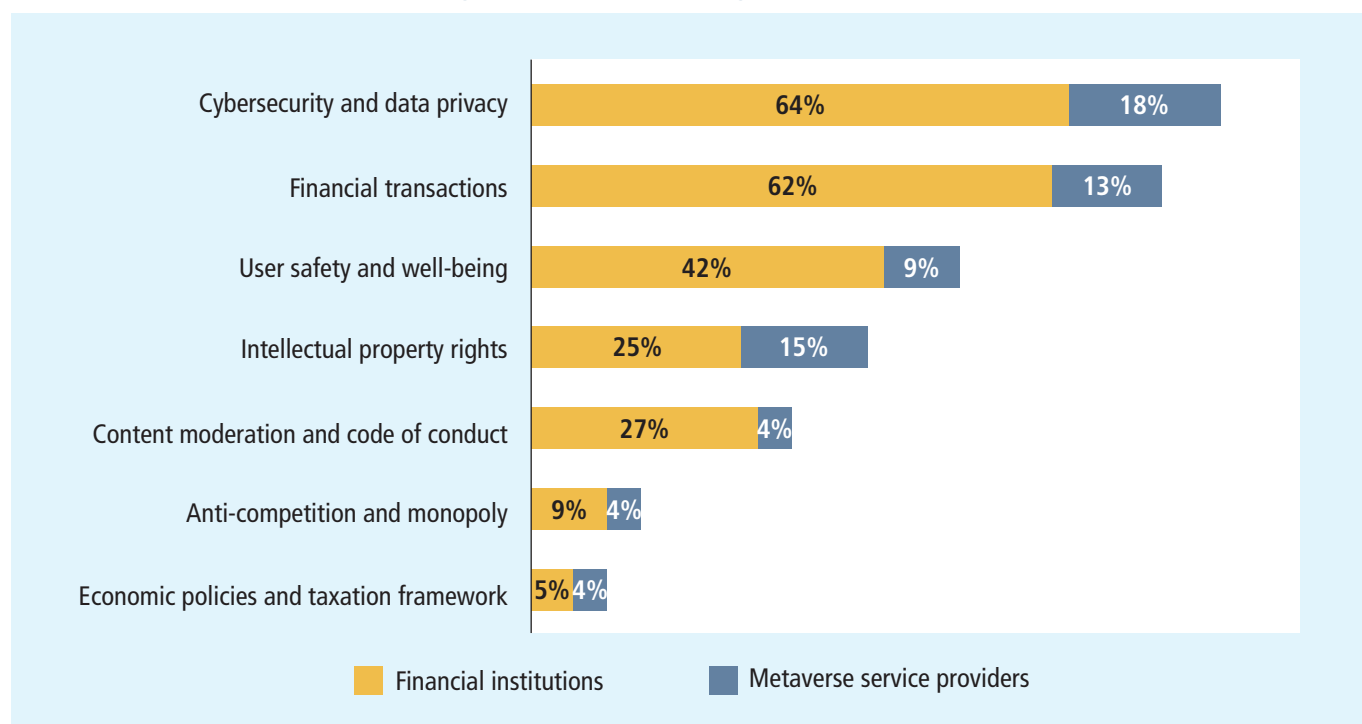
From a supervisory perspective, the majority of the survey respondents acknowledged that it is extremely (35%) or highly important (40%) to integrate traditional financial regulatory measures into the metaverse industry (Chart 4.1). This integration is crucial for addressing emerging risks and challenges whilst ensuring a robust culture of innovation and maintaining a fair and equitable playing field in the industry. They also conveyed that it is crucial to maintain the stability of the financial system, ensure market integrity and safeguard consumers amidst the evolving landscape of financial services.

**Chart 4.1: Importance of traditional financial regulation in guiding metaverse development**



Source: HKIMR staff compilation based on the Metaverse Survey.

Chart 4.2: Critical domains for governance and regulation of the metaverse



Source: HKIMR staff compilation based on the Metaverse Survey.

The Metaverse Survey also sought input from financial institutions and metaverse service providers regarding the crucial aspects required for regulating and governing the metaverse in order to facilitate its healthy and sustainable development. The survey results revealed that the key areas of concern most frequently highlighted by the market participants included cybersecurity, and data privacy (82%), financial transactions (75%), and user safety and well-being (51%) (Chart 4.2). Some of the survey respondents noted the significance of intellectual property rights, content moderation, and a code of conduct within the metaverse environment. These findings emphasised the need to address these key areas to ensure responsible and secure use of the metaverse.

### Cybersecurity and data privacy

A significant majority (82%) of the respondents identified the need for regulations and governance pertaining to cybersecurity and data privacy in the metaverse. The construction and operation of the metaverse involves the use of diverse technologies, thereby creating additional access points that can be targeted by cyber attackers. One notable area of concern lies in the vulnerabilities present in headsets and software protocols, which pose elevated cybersecurity risks. With persistency becoming a possible feature of the metaverse, the ever-increasing amount of data in the virtual environment may also exacerbate issues concerning cybersecurity. These risks heighten the potential for data breaches, including the theft of users' metaverse identities and payment information.<sup>45</sup>

<sup>45</sup> For example, in 2022, the accounts of 17 users in the OpenSea NFT marketplace were hacked due to smart contract flaws and phishing attacks, resulting in US\$1.7 million in losses. More information can be found at: <https://markets.businessinsider.com/news/currencies/nft-opensea-hack-phishing-stolen-millions-smart-contract-crypto-attack-2022-2>.

The immersive nature of the metaverse further compounds these challenges, as it necessitates the collection of users' biometric information at a more granular level. This development introduces new complexities to data privacy, such as the potential for intrusive surveillance of users' personalities, physical traits and surroundings.<sup>46</sup>

### Financial transactions

A majority of the respondents (75%) emphasised the significance of addressing threats to financial transactions in the governance of the metaverse, particularly for financial institutions adopting crypto-assets such as NFTs, cryptocurrencies and stablecoins for investment or payment purposes in the metaverse. For instance, NFTs are highly susceptible to counterfeiting and wash trading,<sup>47</sup> allowing criminals to create fake copies of NFTs or manipulate transactions through controlled addresses.<sup>48</sup> Users also face a growing risk of scams related to crypto-assets, leading to significant financial losses.<sup>49</sup> Similar risks exist in the use of cryptocurrencies and stablecoins. Considering the prevalence of illicit activities, crypto-assets carry high levels of risk and volatility, making them susceptible to misuse by criminals in terms of fraudulent activities, money laundering and terrorist financing.

The increasing involvement of financial institutions and the general public in crypto-assets within the metaverse can increase the link between the traditional financial system and the crypto-asset ecosystem, thereby amplifying the risks to financial

stability primarily attributed to the high volatility observed in crypto-asset prices. The 2023 International Monetary Fund report underscores that sharp declines in crypto-asset prices can erode investor net worth and result in profit losses for exposed financial institutions, which can impact traditional asset prices, investor confidence and the broader financial system.<sup>50</sup> Taking into consideration the risks involved in the crypto-assets activities, various international organisations have set out recommendations aimed at fostering coordinated and consistent regulation, supervision and oversight of crypto-assets across jurisdictions.<sup>51</sup>

The results of the interviews supported the survey findings. Several of the interviewees from the banking and insurance sectors expressed concerns about the risks and volatility associated with NFTs and cryptocurrencies that have not yet been fully explored or understood. As a result, they adopted a cautious approach towards crypto-assets and related transactions in the metaverse space.

### User safety and well-being

User safety and well-being within the metaverse was a priority of the utmost importance for 51% of the respondents. The metaverse, while offering new opportunities, also brings forth potential risks to its users' safety. Instances of abuse, verbal harassment, and exploitation perpetrated by avatars within the virtual realm are among the user safety issues associated with the metaverse.

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<sup>46</sup> World Economic Forum (2024).

<sup>47</sup> Risks associated with these criminal activities are amplified by the permissionless and pseudonymous nature of blockchain. 'Pseudonymous' means that users' physical identities remain anonymous, while their account activities and transactions are visible and traceable. More information can be found at: Organisation for Economic Co-operation and Development (2019)

<sup>48</sup> For example, in January 2022, OpenSea NFT marketplace admitted that over 80% of the items created with the shared storefront contract on its platform were plagiarised, fake or spam. At the same time, it was found that 94% of the weekly transaction value was wash traded in one of the popular NFT collections on another NFT marketplace, LooksRare. More information can be found at: <https://www.dpreview.com/news/5284763122/opensea-admits-at-least-80-percent-of-nfts-hosted-on-its-platform-are-plagiarized-or-knock-offs>; <https://forkast.news/wash-trading-nft-looksrare-inflate-prices-analyst/>.

<sup>49</sup> One of the most common types of scams is the 'rug pull', where the creators of a project hype it up and then suddenly stop backing the project, leading to losses for buyers who have a stake in the project. For example, the Frosties Freeze NFT rug pull scam in January 2022 is estimated to have made over US\$1.3 million from buyers before the creators disappeared from the ecosystem. More information can be found at: <https://coingeek.com/frosties-nft-2-charged-in-us-over-1-3m-rug-pull/>.

<sup>50</sup> International Monetary Fund (2023).

<sup>51</sup> For example, more information can be found at: Financial Action Task Force (2021), Basel Committee on Banking Supervision (2022), Financial Stability Board (2023), International Organization of Securities Commissions (2023).

The metaverse can also have adverse effects on users' mental and physical health. For example, excessive engagement in the metaverse can contribute to a heightened sense of social isolation, with potential ramifications for mental health conditions such as anxiety and depression. Prolonged immersion in the metaverse can also lead to a decrease in physical activities, which, in turn, may give rise to physical health problems.<sup>52</sup>

### Intellectual property rights

The importance of addressing the risks associated with intellectual property rights when establishing governance frameworks for the metaverse was acknowledged by 40% of the respondents. This issue emerged as the second most frequently mentioned concern among the surveyed metaverse service providers.

As a notable example, the potential for mass production of NFTs introduces risks that can lead to violations of intellectual property rights. For instance, an unauthorised user can easily create NFTs representing digital works that are identical or substantially similar to real-life creations, thereby potentially infringing upon trademarks. It is crucial to recognise that, in most cases, an NFT represents ownership of a unique copy of the original creation rather than ownership of the original creation itself. However, purchasers of NFTs can readily illegally duplicate their digital copy to generate additional NFTs for sale without the permission of the creator, thereby infringing on the creator's copyrights.

### Content moderation and code of conduct

A notable portion (31%) of the respondents recognised the significance of regulating and governing content moderation and establishing a code of conduct within the metaverse. Content moderation plays a crucial role in ensuring user safety by detecting and addressing potential threats posed

by harmful contents. It is also essential to combat the dissemination of misleading or false information, which can be magnified within the metaverse. For instance, the presence of misleading advertisements within the metaverse can heighten the risk of consumer exploitation, necessitating robust content moderation measures to protect users.

