KPMG

Confederation of Indian Industry

Metaverse and Web 3.0 opportunities in India

Nurturing Tamil Nadu's growth ambitions through next-gen technologies

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CII Forewords

I am delighted and pleased to share the knowledge report on Web 3.0 and related technologies, all of which are shaping the next wave of technology and business on the inaugural edition of the "CII Tech Next" event in Chennai.

We are at the cusp of a whole new era marked by the rise of the Gen-Z customer. The Gen-Z is a true digital native at the forefront of the Web 3.0 revolution in multiple capacities – as a consumer, as a creator, as an entrepreneur and as a technologist. It is but inevitable that this consumer-backed demand fuels the possibility of disruptive innovation both in terms of technology and in terms of business models. While Web 3.0 and related technologies including Blockchain, Crypto and NFTs promise unlocking significant economic value through their tenets of de-centralisation and interoperability, they offer tantalising new possibilities when combined with the power of the metaverse and artificial intelligence. I believe that these technologies hold the power to reshape every industry imaginable.

I am equally excited to see the tremendous progress made by Indian startups across all facets of Web 3.0, metaverse and AI, with many of them creating impact on the global stage. It would not be a stretch to state that India would be a hotbed for world-class innovation and entrepreneurship in the Web 3.0 space. I am certain you will get to experience some of this innovation first-hand in the event today as well as in the report. We have lined up an exciting conference for you, packed with global speakers, LIVE workshops, boot camps and startups.

As part of the entire CII Chennai chapter, I extend our thanks to our sponsors, speakers, industry partners and multiple other stakeholders who have made this event possible. I am hoping that you enjoy this event as much as we would. We look forward to your continued association with us.

Murugavel J.

Chairman, CII Chennai Zone and
Founder and CEO
Matrimony.com

Web 3.0 builds the opportunity to reshape the way the world works. Web 3.0 is built on top of the blockchain, the core technology that powers it. Web 3.0 is primarily focused on these 4 areas - DeFi (Decentralised Finance), DAO (Decentralised Autonomous Organisations), Entertainment (Metaverse, NFT Marketplace), and Infrastructure (Architecture, Security solutions). India has the massive potential to accelerate the web 3.0 economy in the world with its growing ecosystem of technology entrepreneurs, innovators, and startups. One of the top challenges in building the web 3.0 ecosystem is the lack of trained people on web 3.0 building blocks. Tamil Nadu is rightly positioned to fill this gap and to scale upward with its high quality ~200,000 technology graduates every year. Also, it has the ecosystem of adopting emerging technology with speed and agility. The web 3.0 ecosystem is shaping up, and it's predicted that Metaverse, Blockchain, and NFT will play a larger role in this technology decade.

TechNext is one of its kind summit in India, and it unmutes the opportunity around the web 3.0 economy. It's an event of inspiration and enables us to experience future technologies such as metaverse, NFT, AI, digital trust and blockchain. I'm sure this event will scale up the emerging tech ecosystem of the country and the state.

Kewyn George

Convenor, Tech/Startup Panel
CII Chennai Zone and
Center Head and Director – Information Services
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About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, with around 9000 members from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from 286 national and regional sectoral industry bodies.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, livelihoods, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

As India completes 75 years of Independence in 2022, it must position itself for global leadership with a long-term vision for India@100 in 2047. The role played by Indian industry will be central to the country's progress and success as a nation. CII, with the Theme for 2022-23 as Beyond India@75: Competitiveness, Growth, Sustainability, Internationalisation has prioritized 7 action points under these 4 sub-themes that will catalyze the journey of the country towards the vision of India@100.

With 62 offices, including 10 Centres of Excellence, in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 350 counterpart organizations in 133 countries, CII serves as a reference point for Indian industry and the international business community.

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About KPMG in India

KPMG entities in India are professional services firm(s). These Indian member firms are affiliated with KPMG International Limited. KPMG was established in India in August 1993. Our professionals leverage the global network of firms, and are conversant with local laws, regulations, markets and competition. KPMG has offices across India in Ahmedabad, Bengaluru, Chandigarh, Chennai, Gurugram, Hyderabad, Jaipur, Kochi, Kolkata, Mumbai, Noida, Pune, Vadodara and Vijayawada.