The metaverse also has the potential to exacerbate misconduct by entities and users, including collusive and unethical behaviours. This emphasises the importance of establishing a comprehensive code of conduct to govern the metaverse effectively. A well-defined code of conduct can provide clear guidelines and standards for acceptable behaviour, promoting a safe and ethical metaverse environment for all participants.

## 4.2. REGULATORY INITIATIVES FOR METAVERSE DEVELOPMENT ACROSS JURISDICTIONS

In light of the aforementioned risks, regulators and policymakers across a number of jurisdictions have taken steps to develop regulatory proposals and supervisory guidance to oversee and promote metaverse development (Table 4.1). Various provinces of Mainland China have published a range of measures to foster the development of the metaverse industry. For example, in February 2022, Beijing's Tongzhou government published eight measures to guide the development of the metaverse industry, encourage the development of consistent metaverse standards, and monitor compliances.<sup>53</sup> In March 2022, the Xiamen government announced the three-year action plan for the development of the metaverse industry 2022–2024, which includes a focus on the development of governance and regulatory policies applicable to the metaverse.<sup>54</sup> The Guangzhou Huangpu District and Guangzhou Development Zone also jointly issued the ten metaverse measures in April 2022 to promote innovation and talent development in the metaverse industry within the Guangdong–Hong Kong–Macao Greater Bay Area.<sup>55</sup> These initiatives take into

<sup>52</sup> Kim and Kim (2023).

<sup>53</sup> 關於加快北京城副中心元宇宙創新引領發展若干措施 available at: [www.bjtz.gov.cn/bjtz/xxfb/202203/1515469.shtml](http://www.bjtz.gov.cn/bjtz/xxfb/202203/1515469.shtml).

<sup>54</sup> 廈門市元宇宙產業發展三年行動計畫 (2022-2024年), available at: [www.hnzm.vip/policy/content/3463](http://www.hnzm.vip/policy/content/3463).

<sup>55</sup> 廣州市黃埔區 廣州開發區促進元宇宙創新發展辦法, available at: [www.hp.gov.cn/gzjg/qzfgwhgzbm/qgyhxxhj/xxgk/content/post\\_8171935.html](http://www.hp.gov.cn/gzjg/qzfgwhgzbm/qgyhxxhj/xxgk/content/post_8171935.html).

consideration the establishment of a prudent and inclusive regulatory mechanism, while emphasising the importance of enhancing the governance system and promoting self-discipline among stakeholders in the metaverse space.

Regulators and policymakers in some jurisdictions have taken steps to develop regulatory proposals and supervisory guidance to oversee and promote the metaverse development.

Similarly, in South Korea, the Ministry of Science and ICT (MSIT) released a draft concerning ethical principles for the metaverse in August 2022 and disclosed plans for new metaverse regulations in September 2022 to differentiate between the metaverse and video game contents.<sup>56</sup> More recently, the European Commission (EC) solicited public comments and issued an initiative focusing on Web 4.0<sup>57</sup> and virtual worlds in July 2023, setting out the EU’s vision, strategy and upcoming implementation measures and regulatory updates.<sup>58</sup>

Table 4.1: Examples of metaverse-specific regulatory initiatives across jurisdictions

Jurisdiction	Regulatory Initiative	Description
EU	EU initiative on Web 4.0 and virtual worlds (2023)	Vision and strategic actions on Web 4.0 and virtual worlds to steer the next technological transition and ensure an open, secure, trustworthy, fair and inclusive digital environment
Japan	Amendments to intellectual property laws (2023)	Amendments to cover digital intellectual property violations
Mainland China (Beijing)	Eight measures to attract metaverse industry development in Beijing (2022)	Combination of measures to support the construction of the digital ecosystem in Beijing
Mainland China (Guangzhou)	Guangzhou Huangpu District and Guangzhou Development Zone measures for promoting metaverse innovation and development (2022)	Measures to oversee and promote innovation and development of the metaverse
Mainland China (Xiamen)	Three-year action plan for the development of the metaverse industry 2022–2024 (2022)	Actions in five key areas aimed at fostering the development of key enterprises with metaverse-related technologies and accelerate metaverse industry development

<sup>56</sup> MSIT (2022).

<sup>57</sup> The EC defined ‘Web 4.0’ as the expected fourth generation of the World Wide Web. Using advanced artificial and ambient intelligence, the IoT trusted blockchain transactions, virtual worlds and XR capabilities, digital and real objects and environments are fully integrated and communicate with each other, enabling truly intuitive, immersive experiences, seamlessly blending the physical and digital worlds.

<sup>58</sup> EC (2023).

Jurisdiction	Regulatory Initiative	Description
South Korea	Draft of ethical principles for the metaverse (2022)	Ethical guidelines focused on promoting user expression and self-identity, safe enjoyment and sustainable prosperity in the metaverse space
	Metaverse ecosystem user protection policy promotion team (2022)	Rules facilitating discussions and preparations of user protection policies for the healthy development of the metaverse
Spain	The metaverse and privacy (2022)	Guidance for data processing and data privacy issues in the use of the metaverse
United Arab Emirates (Dubai)	MetaHQ (2022)	Setup of a Virtual Assets Regulatory Authority (VARA) headquarters in the metaverse enabling the creation of a prototype regulatory model and facilitating collaborative engagement between stakeholders
United Kingdom	Online safety bill (2023)	Proposal for a new set of laws to protect people on online platforms including the metaverse space

Source: HKIMR staff compilation.

Regulators have placed significant importance on four key areas in overseeing metaverse activities, namely user safety and well-being, intellectual property rights, cybersecurity and data privacy, and financial transactions.

### User safety and well-being

Regulatory initiatives have been rolled out in various jurisdictions to enhance user safety and well-being, such as by combating virtual sexual violations and monitoring metaverse content that spreads misinformation or incites violence. For example, the Korea Communications Commission (KCC) launched a policy promotion team in January 2022 and declared plans to prepare a metaverse user protection policy in September 2022, including basic principles for user protection based on cooperative self-regulation in South Korea.<sup>59</sup> In the United Kingdom, the online

safety bill was approved by the Houses of Parliament in September 2023. The law applies to online platforms, including the metaverse, and seeks to ensure that platform providers are held accountable for the content they host. The goal of the bill is to protect users' mental health and to protect children from harmful and illegal content.<sup>60</sup>

### Intellectual property rights

Policymakers and regulators have also placed emphasis on the protection of intellectual property rights in the metaverse space. In Mainland China, policymakers revealed measures in February 2022 to strengthen the protection of and standardise regulations related to intellectual property rights, such as helping enterprises establish a metaverse-related intellectual property database and create national and international metaverse standards.<sup>61</sup> Furthermore, in

<sup>59</sup> KCC (2022).

<sup>60</sup> Department for Science, Innovation and Technology, and Donelan (2023).

<sup>61</sup> 關於加快北京城副中心元宇宙創新引領發展若干措施, available at: [www.bjtz.gov.cn/bjtz/xxfb/202203/1515469.shtml](http://www.bjtz.gov.cn/bjtz/xxfb/202203/1515469.shtml).

June 2023, Japan authorised amendments to six intellectual property laws, including an amendment to the unfair competition prevention law that prohibits the sale or transfer of counterfeit products in digital spaces such as the metaverse.<sup>62</sup>

### Cybersecurity and data privacy

To protect against threats to cybersecurity and data privacy in the metaverse, regulators have highlighted the significance of regulation and governance of information dissemination and data processing. For example, in June 2022, the Spanish Data Protection Authority circulated guidance for data processing and data privacy issues in connection with the metaverse. In July 2023, the EC also disclosed plans to create a toolbox on various related aspects, notably covering the use of digital identity and digital wallet solutions for authentication, cybersecurity, and data protection and privacy.

### Financial transactions

Financial transactions in the metaverse, especially those related to crypto-assets, have the potential to facilitate unlawful activities and threaten financial stability across the wider financial system. This underscores the importance of relevant regulatory development in this area. In Dubai, the VARA was established in 2022 as a financial services regulator responsible for regulating the virtual assets sector. In May 2022, VARA announced the setup of 'MetaHQ', or headquarters in the metaverse, which aims to facilitate international cooperation in the creation of a virtual assets regulatory model to shape a safe and sustainable virtual economy.<sup>63</sup>

## 4.3 REGULATORY INITIATIVES RELEVANT TO METAVERSE DEVELOPMENT IN HONG KONG

In Hong Kong, although there are no specific regulatory initiatives targeting the metaverse, current regulatory efforts have been made in regards to virtual asset-related activities, which play a crucial role within the metaverse ecosystem in promoting responsible and sustainable development of the digital landscape in the city. More details can be found in Table 4.2.

**Efforts have been made in Hong Kong to regulate virtual asset-related activities, which play a crucial role within the metaverse ecosystem.**

As set out in the policy statement on development of virtual assets in Hong Kong in October 2022, the Government has acknowledged the potential presence of future opportunities as virtual assets move into the areas of Web3 and the metaverse. The statement also emphasised the Government's focus on the implementation of a risk-based, prudent regulatory approach, guided by the principle of 'same activity, same risk, same regulation' and drawing on relevant international standards for reference.<sup>64</sup> Such regulatory developments aim to encourage financial innovation whilst putting in place timely and sound guardrails to protect investors, especially from the risks posed by highly speculative virtual assets, thereby instilling public trust in Hong Kong's digital ecosystem.

<sup>62</sup> More information can be found at: <https://harakenzo.com/cgi-bin/newsmnt/article.cgi?lang=e&id=03795>.

<sup>63</sup> Government of Dubai (2022).

<sup>64</sup> FSTB (2022); FSTB (2024).

Financial regulators in Hong Kong have continuously made progress on setting out their regulatory approaches towards virtual assets. Since 2017, the Securities and Futures Commission (SFC) has issued a number of statements and circulars to clarify that virtual assets classified as “securities” or “futures contracts” under the definition in the Securities and Futures Ordinance (SFO) would constitute a “regulated activity” subject to the SFC’s regulatory remit.<sup>65</sup> To further strengthen virtual asset investor protection, the SFC published a statement in November 2018 to extend its regulatory approach for virtual asset portfolio managers and fund distributors, irrespective of whether such virtual asset-related activities fall under the definition of “securities” or “futures contracts”. The statement also set out a conceptual framework for the potential regulation of virtual asset trading platforms.<sup>66</sup> Following the statement, the SFC has taken a series of actions to examine the various aspects of regulating virtual asset trading platforms.<sup>67</sup> In November 2019, the SFC’s position paper set out the establishment of an opt-in licensing framework for centralised virtual asset trading platforms trading virtual assets that fall within the SFC’s regulatory oversight.<sup>68</sup>

In January 2022, the Insurance Authority (IA) released a circular on regulatory approaches in relation to virtual assets and virtual asset service providers, which provides guidance on pertinent issues that authorised insurers should take into account when they have involvement or interaction with virtual asset-related activities.<sup>69</sup> In December 2022, the Anti-Money Laundering and

Counter-Terrorist Financing Ordinance was amended to introduce a new licensing regime for virtual asset service providers administered by the SFC.<sup>70</sup> In November 2023, the SFC issued two circulars to provide guidance to the industry on tokenised securities-related activities and tokenisation of SFC-authorised investment products. In these circulars, the SFC emphasised how traditional financial institutions should address and manage the risks arising from tokenisation.<sup>71</sup>

Since January 2022, the SFC and the Hong Kong Monetary Authority (HKMA) have issued a series of joint circulars to provide guidance to intermediaries engaging in virtual asset-related activities.<sup>72</sup> In December 2023, the SFC and the HKMA further updated the joint circular on intermediaries’ virtual asset-related activities, which sets out the investor protection measures applicable to intermediaries for the distribution of virtual asset-related products,<sup>73</sup> including virtual asset funds<sup>74</sup> authorised by the SFC,<sup>75</sup> and provision of dealing, advisory and asset management services in respect of virtual assets. The HKMA and the Financial Services and the Treasury Bureau (FSTB) also jointly issued a public consultation paper on the legislative proposal to regulate stablecoin issuers. This indicates a new licensing regime for fiat-referenced stablecoin<sup>76</sup> (FRS) issuers, the expected regulatory scope, key regulatory, supervisory and enforcement parameters to address the potential monetary and financial stability risks posed by FRS in line with the international standards.<sup>77</sup>

<sup>65</sup> For more information, please refer to Table 4.2.

<sup>66</sup> SFC (2018c).

<sup>67</sup> The SFC met with virtual asset trading platform operators to discuss their businesses and explain the SFC’s regulatory expectations. Having examined in depth the technical, operational and other aspects of virtual asset trading, the SFC has concluded that some types of centralised platforms trading security and non-security tokens would be suitable to be regulated under the framework set out in the SFC’s position paper issued in November 2019.

<sup>68</sup> SFC (2019).

<sup>69</sup> IA (2022).

<sup>70</sup> More information can be found at: <https://www.info.gov.hk/gia/general/202212/07/P2022120700263.htm>

<sup>71</sup> SFC (2023a); SFC (2023b).

<sup>72</sup> For more information, please refer to Table 4.2.

<sup>73</sup> See Appendix B for definition of ‘virtual asset-related product’.

<sup>74</sup> See Appendix B for definition of ‘virtual asset fund’.

<sup>75</sup> HKMA and SFC (2023b).

<sup>76</sup> Fiat-referenced stablecoin refers to a stablecoin that references the value of one or more fiat currencies.

<sup>77</sup> HKMA and FSTB (2023).

In February 2024, the Government launched a public consultation on legislative proposals to introduce a licensing regime for providers of over-the-counter trading services of virtual assets, which can support virtual asset over-the-counter trading services providers to effectively mitigate the money laundering and terrorist financing risks of the relevant virtual asset activities.<sup>78</sup> During the same month, the HKMA issued guidance on the supervisory standards for provision of digital asset custodial services<sup>79</sup> as well as sale and distribution of tokenised products,<sup>80</sup> with a view to providing banking customers with the same protection as in traditional banking services. In March 2024, the HKMA announced the establishment of sandbox arrangement for stablecoin issuers to test out the feasibility of their intended business models. The aim of this initiative is to communicate supervisory

expectations and guidance to institutions that plan to issue FRS in Hong Kong and obtaining feedback from sandbox participants on the proposed regulatory requirements.<sup>81</sup>

Furthermore, as DLT is an important component in the virtual asset ecosystem and in support of DLT adoption in the city, the HKMA issued a circular on risk management considerations related to the use of DLT in April 2024. The circular specifies the key risk management considerations that authorised institutions are encouraged to take into account when developing and adopting DLT solutions.<sup>82</sup> These regulatory developments in the virtual assets space can generate a conducive and favourable environment for the healthy development of the metaverse industry in Hong Kong.<sup>83</sup>

Table 4.2: Metaverse-related regulatory initiatives in Hong Kong

Regulatory initiative in Hong Kong	Description
Statement on initial coin offerings (2017) <sup>84</sup>	Statement to make clear that, depending on the facts and circumstances of an initial coin offering, digital tokens that are offered or sold may be “securities” as defined in the SFO, and subject to the securities laws of Hong Kong
Circular to licensed corporations and registered institutions on Bitcoin futures contracts and cryptocurrency-related investment products (2017) <sup>85</sup>	Circular to remind intermediaries of the legal and regulatory requirements for providing financial services relating to Bitcoin futures contracts and other cryptocurrency-related investment products, which constitute a “regulated activity” under the SFO
SFC warns of cryptocurrency risks (2018) <sup>86</sup>	Announcement to alert investors of the potential risks of dealing with cryptocurrency exchanges and investing in initial coin offerings

<sup>78</sup> More information can be found at: <https://www.info.gov.hk/gia/general/202402/08/P2024020800238.htm>

<sup>79</sup> HKMA (2024a).

<sup>80</sup> HKMA (2024b).

<sup>81</sup> HKMA (2024c).

<sup>82</sup> HKMA (2024d).

<sup>83</sup> For more information on relevant regulatory developments, please refer to the HKIMR’s report: HKIMR (2024).

<sup>84</sup> SFC (2017a).

<sup>85</sup> SFC (2017b).

<sup>86</sup> SFC (2018a).

Regulatory initiative in Hong Kong	Description
<b>Circular to intermediaries on compliance with notification requirements (2018)<sup>87</sup></b>	Circular on the notification requirements under the Securities and Futures (Licensing and Registration)(Information) Rules if intermediaries intend to provide trading and asset management services involving crypto-assets
<b>Statement on regulatory framework for virtual asset portfolios managers, fund distributors and trading platform operators (2018)</b>	Guidance on the regulatory standards expected of virtual asset portfolio managers and fund distributors, and announcement of a conceptual framework for the potential regulation of virtual asset trading platforms
<b>Position paper: Regulation of virtual asset trading platforms (2019)</b>	Opt-in licensing framework for virtual asset trading platforms under the SFC's power pursuant to the Securities and Futures Ordinance
<b>Joint circular on intermediaries' virtual asset-related activities (2022)<sup>88</sup></b>	Guidance to intermediaries engaging in tokenised securities-related activities, with a focus on addressing and managing new risks arising from the use of this new tokenisation technology
<b>Regulatory approaches of the Insurance Authority in relation to virtual assets and virtual asset service providers (2022)</b>	Guidance on the pertinent issues that authorised insurers should take into account on activities relating to virtual assets and virtual asset service providers
<b>Policy statement on development of virtual assets in Hong Kong (2022)</b>	The Government's policy stance and approach towards developing a vibrant sector and ecosystem for virtual assets in Hong Kong
<b>Anti-money laundering and counter-terrorist financing (amendment) ordinance (2022)</b>	New licensing regime for virtual asset service providers administered by the SFC
<b>Joint circular on intermediaries' virtual asset-related activities (2023a)<sup>89</sup></b>	Further guidance to intermediaries on client deposits and withdrawals of virtual assets and distribution of SFC- authorised virtual asset spot exchange-traded funds
<b>Circular on intermediaries engaging in tokenised securities-related activities (2023)</b>	Guidance to intermediaries engaging in tokenised securities-related activities, with a focus on managing and addressing new risks arising from the use of this new tokenisation technology
<b>Circular on tokenisation of SFC- authorised investment products (2023)</b>	Requirements for offering tokenised SFC- authorised investment products to the public in Hong Kong

<sup>87</sup> SFC (2018b).

<sup>88</sup> HKMA and SFC (2022).

<sup>89</sup> HKMA and SFC (2023a).

Regulatory initiative in Hong Kong	Description
Joint circular on intermediaries' virtual asset-related activities (2023b)	Further guidance to intermediaries that engage in virtual asset-related activities to set out the investor protection measures applicable to intermediaries for the distribution of virtual asset-related products, including virtual asset funds authorised by the SFC, and provision of dealing, advisory and asset management services in respect of virtual assets
Legislative proposal to implement regulatory regime for stablecoin issuers (2023)	Proposed licensing regime for FRS issuers, expected regulatory scope, key regulatory parameters and requirements for regulating the issuance of FRS
Public consultation on legislative proposals to regulate over-the-counter trading of virtual assets (2024)	Public consultation on legislative proposals to introduce a licensing regime for providers of over-the-counter trading services of virtual assets
Provision of custodial services for digital assets (2024)	Guidance on provision of digital asset custodial services by authorised institutions <sup>90</sup> and subsidiaries of locally incorporated authorised institutions
Sale and distribution of tokenised products (2024)	Supervisory standards expected of authorised institutions in the sale and distribution of tokenised products to their customers
Stablecoin issuer sandbox (2024)	Initiative to allow sandbox participants to test out their intended business models within a risk-controlled environment and provide feedback on the proposed regulatory requirements
Risk management considerations related to the use of DLT (2024)	Guidance on key risk management considerations to the use of DLT by authorised institutions

#### 4.4 MARKET PARTICIPANTS' VIEW ON INITIATIVES SUPPORTING THE REGULATORY DEVELOPMENTS PERTAINING TO THE METAVERSE

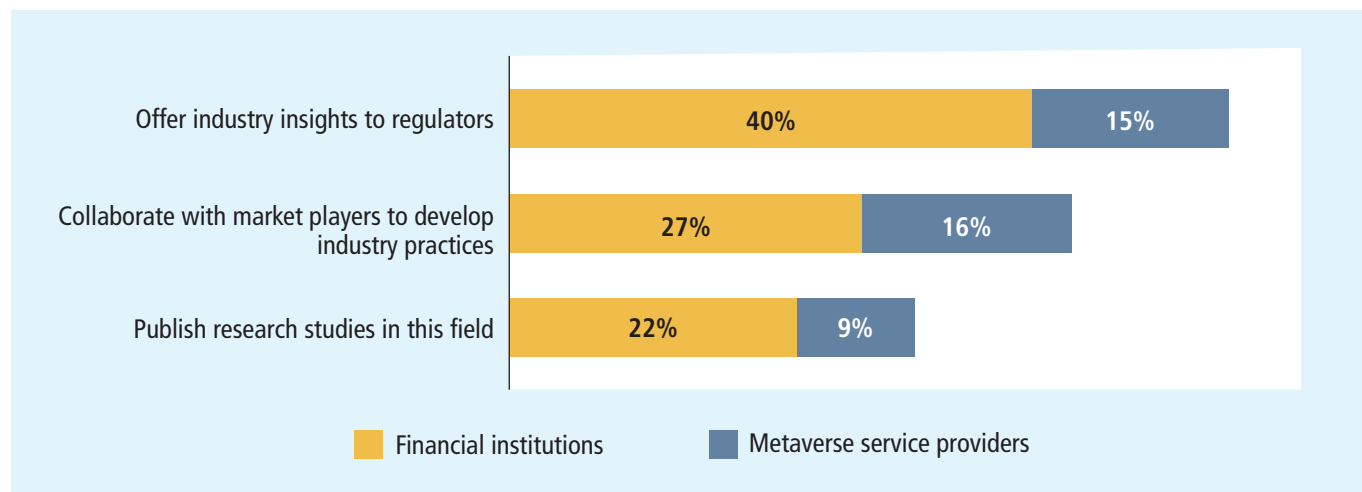
In addition, the Metaverse Survey solicited opinions from financial institutions and metaverse service providers regarding the initiatives that their company

can contribute to the development of regulations pertaining to the metaverse. The top three essential actions identified by the survey respondents include offering industry insights to regulators (55%), collaborating with market players to develop industry practices (43%) and publishing research studies in this field (31%) (Chart 4.3).