KPMG entities in India offer services to national and international clients in India across sectors. We strive to provide rapid, performance-based, industry-focussed and technology-enabled services, which reflect a shared knowledge of global and local industries and our experience of the Indian business environment.

KPMG in India Foreword

Humans always have had a desire to discover life in other parts of the world. Eventually discovery of other tribes resulted in more physical collaboration and increased the overall net worth of the world. From printing and telegraph in the first industrial revolution to telephone, TV and radio in the second, to Internet and cell phones in the third industrial evolution, human race has also looked for efficient and automated ways of working. And yet, the greatest underutilised resource in all the world is human potential that combines efficiency and collaboration at scale. In recent past, the discovery and penetration of internet enhanced the collaboration at rapid pace and because of it, the global GDP has increased multiple times in first two decades of this century.

The current rate of technological and digital change rebalances, reshapes and reimagines traditional ecosystems and business models, creating enormous opportunities for industries, governments, startups, and regulators. The upcoming disruptive technologies are set to further enhance the pace of collaboration at a global level by enabling immersive and efficient spaces – or metaverses – thus providing reality equivalent experience and acting as a catalyst for the next few decades of global value creation.

The FIRST principles of the metaverse, viz., Fair, Interoperable/Immersive, Redressable, Secured/ Self-sovereign and Tranparent that form the trust in the ecosystem are quintessential for metaverse and web 3.0 development. These then need to be balanced with optimum levels of autonomy and ecosystem harmony that promotes fair play with free speech under secured constructs. As such, the government's razor-sharp focus on portraying Digital India has begun with building a digital-first landscape that can be trusted – and that change has come from the regulatory department, which not only understands the nuances of metaverse and web 3.0 but also weighs the known ecosystem benefits with autonomy, free speech and security challenges. With 75000+ blockchain professionals in India, India ranks second[1] among the top 10 countries for global blockchain talent availability. Further, the growth rate is pegged at 122 per cent. With PLI schemes progressing to support Atma Nirbhar Bharat movement, startups being promoted, and IT/ITeS investing in web 3.0 and metaverse, India today stands at the cusp of a hyper-change where opportunities are proliferating.

In association with CII, KPMG in India is proud to present the report, 'Metaverse and web 3.0 opportunities for India: Nurturing Tamil Nadu's growth ambitions through next-gen tech', which provides a ray of hope for the ICT sector to re-purpose, re-engineer and re-position their offerings for a changing world.

Akhilesh Tuteja
Partner and Head
Technology Media and Telecom

1. 2022 LinkedIn's Talent Insights

Executive summary

In the 21st century, we have seen proliferation of software and product brands along with the rise in technologies spanning chipsets, display/ projection, electronics manufacturing, optics, content, special effects, tracking as well as motion detection. This is further supported by new-age technologies such as IoT & sensors, cloud & compute, edge & storage, 5G, blockchain, robotics, swarm intelligence, AI/ML, security & privacy and AR/VR/XR. The convergence of these digital technologies with new products and services at scale is a true boilerplate for providing an immersive and unified experience – providing a new parallel virtual world that aids and supports the real world. This experience is further accentuated by the blurring boundaries of physical and virtual worlds by adding a three-dimensional layer to everything we interact with, see, hear or touch – posing an omnipresent personalised experience with avatars. This immersive experience is being termed as metaverse, which is seen to be supported by the idea of privacy first and decentralisation, thus evolving as a new social form which is free, open and yet more secured.

The idea of web 3.0 is to build an internet and all associated services which are user centric, privacy first, user owned and governed instead of corporate centric, corporate owned and governed. Web 3.0 is being built on top of the blockchain technology along with digital tokens providing governance rights to users/owners.

Steven Spielberg's Ready Player One (2018) projected a world where users spent majority of their time in a virtual world accessible by virtual reality headsets. They used the virtual space for activities related to gaming, entertainment, social, work, etc.