Consistent with these findings, the interviewees noted the significance of fostering an open dialogue between

<sup>90</sup> As defined in the Banking Ordinance (Cap. 155 of Hong Kong Laws), authorised institution means a bank, a restricted licence bank or a deposit-taking company.

**Chart 4.3 The top 3 initiatives that market participants believed they could contribute to the development of metaverse-related regulations**



Source: HKIMR staff compilation based on the Metaverse Survey.

regulators and financial institutions. They emphasised that such communication and knowledge sharing could support a fair and conducive regulatory regime, thereby improving regulatory compliance and enhancing the metaverse market's development. The interviewees commented on the importance of closer regulatory cooperation between Hong Kong and other jurisdictions to align metaverse-related standards. Such cooperation can resolve potential regulatory gaps and ensure consistent enforcement, enabling financial institutions to confidently engage in cross-border metaverse-related activities while adhering to relevant regulations in their own jurisdictions.

The financial institutions emphasised the significance of jurisdictions joining forces to cultivate foundational standards and industry practices for the metaverse in various aspects, such as cybersecurity and payment systems. These collaborative efforts would promote transparency and efficiency within the metaverse ecosystem. Financial institutions can contribute to shaping the regulatory landscape by publishing research reports on metaverse-related topics. Such reports serve as valuable resources that offer insights into the latest developments in the metaverse and help bridge the perception gap surrounding this emerging technology. Therefore, in publishing them,

financial institutions can play a vital role in facilitating informed regulatory decision-making.

A notable example of this involves the Institute of Web 3.0 Hong Kong, which has set up multiple work streams to support regulatory developments in the Web3 space in Hong Kong. The institute includes a dedicated working group focused on policymaking that liaises with the government and provides expertise on Web3 initiatives. It also has a working group focused on promotion, responsible for publishing reports and other educational content to enlighten the market about Web3. Through these concerted efforts, the Institute of Web 3.0 Hong Kong actively contributes to the regulatory discourse and market education surrounding this technology.

The following chapter studies strategies that can facilitate the healthy development of the metaverse within Hong Kong's financial services industry. It explores the roles of different stakeholders in creating an environment that nurtures innovation while also effectively mitigating relevant risks. Through a comprehensive examination of these strategies, the chapter aims to provide valuable insights into establishing a sustainable metaverse ecosystem in the financial services industry.

# Chapter 5

## Looking into the Future

### Considerations for sustainable metaverse development and integration

#### HIGHLIGHTS:

- According to the market participants, Hong Kong has several key competitive advantages in the development of the metaverse ecosystem, including the defined legal and regulatory framework, business-friendly environment, and robust financial infrastructure and network. Hong Kong's strategic location, connectivity, bilingual environment, and trade system are additional strengths that attract metaverse stakeholders.
- Based on our survey and the experience of other jurisdictions, this report proposes certain considerations to ensure a sound and orderly integration of the metaverse into the financial services industry in Hong Kong. These considerations include nurturing talents and fostering innovative entrepreneurship, and supporting technology and digital infrastructure developments. Increasing knowledge about the metaverse and fostering collaborations among stakeholders and across jurisdictions are also essential to this endeavour. Other considerations include adapting the relevant regulatory framework to keep in view of the latest developments and establishing well-defined corporate governance structures for metaverse adoption within financial institutions.

With respect to the risks and challenges involved in metaverse adoption, financial institutions and regulators in Hong Kong can play a key role in addressing these challenges and contributing to the healthy development of the metaverse in the city's financial services industry. This chapter first provides a brief overview of market participants' views on the prospects for the metaverse in Hong Kong and their opinions on initiatives to nurture talents and ensure the metaverse's sustainable and orderly integration into the city's financial services industry. Finally, this chapter puts forth various considerations for financial institutions and regulators to promote the healthy progression of the metaverse in Hong Kong's financial services industry.

## 5.1. PROSPECTS FOR THE METAVERSE IN HONG KONG

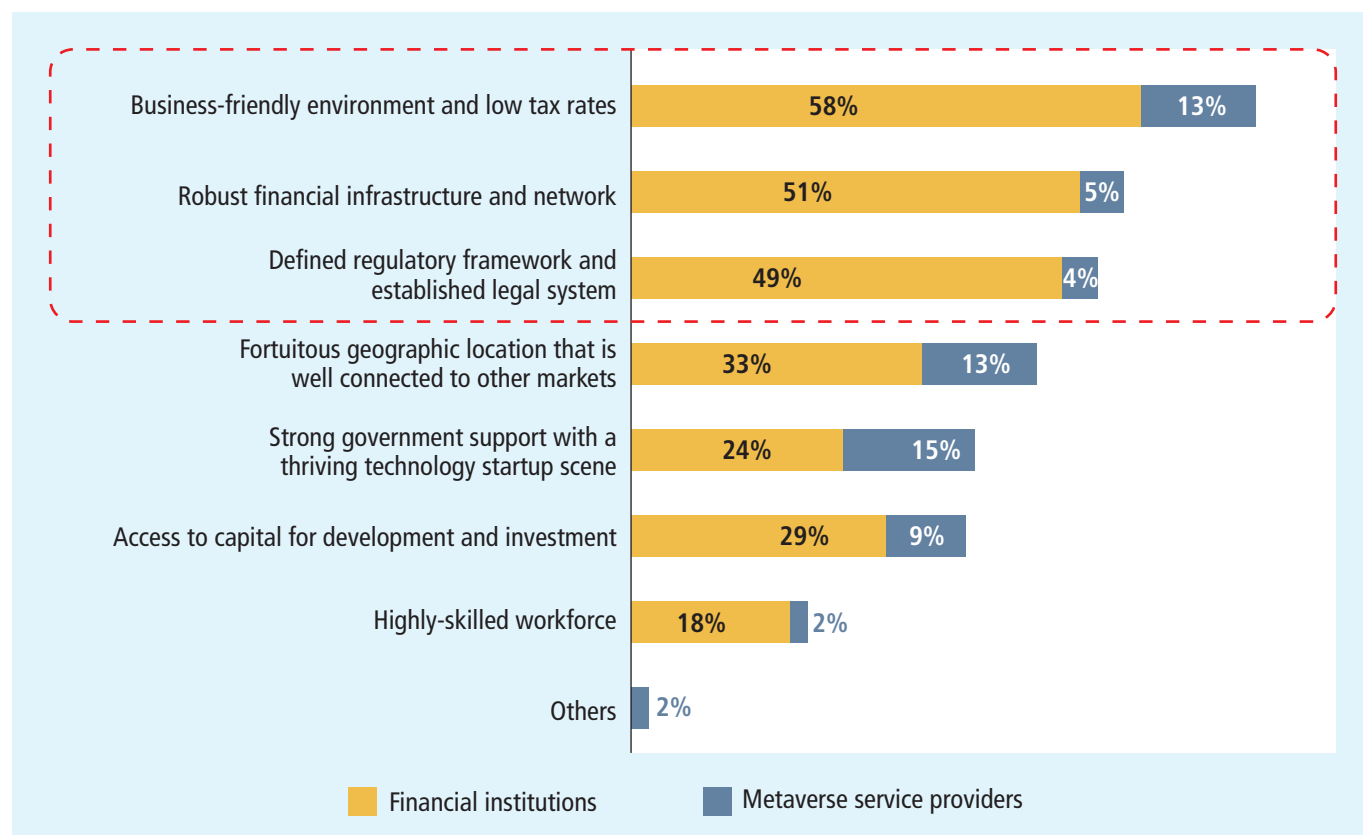
When queried about the competitive advantages of Hong Kong in terms of metaverse development, 71% of the respondents cited the business-friendly

environment and low tax rates as crucial factors (Chart 5.1). Furthermore, 56% of the respondents noted the presence of a robust financial infrastructure and network, while 53% emphasised the significance of a defined regulatory framework and an established legal system.

These survey findings were corroborated by insights from the interviews. Many of the interviewees recognised Hong Kong's reputation as a prominent city for investment and wealth creation and Hong Kong's unique advantage as the primary gateway to Mainland China. The interviewees highlighted the city's well-established financial ecosystem, free trade system and low tax regime, all underpinned by a robust legal and regulatory framework. These strengths are further amplified by Hong Kong's bilingual environment, encompassing both Chinese and English.

The interviewees disclosed that the strengths of Hong Kong were further enhanced by recent developments such as the establishment of the

**Chart 5.1: Key competitive advantages of Hong Kong**



Source: HKIMR staff compilation based on the Metaverse Survey.

Institute of Web 3.0 Hong Kong<sup>91</sup> and the government's supportive stance towards the responsible development of Web3 and crypto-assets in the city. Accordingly, they expressed confidence that Hong Kong, as a global business and financial hub, provides an ideal environment to attract and sustain talents and businesses, thereby fostering the development of a healthy, fair and transparent metaverse ecosystem.

The findings of the Metaverse Survey revealed that Hong Kong was identified as the primary target market for the metaverse strategy by nearly half of the financial institutions, followed by Mainland China (16%), North and South America (9%) and the Asia-Pacific region excluding Mainland China and Hong Kong (7%) (Chart 5.2).

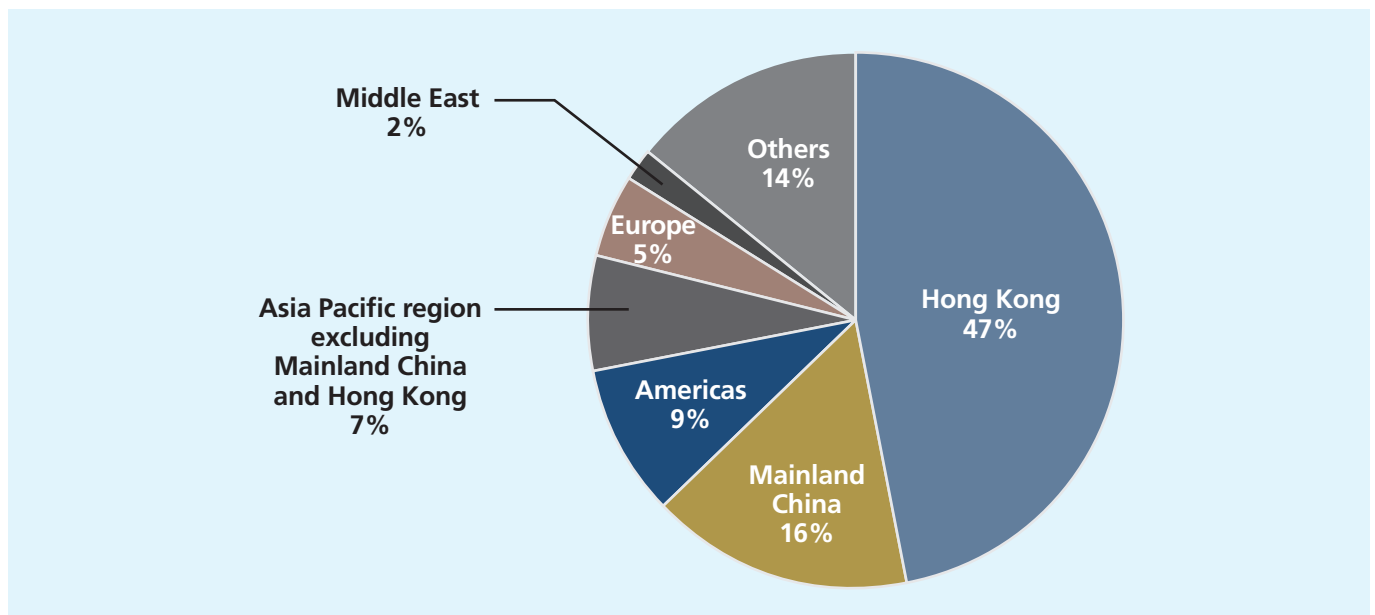
Among those who selected Hong Kong as their primary target market, the most commonly cited reasons for this choice were the favourable legal and regulatory environment and the lower barriers to entry and competition in the city. These findings are in line with the market views regarding Hong Kong's key competitive advantages illustrated in Chart 5.1.

**Interviewees expressed confidence that Hong Kong, by providing an ideal environment to attract talents and businesses, can foster the development of a healthy, fair and transparent metaverse ecosystem.**

## 5.2. MARKET VIEWS ON INITIATIVES TO PROMOTE THE HEALTHY DEVELOPMENT OF THE METAVERSE IN HONG KONG

Despite acknowledging the potential development of the metaverse in Hong Kong, some of the interviewees expressed concerns about intense competition from other jurisdictions. They emphasised the importance of taking a proactive approach to consolidate Hong Kong's leading position and competitiveness in relevant fields. The Metaverse Survey sought perspectives from

**Chart 5.2: Primary target market for metaverse strategy**



Source: HKIMR staff compilation based on the Metaverse Survey.

<sup>91</sup> The Institute of Web 3.0 Hong Kong is a non-profit organisation that assembles Web 3.0-related professionals with the aims of improving Web 3.0-related technology and applications and providing support for the construction of digital ecosystems in Hong Kong, the Greater Bay Area and the rest of the world. More information can be found at: <http://web3-hk.org/index.html?lang=hk#/>.

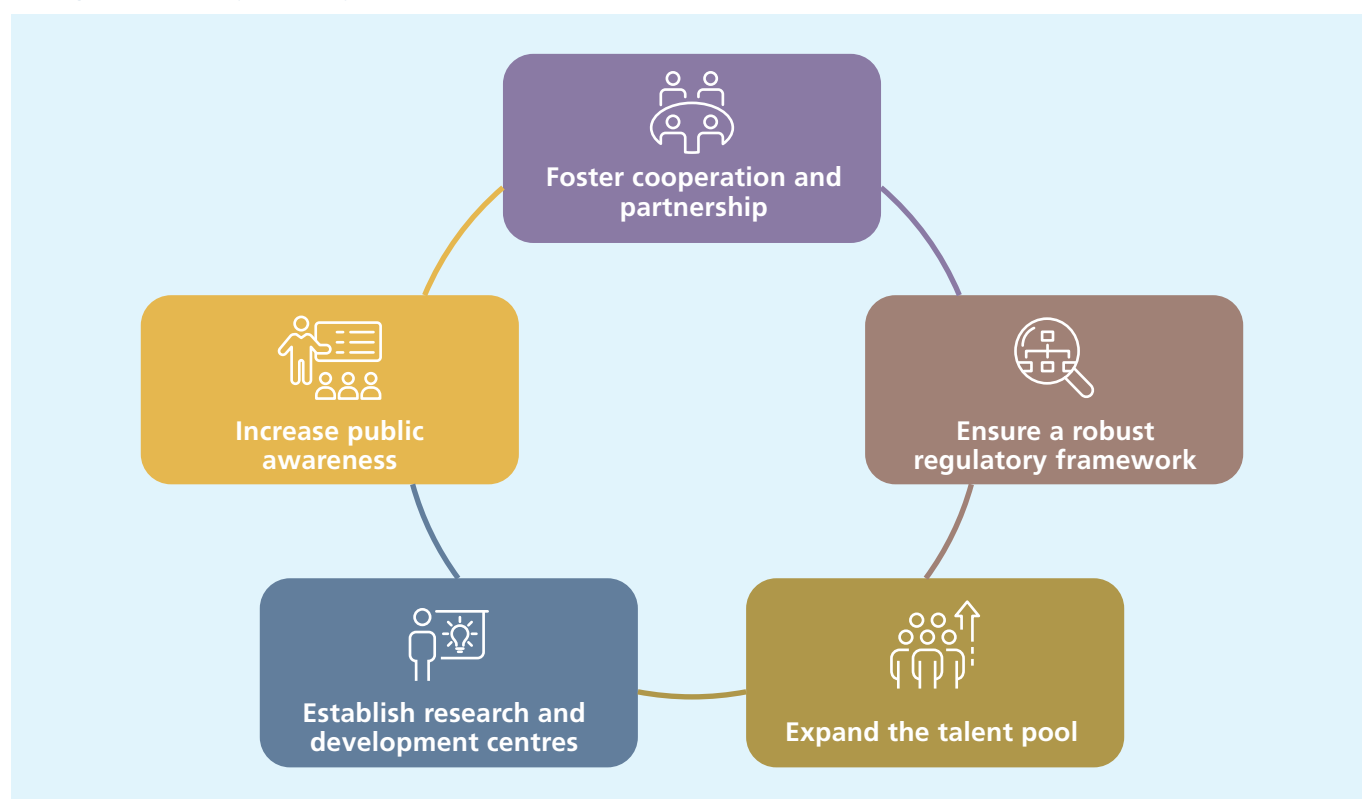
both financial institutions and metaverse service providers on initiatives that can be helpful in fostering the healthy development of the metaverse within Hong Kong's financial services industry.

Fostering cooperation and partnership and ensuring a robust regulatory framework were among the most desirable strategies identified by the survey respondents (Chart 5.3). For instance, partnering with technology companies would enable financial institutions to leverage their technological expertise and enhance the security of metaverse-related activities. The interviewees also suggested that regulators could collaborate with the industry to create a proof-of-concept<sup>92</sup> bank branch within the metaverse. Such collaboration would strengthen the legitimacy and credibility of the metaverse industry while showcasing the feasibility of providing financial services within the virtual environment.

In addition, the interviewees indicated that a robust regulatory framework could create an environment conducive to innovation and provide clarity for financial institutions and consumers regarding metaverse adoption. As a result, financial institutions would be encouraged to explore the systematic integration of the metaverse into their business operations, ensuring a well-regulated approach.

The survey respondents further stressed the importance of establishing research and development (R&D) centres and increasing public awareness as crucial strategies for advancing the orderly adoption of the metaverse in the financial services industry. The establishment of R&D centres can support the commercialisation of metaverse-related technologies and drive the development of a full-fledged metaverse ecosystem, thereby expanding the range of metaverse use cases within Hong Kong's financial services industry.

**Chart 5.3: Key strategies for promoting the healthy development of the metaverse in Hong Kong viewed by survey respondents**



Source: HKIMR staff compilation based on the Metaverse Survey.

<sup>92</sup> 'Proof of concept' refers to a specific activity or project performed to determine if a concept or technology is feasible for a desired use.

Moreover, the survey respondents reported that both regulators and market participants can play a part in effectively enhancing consumer protection by raising public awareness of the potential risks surrounding metaverse-related activities. In line with this survey finding, one of the interviewees from the insurance sector noted that they had implemented an educational metaverse application to inform customers of metaverse-related technologies and associated risks.

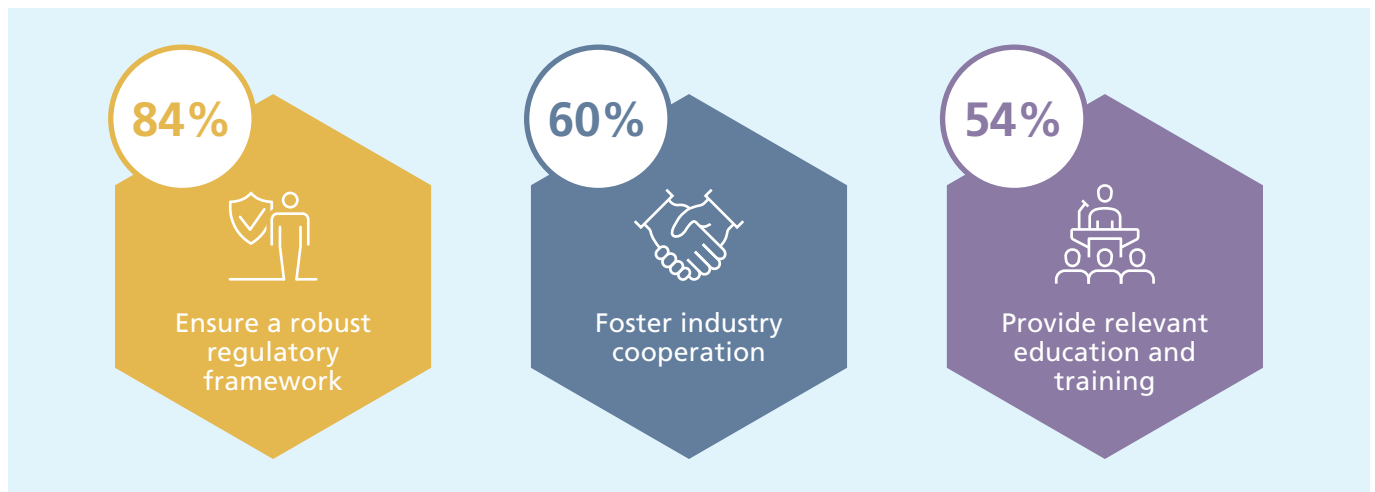
Expanding the talent pool in Hong Kong was another key strategy recognised by the survey respondents. Sustainable talent development is an important consideration for promoting entrepreneurship and driving technological advancements to contribute to the overall development of the metaverse. To gather deeper insights, the survey respondents were asked to rank the most important aspect for attracting and retaining talents with metaverse-related skill sets (Chart 5.4).