If you observe closely, today's successful gaming environments such as Fortnite, Roblox, Minecraft do reflect an early version of the world imagined by Spielberg in Ready Player One. All these gaming universes have hundreds of millions of active users who are spending a majority of their time in these gaming worlds. They are not yet immersive due to non-availability of headset devices to the masses. These games have their own "central economies" where users are spending billions of dollars to buy digital goods within the games. However, the ownership of these digital goods is ''controlled by the platforms'' today. Web 3.0 powered by blockchains aims to make these platforms and digital assets decentralised and user owned. This shift from a 'pay-to-play' to 'play-to-earn and own' models will provide a boost to the gig economy of the future.

However, beyond gaming and entertainment, the true test of metaverse will be first to democratise access and infrastructure availability for essential goods and services. For a country like India, the next generation of Internet-enabled technologies show not only a profound promise of altering ways of interaction but also provide a glimpse of the new economy through which the older economy gets a boost in efficiency as well as user experience. A trillion-dollar digital economy that constitutes the 20 per cent of the overall economy by 2025/26 will not only spur innovation but also act as a magnet for global industries with various opportunities emanating from India as an innovation super-house in the metaverse and web 3.0 era. Banking, manufacturing/industrial, retail and commerce as well as TMT industries provide a plethora of opportunities in global services and new product development in the metaverse and web 3.0.

Developed economies such as Singapore and the US have already framed regulations for the crypto markets which act as a crucial pathway for building metaverse and web 3.0 applications. Further, as global technology corporations, telecoms & media companies, startups, non-for-

profits, standards bodies, governments and small & medium enterprises compete to define, standardise and channelise the metaverse, it is crucial to witness how companies balance cross-platform data sharing and interoperability with data privacy and security. Tackling individual anonymity, virtual labour laws, state censorship and other regulations are still a work in progress for the metaverse.

Amid this evolving landscape, Indian policies and regulations on the development of crypto-markets, web 3.0 and blockchain based economy take a very sound and cautionary stance – balancing the libertarian utopia of decentralised systems with techno-anarchy posed by the platforms, enterprises, the unicorns and the sooni-corns. The National Blockchain Strategy (NBS) released in December 2021 was followed by the launch of India Blockchain Forum in August 2022, and then with the formation of the recent Bharat Web3 Association in November 2022, a solid platform for a future web 3.0 economy has been laid. The Draft Digital Personal Data Protection (DPDP) Bill 2022 might also dovetail with these policies to give a mutable flavour to the data which is much needed in a decentralised ecosystem of decentralised apps (dApps). Combined with the skills availability, the startup ecosystem and adoption of industry 4.0 and new-gen technologies across consumer tech, ed-tech, agri-tech and other industries, web 3.0 poses a new level of opportunity for India. With 11 per cent of the global web 3.0 talent in India, with the right set of regulations, India is poised to become the blockchain and web 3.0 capital of the world. Further, with collaborative innovation, India's modernisation could contribute to the global progress. For example, with the huge success of UPI in India, globalisation of UPI becomes one promising element in a decentralised, co-governed, cross-border payment system.

In line with the national policies, several Indian states such as Telangana, Tamil Nadu, Uttar Pradesh, Goa and others have been proactive towards Central government initiatives. Creation of web 3.0 regulatory sandbox or web 3.0 accelerators by the Telangana government or Deputy Superintendents of Police from Tamil Nadu getting trained in web 3.0 and crypto for examining fraud, or hosting of web 3.0 conference by Goa, the states have come a long way in putting forward their capabilities and further align with their strengths in respective sectors. In Tamil Nadu, the second richest and tenth largest Indian state, Chennai leads from the front, and other industry clusters in Coimbatore, Trichy, Madurai, Tirunelveli, Salem and Hosur pave the way for absorption of web 3.0 technologies. Tamil Nadu's ICT infrastructure and policy frameworks only help to get the necessary FDI and job growth. With the right set of push, Tamil Nadu can take a prime position to serve the world in the new era.