In line with the market participants' views shown in Chart 5.3, ensuring a robust regulatory framework (84%) and fostering industry cooperation (60%) were also reported by the respondents as crucial factors for attracting and retaining talents. The interviewees

noted that a robust regulatory framework could send a signal to the global market, demonstrating Hong Kong's proactive stance in embracing the metaverse and enhancing business confidence in exploring its potential. This could foster a thriving ecosystem and attract foreign workers with metaverse expertise to Hong Kong. One interviewee also noted that enhancing industry cooperation could lower barriers to entry into the metaverse, which would drive metaverse adoption and increase job opportunities in the relevant industries.

Providing metaverse-related education and training garnered support from over half of the respondents. The interviewees stressed the importance of multi-disciplinary training programmes aimed at nurturing talents with adaptable skills applicable to the metaverse.<sup>93</sup> They also indicated that Hong Kong could draw inspiration from established university programmes focused on the metaverse<sup>94</sup> and proactively encourage higher education institutions to expand their offerings in this field. This could help develop the relevant skills and knowledge while enhancing Hong Kong's ability to attract and retain talents interested in this field, thus enriching the talent pool in Hong Kong.

**Chart 5.4: Key factors for attracting and retaining relevant talents**



Source: HKIMR staff compilation based on the Metaverse Survey.

<sup>93</sup> This is in line with the results of the survey by the HKIMR in 2021, which found that talents with comprehensive skills were in high demand in the financial services industry. More information can be found at HKIMR (2021).

<sup>94</sup> For instance, The Hong Kong Polytechnic University has introduced a new master's degree programme in Metaverse Technology.

**Sustainable talent development is an important consideration for promoting entrepreneurship and driving technological advancements to contribute to metaverse developments.**

### 5.3. PRELIMINARY CONSIDERATIONS FOR FOSTERING THE METAVERSE IN HONG KONG'S FINANCIAL SERVICES INDUSTRY

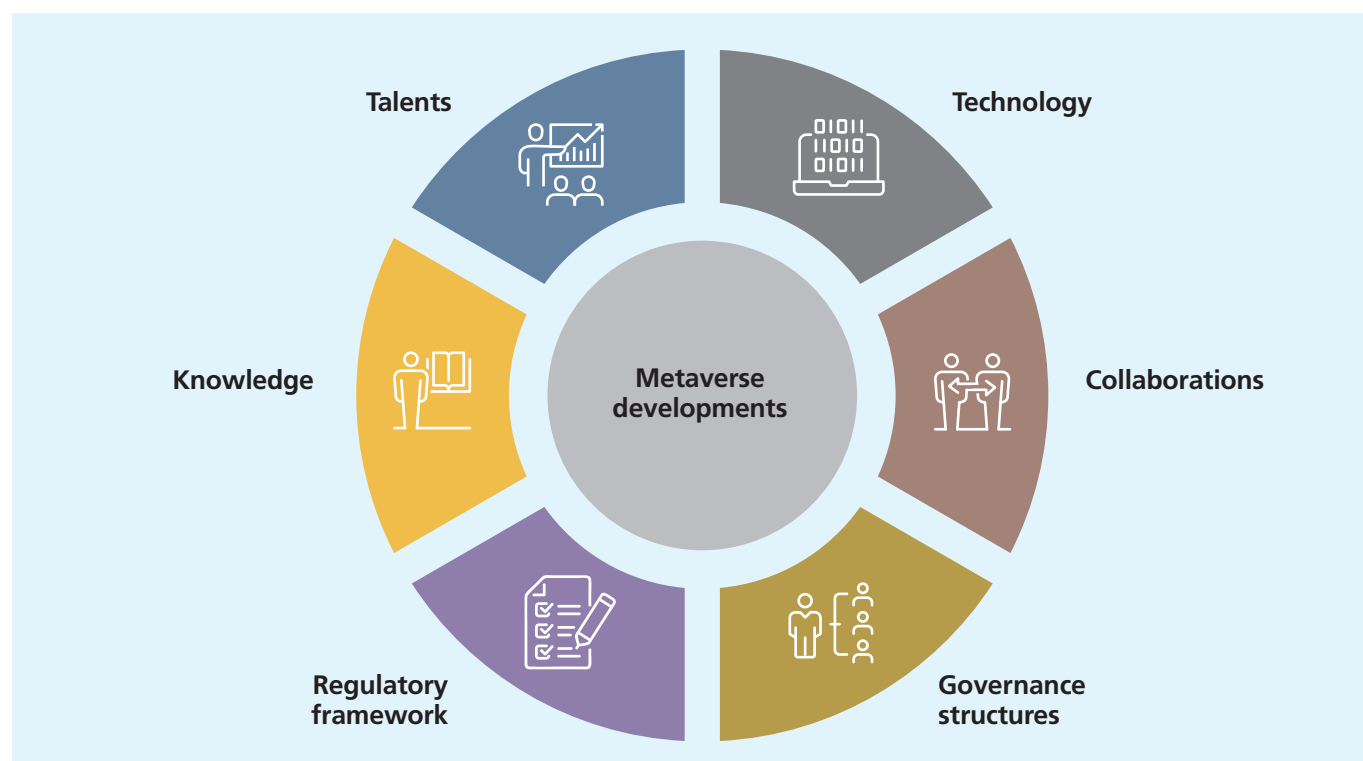
Drawing on the insights gathered from the surveyed market participants and international experience on metaverse development, this section presents discussions on the promotion of sustainable and responsible growth of the metaverse in Hong Kong

while managing potential risks related to consumer protection and financial stability. Relevant considerations include nurturing talents and fostering innovative entrepreneurship, supporting technology and digital infrastructure developments, increasing knowledge about the metaverse, and fostering collaborations among stakeholders and across jurisdictions. Moreover, adapting the relevant regulatory framework to keep in view of the latest developments and establishing well-defined corporate governance structures for metaverse adoption are crucial for Hong Kong's further progress in this domain (Chart 5.5).

#### **Nurture talents and foster innovative entrepreneurship**

Nurturing talents is of the utmost importance for metaverse development and growth. It plays a vital role in addressing the challenges associated with metaverse talent acquisition. Attracting and retaining talents can help narrow the talent gap by expanding the diversity of the talent pool and ensuring the

**Chart 5.5: Preliminary considerations for promoting the healthy development of the metaverse in Hong Kong**



Source: HKIMR staff compilation.

adequate supply of talents with the required technical skills in Hong Kong. Given the multifaceted nature of the metaverse, specialised expertise in areas such as VR, AR, blockchain and AI are essential. Talent development and upskilling can bridge skill gaps through cultivating high-quality talents and building in-house capabilities for financial institutions. This will enable financial institutions to secure suitable metaverse talents. By fostering talents, governments, educational institutions and industry stakeholders can cultivate a skilled workforce that drives innovation, creativity and overall progress within the metaverse ecosystem.

Attracting and retaining foreign talents represents a key strategy for metaverse talent development.<sup>95</sup> Hong Kong's advantageous position should also be fully exploited, by leveraging its low and simple tax regime and its robust regulatory environment and infrastructure, as well as its proximity to Mainland China and international markets. By fostering an environment that encourages innovation, embraces diversity and supports work-life balance, governments can attract and retain foreign talents, thereby contributing to the local metaverse ecosystem's growth.

Developing local talents holds equal importance. Policymakers and educational institutions can join forces to establish specialised programmes, courses and training initiatives that centre around metaverse technologies. These programmes should provide hands-on training and exposure to real-world projects. Aligning education with industry demands can help to equip local talents with the required skills and knowledge to contribute to metaverse development. The interviewees indicated that creative and gaming talents have interchangeable skills that can be utilised in the development of metaverse applications. They proposed that it would be helpful for policymakers to provide support to the creative and gaming industry to boost job opportunities and facilitate clear career development paths in that industry. This would attract more talents to the relevant industries, enriching the metaverse talent pool. It is also essential

to provide opportunities for upskilling and reskilling employees. As the metaverse landscape evolves rapidly, continuous learning and development are vital to keep pace with emerging technologies and new standards. By offering avenues for employees to enhance their existing skills and acquire new ones, businesses can ensure that their workforce can adapt to the evolving demands of the metaverse.

Fostering entrepreneurship is also necessary for maintaining Hong Kong's international competitiveness and strengthening its status as a leading financial and commercial hub. Entrepreneurship can fuel innovation, promote healthy competition and create new business opportunities, which are crucial for sustainable metaverse growth and for the overall digital ecosystem in Hong Kong. Some of the interviewees advocated for policymakers' active engagement in the creation of metaverse experiences, to signal their support for the industry. Policymakers play a key role in creating a friendly environment that encourages entrepreneurship among local start-ups and attracts foreign technology enterprises to establish operations in the city, which can also complement talent attraction and retention initiatives. Fostering a thriving tech scene can inspire confidence among financial institutions regarding the industry's prospects. This, in turn, can motivate them to embrace metaverse opportunities and lead the way in constructing a conducive and healthy metaverse ecosystem.

### **Support technology and digital infrastructure developments**

Investing in various technologies and establishing a robust digital infrastructure are essential for metaverse development. Technological advancements are crucial to overcoming the current technical limitations of the metaverse and supporting a wider range of practical use cases applicable to financial services operations. New technologies can facilitate highly tailored, secure and engaging service experiences for consumers. According to the survey findings, technological development requires an approach focused on key areas such as VR, AR, blockchain, cloud computing

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<sup>95</sup> Entice a broader range of foreign talents to Hong Kong is also an important aspect to foster talent development in the financial services industry. More information on financial services talent development in Hong Kong can be found at HKIMR (2023c).

and AI. Investing in these technologies would empower stakeholders to unlock the vast potential of the metaverse, enabling immersive experiences and the establishment of decentralised virtual economies.

To ensure the successful advancement of the metaverse, it is essential to establish and enhance the digital infrastructure, including through high-speed internet access, display hardware and digital payment systems. The interviewees suggested that policymakers can support nationwide digital infrastructure projects focused on strengthening the accessibility of 5G internet services and resolving barriers related to VR or AR devices. These efforts can facilitate individuals' access to the metaverse, leading to the development of a more reliable and inclusive metaverse ecosystem.

Enhancing digital payment systems, implementing effective data infrastructure, and establishing robust KYC protocols can address the challenges related to identity authentication, data privacy and financial transactions in the metaverse described in the preceding chapter. Such measures can thus ensure safety and security within the metaverse ecosystem. As technologies continue to advance, integrating AI technology into these digital infrastructures can enable real-time user data screening and transaction monitoring to efficiently mitigate financial crime and fraudulent activities. Such efforts by policymakers can lay a solid foundation for metaverse development, allowing for the creation of dynamic and interconnected virtual worlds that redefine our interactions with virtual environments.

Supporting the advancement of technologies and digital infrastructure can be achieved by establishing dedicated task forces and innovation hubs to drive R&D. Such entities can bring together government bodies, industry leaders, researchers and innovators to collaborate on metaverse-related initiatives, exchange knowledge and foster innovation. Task forces can play a pivotal role in identifying key challenges, formulating policies and coordinating efforts to support the development of technologies

and infrastructure critical to the metaverse. Innovation hubs can serve as physical or virtual spaces where start-ups, entrepreneurs and researchers converge to explore and develop metaverse technologies. Such hubs can provide invaluable resources and mentorship and networking opportunities, creating a supportive ecosystem that fuels innovation. There has been some progress in Hong Kong in this area. For example, the Web3 Hub@Cyberport was launched in January 2023 to offer advanced facilities and support for relevant technological enterprises, which in turn will promote national technological advancements.<sup>96</sup> In June 2023, the Task Force on Promoting Web3 Development was established to provide recommendations on the sustainable and responsible development of Web3 in Hong Kong.<sup>97</sup>

### **Increase knowledge about the metaverse**

Strengthening industry awareness and knowledge related to the metaverse is of vital importance. By improving financial institutions' understanding of the metaverse, they can better seize the opportunities arising from metaverse development and contribute to the sustainable growth of the digital ecosystem in Hong Kong. Harnessing awareness and knowledge within the internal departments of financial institutions can bridge knowledge gaps and foster a solid understanding of emerging risks in the metaverse. Establishing a robust risk-aware culture throughout a company would enable effective risk management and operational streamlining, thereby ensuring adequate compliance in metaverse adoption. The interviewees suggested that policymakers can facilitate this process by introducing learning platforms and forums to provide financial institutions with access to valuable information about metaverse adoption. Such learning platforms could enable financial institutions to seek advice and support on metaverse-related matters, while forums could serve as platforms for industry experts to share experiences and the latest trends in metaverse applications within the financial services industry. These collaborative approaches would enable financial institutions to

<sup>96</sup> More information can be found at: <https://www.cyberport.hk/files/63bbe1bc906dc198207375120230109%20Hong%20Kong%20Web3%20Innovator%20Summit%20&%20Web3%20Hub@Cyberport%20Inauguration%20Ceremony.pdf>.

<sup>97</sup> More information can be found at: <https://www.info.gov.hk/gia/general/202306/30/P2023063000579.htm>.

leverage diverse views to analyse key considerations for developing metaverse applications.

As highlighted by the survey and interview respondents, educating the public about the advantages, disadvantages and inherent risks of engaging in the metaverse is equally important. Disseminating useful metaverse-related information to the public on a continual basis is crucial to raising their awareness and knowledge of emerging risks and unintended consequences of metaverse-related activities. Such an approach would empower the public to enhance risk monitoring at the individual level and protect individuals in the virtual space. For example, enhancing risk awareness among the public would enable individuals to self-protect against cyberattacks, virtual harassment and metaverse addiction. Some of the interviewees advocated for more education for the public to rectify current misconceptions about the metaverse vision, increase social acceptance of the metaverse and potentially drive more informed consumer decisions about engaging in the metaverse. Policymakers may take the lead to launch public crime prevention and safety education campaigns, which can help uphold consumer protection in the metaverse space.

### **Foster collaborations among stakeholders and across jurisdictions**

Collaboration between regulators and financial institutions is crucial for the responsible growth of the metaverse. Regulators play a vital role in safeguarding consumer interests, ensuring market stability and upholding legal compliance. By actively engaging with financial institutions, regulators will gain useful insights into the metaverse to facilitate the formulation of comprehensive regulations. In addition, financial institutions can share their expertise in risk management, compliance and technology, contributing to the establishment of practical and adaptable regulations tailored to the dynamic nature of the metaverse.

Collaboration among financial institutions themselves is essential for creating a robust and interconnected metaverse ecosystem. Financial institutions possess a wealth of knowledge and resources, including expertise in digital payments, asset management and customer services. By joining forces, they can establish common standards, promote interoperability and facilitate the seamless integration of financial services across various metaverse platforms. Consequently, users will experience enhanced navigability within the metaverse, enjoy secure transactions and gain access to a comprehensive array of financial services.

Collaboration across industries is also important to realise the full potential of the metaverse. Through collaborative commitments, financial institutions can leverage industry practitioners' metaverse experiences and technical capabilities to gain additional insights into constructing commercially sustainable metaverse strategies. Industry collaboration also facilitates the sharing of resources between stakeholders to co-create future-proof solutions to develop and maintain the metaverse experience. This can subsequently enhance product development efficiency and alleviate the high costs faced by financial institutions in metaverse adoption. Extending beyond the realms of gaming and entertainment, the metaverse offers opportunities to various industries, including education, healthcare, retail and financial services. For example, collaboration between the gaming and financial services industries can create innovative financial education or virtual investment experiences. By leveraging the gaming industry's expertise in crafting immersive and interactive experiences, financial institutions can enhance users' financial literacy and empower them to make informed investment decisions.

In the global metaverse landscape, collaboration across jurisdictions is equally important. As the metaverse transcends geographical boundaries, harmonised regulatory frameworks are essential to

promote fair competition and prevent regulatory arbitrage. International cooperation enables knowledge sharing, policy coordination and the establishment of common standards. As an example, the World Economic Forum announced a multi-stakeholder ‘Define and Build the Metaverse’ initiative in May 2022 to develop and share actionable strategies for building the foundations of governance and policy as well as generating economic and social value creation in the metaverse.<sup>98</sup> By aligning their regulatory approaches and fostering cross-border collaboration, jurisdictions can effectively address challenges related to cross-border transactions, taxation, intellectual property rights and user protection. Such collaboration can lay the foundation for an inclusive and globally interconnected metaverse, benefiting users, businesses and societies as a whole.

### **Adapt relevant regulatory framework to keep in view of the latest developments**

Regulators and policymakers in Hong Kong have implemented timely regulatory measures and maintained close monitoring of the development of virtual assets, which is a key component of the metaverse. It is crucial to stay abreast of international experiences in regulatory advancements related to the metaverse and its associated fields. Moreover, given the rapidly evolving nature of the metaverse, virtual assets and other related areas, it is useful to regularly review and adjust the relevant regulatory requirements to keep in view of the latest developments, while accounting for differences in scale, risk level and strategic importance to the broader financial system, with a particular focus on addressing potential risks to financial stability.

### **Establish well-defined corporate governance structures for metaverse adoption**

It is important to align metaverse adoption strategy with corporate value and ensuring adherence to regulatory requirements and guidelines. The interview findings conveyed that maintaining a well-defined corporate governance structure can help financial institutions in integrating metaverse strategies into their current operations and systems. To enhance the existing corporate governance structure, it is important to clearly define and segregate the roles and responsibilities of the management body concerning the metaverse adoption strategy. This will strengthen coordination within the company in order to optimise operational approaches to effectively oversee the development of metaverse applications.

A well-defined corporate governance structure would involve a robust risk management system that takes into account the risks relevant to metaverse adoption. Such a system would enable financial institutions to identify and quantify the full spectrum of potential risks arising from metaverse-related activities, allowing them to develop appropriate measures to respond promptly to various risk events. For example, incorporating metaverse risk scenarios and conducting relevant vulnerability assessments in the risk management system can help protect against potential security risks in the metaverse. By integrating resilience into the system, cybersecurity management can be strengthened and security vulnerabilities in data infrastructure can be mitigated.

<sup>98</sup> More information can be found at: <https://initiatives.weforum.org/defining-and-building-the-metaverse/home>.

# Conclusions

**This report highlights that engagement in metaverse applications among financial institutions is currently moderate in Hong Kong. The transition to a comprehensive metaverse ecosystem is key to facilitating wider adoption within the industry.** The survey findings indicated that 65% of the financial institutions were involved in the metaverse to varying degrees, with **current applications predominantly concentrated on marketing, internal operations, talent recruitment, and workplace social events.** In order to foster widespread adoption of the metaverse, it is important to enhance market participants' opportunities to utilise this technology as an investment tool, sales channel and revenue stream.

**Technological advancements play a pivotal role in facilitating the transition to a full-fledged metaverse ecosystem.** The surveyed market participants acknowledged the significance of network technology, display hardware, computing technology, and blockchain technology in accelerating metaverse development. Nonetheless, it is crucial to address the associated challenges, such as data privacy concerns, constraints in platform functionalities, elevated costs associated with development and maintenance and complexities in integrating the metaverse with existing operations and systems. Moreover, **as the metaverse encompasses a multitude of innovative technologies connected to virtual assets and the Web3 ecosystem, it is equally important to formulate timely regulatory measures and closely monitor their developments.** Relevant regulatory initiatives have been introduced both internationally and in Hong Kong to protect consumers and foster a conducive and safe environment for the digital ecosystem.

**Talent acquisition serves as a catalyst for technological advancements and the healthy**

**development of the metaverse.** While the surveyed financial institutions demonstrated relatively low engagement in metaverse talent acquisition, most of the metaverse service providers asserted the availability of adequate talents possessing specialised skill sets. Nevertheless, the metaverse service providers emphasised the significance of acquiring a broader spectrum of metaverse-specific skills in Hong Kong and highlighted that talents with expertise in blockchain technology were most sought after by the employers. The findings suggest that **regulators and policymakers have a role to play in fostering a supportive environment for talent acquisition and skills development** to contribute to the local metaverse ecosystem's growth.

**Hong Kong possesses competitive advantages for developing the metaverse ecosystem.** Such advantages include its **robust legal and regulatory framework, business environment and financial ecosystem.** The survey participants also acknowledged Hong Kong's **strategic location, connectivity, bilingual environment and trade system** as additional strengths attracting metaverse stakeholders.

**Certain actions are needed to address the relevant challenges and further advance metaverse development in Hong Kong's financial services industry.** Such actions include nurturing relevant talents and fostering innovative entrepreneurship, supporting technology and digital infrastructure developments, increasing knowledge about the metaverse, and fostering collaborations among stakeholders and across jurisdictions. Additional efforts should focus on adapting the relevant regulatory framework to keep in view of the latest developments and establishing well-defined corporate governance structures for metaverse adoption.

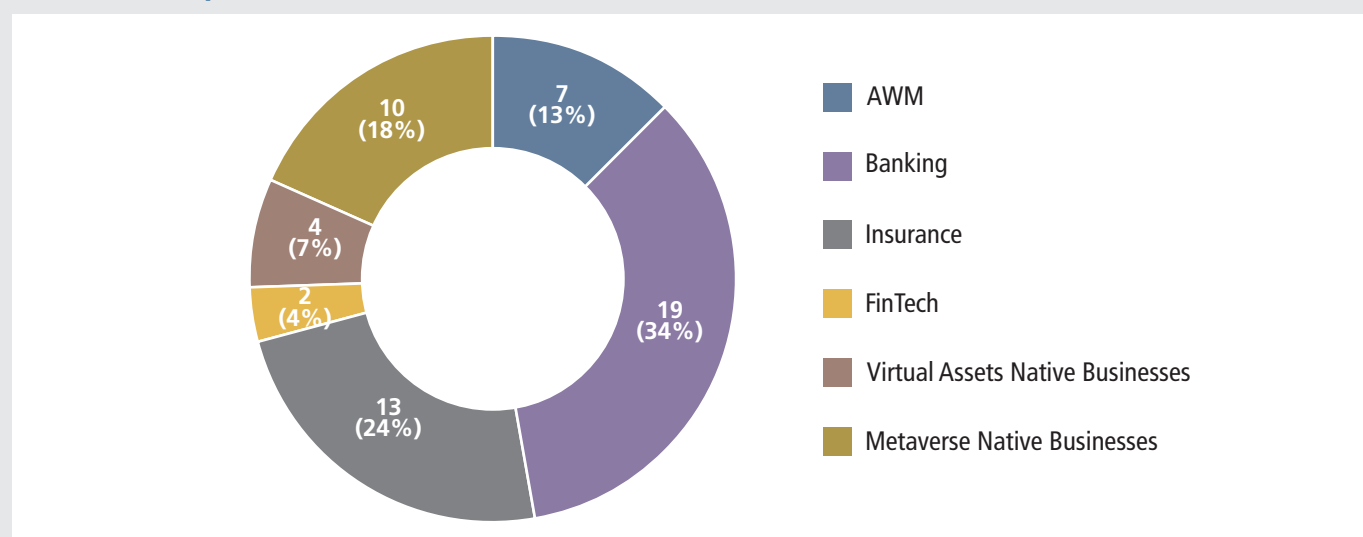
# Appendix A:

## Background of the Metaverse Survey

The results presented in this report are based on a survey titled *Current Landscape and Recent Developments of the Metaverse in Hong Kong's Financial Services Industry*, which was conducted from May to July 2023 in collaboration with PricewaterhouseCoopers Limited. The survey was designed to collect insights from financial institutions (i.e. banking, insurance and asset wealth management institutions) and metaverse service providers about the current landscape of the metaverse in Hong Kong's financial services industry. It also aimed to analyse the opportunities and challenges encountered by market participants. Lastly, the survey sought to explore the prospects envisioned by these entities for the development of the metaverse in the city.

In total, 55 entities participated in the survey (Chart A.1), and the results are divided into two sub-groups: 12 supply-side respondents and 43 demand-side respondents. The supply-side respondents were entities that designed, created, and/or managed virtual environments within the metaverse, primarily include platform providers and creative studios. The demand side comprised traditional financial institutions and other entities that utilised the metaverse for a variety of business-related activities. Out of the 39 responses by traditional financial institutions, 16 stayed anonymous. As of December 2022, the nine identifiable sampled banks accounted for 82% of the total market deposit volume, and the eight identifiable sampled insurers accounted for 47% of the gross premium in general and long-term insurance markets. The six identifiable entities from the asset wealth management industry represented the traditional wealth/fund management, venture capital, private equity and brokerage sub-sectors.

**Chart A.1: Representation of sectors**



Source: HKIMR staff compilation based on the Metaverse Survey.

Note: The supply-side respondents comprise ten metaverse service providers and two digital native business providers. The remaining ones are demand-side respondents in our survey.

In addition to the survey, 23 interviews were conducted to obtain in-depth insights from market participants within the metaverse ecosystem. The interviewees consisted of 12 representatives from traditional financial institutions and 11 representatives from entities that carried out various types of businesses within the metaverse, including metaverse platforms, metaverse builders, communication platforms, data analytics platforms, GameFi and digital entertainment operators, industry associations, law firms and technology infrastructure providers.

# Appendix B:

## Glossary of Technical Terms

Term	Meaning
<b>Artificial Intelligence (AI)</b>	A set of technologies that mimic the cognitive functions of humans such as decision-making
<b>Augmented Reality (AR)</b>	Technology that contains the addition of digital elements into a live, real-world environment
<b>Blockchain Technology</b>	A type of DLT in a P2P network, where every node in the blockchain owns a copy of the database, and operates in a competitive and decentralised manner to manage the immutable archive of data, such as transaction records
<b>Central Bank Digital Currency (CBDC)</b>	An electronic form of central bank money issued or backed by the central bank
<b>Cloud Computing</b>	On-demand access, via the internet, to computing resources including data storage, servers, databases, networking, and software
<b>Computer Vision</b>	Technology that enables the analysis of information from digital images or videos
<b>Consensus Protocols</b>	The mechanisms by which all users within a distributed ledger agree on the validity of the underlying data
<b>Creator Economy</b>	An ecosystem where content creators can earn from their activities on the internet
<b>Crypto-Asset</b>	A type of private sector digital asset that depends primarily on cryptography and distributed ledger or similar technology, as defined by the FSB
<b>Cryptocurrency</b>	A form of private sector non-asset-linked crypto-asset
<b>Cryptocurrency wallet</b>	Device, physical medium, program or service that stores public and/or private keys for cryptocurrency transactions
<b>Cryptography</b>	Use of advanced encryption techniques to ensure that transactions are secure
<b>Decentralisation</b>	Dispersion of authority and governance from a central, trusted third party to the community
<b>Decentralised Finance (DeFi)</b>	An umbrella term referring to the provision of financial services and products related to crypto-assets, which are facilitated and managed by blockchain and smart contracts without any central authority or intermediary
<b>Deep Learning</b>	A subfield of machine learning that uses neural networks and can analyse unstructured raw datasets in order to imitate the way that human beings learn
<b>Digital Twin</b>	A virtual representation of an intended or actual real-world physical product, system, or process

<b>Disintermediation</b>	A structure that removes the requirement of a trusted intermediary in the process of decision-making
<b>Distributed Ledger Technology (DLT)</b>	A P2P network system, where every node in the ledger owns a copy of the database and operates using consensus protocols to manage the archive of data, such as transaction records
<b>Edge Computing</b>	Distributed computing framework that enables data computation within local devices or servers
<b>Explainable AI</b>	A set of methods and processes that allows human beings to understand the outputs created by machine learning algorithms
<b>Extended Reality (XR)</b>	A term that covers AR, VR and MR
<b>Fiat-Referenced Stablecoin (FRS)</b>	A stablecoin that references the value of one or more fiat currencies.
<b>Fog Computing</b>	Distributed computing framework that enables data computation, storage and applications to be located somewhere between the data source and the central server
<b>Generative AI</b>	A model, based on deep learning algorithms, that identifies patterns and structures within existing data to generate new and original contents
<b>Internet of Things (IoT)</b>	A network of interconnected physical devices embedded with sensors and actuators that collect and exchange information through wired or wireless networks
<b>Machine Learning</b>	Use of algorithms and datasets to imitate the way that human beings learn
<b>Metadata</b>	A set of data that provides information about other data
<b>Mixed Reality (MR)</b>	Technology that includes the feature of AR and also enables content to be interactive with the real environment
<b>Natural Language Processing (NLP)</b>	A set of tools that transforms unstructured data such as text and voice recordings into structured data so that human languages can be understood by a computer
<b>Non-Fungible Token (NFT)</b>	A unique cryptographic token that contains the identification code and meta data specifying the conditions of ownership and transfer of the assets on the blockchain
<b>Ownership Economy</b>	An ecosystem where property rights are directly attributed to users
<b>Permissioned Distributed Ledger</b>	DLT system where a certain group of nodes controls the consensus protocol used to validate new transactions
<b>Permissionless Distributed Ledger</b>	DLT system where the consensus protocol is not controlled by any group of nodes
<b>Private Distributed Ledger</b>	DLT system where the access to the system is restricted to a certain group of nodes
<b>Proof-of-Concept</b>	A specific activity/project performed to determine if a concept or technology is feasible for a desired use

<b>Pseudonymity</b>	In the context of blockchain, the characteristic of users' physical identities remains anonymous while their account activities and transactions are visible and traceable
<b>Public Distributed Ledger</b>	DLT system that is publicly accessible by all of the nodes
<b>Quantum Computing</b>	A computing framework that utilises quantum mechanics principles
<b>Quantum Mechanics Principle</b>	A theory used to explain and predict the behaviour of particles at the microscopic level
<b>Self-Sovereign Identity</b>	A model in which individuals have sole ownership of the ability to control their accounts and personal data
<b>Semantic Web</b>	A vision for a web of data that can be processed by machines
<b>Smart Contracts</b>	Self-drafted agreements that are developed in computer code, enabling DLT to execute them automatically and in precise conformity with the contract terms
<b>Software-Defined Networking (SDN)</b>	A network architecture approach that separates the control plane from the data plane and enables the network to be centrally controlled through software applications
<b>Stablecoin</b>	A type of crypto-asset that aims to maintain a stable value relative to a specified asset, or pool of assets
<b>Virtual Asset</b>	Defined in section 53ZRA of the Anti-Money Laundering and Counter-Terrorist Financing Ordinance to generally mean a cryptographically secured digital representation of value, excluding certain forms such as CBDCs and those within the definitions of securities and futures contract
<b>Virtual Asset Fund</b>	A fund which meets the definition of a virtual asset-related product
<b>Virtual Asset-Related Product</b>	An investment product that (a) has a principal investment objective or strategy to invest in virtual assets, (b) derives its value principally from the value and characteristics of virtual assets or (c) tracks or replicates investment results or returns that closely match or correspond to virtual assets
<b>Virtual Asset Service Provider</b>	Any natural or legal person who is not covered elsewhere under the FATF's recommendations and, as a business, conducts one or more of the following activities or operations for or on behalf of another natural or legal person, as defined by the FATF: <ul style="list-style-type: none"> <li>i. Exchange between virtual assets and fiat currencies;</li> <li>ii. Exchange between one or more forms of virtual assets;</li> <li>iii. Transfer of virtual assets;</li> <li>iv. Safekeeping and/or administration of virtual assets or instruments enabling control of virtual assets; and</li> <li>v. Participation in and provision of financial services related to an issuer's offer and/or sale of a virtual asset</li> </ul>
<b>Virtual Avatar</b>	The virtual representation of real-life user

<b>Virtual Reality (VR)</b>	Technology that can immerse the user into a virtual environment separate from the real world
<b>Virtual World</b>	A computer-simulated environment, also known as a virtual platform
<b>Web3</b>	An acronym used for Tim Berners-Lee's vision of Web 3.0, a decentralised online ecosystem leveraging blockchain technology
<b>World Wide Web</b>	A system that enables information sharing on the internet

# Appendix C:

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### **CONTACT US**

Email: [hkimr@hkma.gov.hk](mailto:hkimr@hkma.gov.hk)

Tel: +852 2878 1706

Website: <https://www.aof.org.hk/research/HKIMR>



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