In its first part, this report decodes the metaverse and web 3.0 by providing KPMG in India's definition – its characteristics, requirements and design elements – and how different industries such as retail, banking, education and manufacturing pose myriad opportunities for India. The report provides a snapshot on deal funding and lays key considerations and recommendations for tax, security and valuations in the space. In the second part, KPMG in India explores Tamil Nadu and its propensity to lead in the metaverse and web 3.0 world. While there is a clear need to develop regulatory clarity and framework to nurture startups at a national level, KPMG in India has laid down a possible roadmap for nurturing Tamil Nadu's industries juxtaposed with the current policies and investments. The web 3.0 and new gen investments are here to provide a boost to its current USD290 billion GSDP in this decade and create a 20 per cent digital economy cushion which is ever more resilient, additive to the economy, and far more democratised.

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Part A

Decoding the metaverse and related technologies

Introduction: What the metaverse and web 3.0 bring to the table

An astounding 10 million people participated on an average in virtual concerts by the likes of Ariana Grande and Travis Scott in the Fortnite metaverse. Roblox has been used by more than 164 million users every month since August 2020. Meta is investing USD10 billion on metaverse. Game developer, Supersocial raised USD5.2 million to make games on the Roblox platform.

While metaverse stakeholders – developers like Meta, brands, hardware providers and users are imagining and exploring the various facets of the concept, our interactions with multiple industry stakeholders reveal that there is no consistent definition of the metaverse. So, we start at the basics – What is the metaverse and web 3.0?

Definition of the metaverse and web 3.0

We define the metaverse as a virtual environment that seeks to enable real-world activities and experiences, as well as create virtual experiences which are unique to the digital world.

For example, social experiences like watching a movie real-time in a theatre with other people albeit in a virtual environment sitting at home; participating in a real-time, virtual marathon in London; attending a wedding in an avatar form, etc. Walking around in a virtual mall or a high street, trying on a dress in an avatar mode and making an online purchase; attending online classes in a 3D classroom environment are examples of how real-world activities can be experienced in the metaverse.

We define web 3.0 as a fusion of decentralised digital identity, decomposable digital assets and automated ecosystems enabled by smart contracts that void the need of a central authority. At its core, a decentralised internet means that technology companies that mediate services may no longer own or govern the web. Using this privacy-first construct, users may bypass these central authorities that store their personal data.

Hence, the centralised model currently preferred by technology titans might ultimately morph into a hybrid structure supporting decentralised operating models. However, the metaverse of the future ecosystem benefits from multiverses constructed on competing technologies and varied degrees of openness, as well as the coexistence of web 2.0 and web 3.0. The evolution of metaverse will be to enable online simulation of the real world with web 3.0 characteristics of cross-compatible universe of web 2.0 technologies (the age of two dimensional Facebook, YouTube, online transactions which are aimed at user convenience, whether in terms of ease of access to content for consumption or digital commerce).

Metaverse platforms are likely to be built in conjunction with users who will be able to create content within the metaverse (like virtual buildings, games etc.) and monetise the same. Metaverse is thus likely to provide a create-to-earn proposition, akin to the real world. Also, the users will be able to participate in decisions related to the platforms by means of tokens that give them voting rights on select matters. For example, Sandbox and Decentraland, among the pioneers in the metaverse space, allow users to purchase digital real estate ('land'). Like in the real world, the price of these land parcels depends on their 'location' within the platform. The purchaser can develop the land on their own (potentially for monetisation purposes like a gaming zone) or rent it out to other users.

Characteristics of a 'metaverse' platform in a centralised versus web 3.0 world

In KPMG in India's view, for a platform to be called a 'metaverse', it needs to be able to replicate at least one real world activity in the virtual world or completely immerse with gaming platforms with embodiment, immersion and privacy settings. This means that a user can choose to explore and create virtual experiences without the platform defining the next steps or next set of activities for him. The user quintessentially becomes the creator, moderator and decider for his actions in a web 3.0 semantic world. The underlying tenet that metaverse will gradually gravitate towards a web 3.0 ecosystem holds true in current technological evolution.

A web 3.0 powered metaverse platform is in essence boundaryless, persistent, immersive, decentralised, and enables social experiences along with having an independent economic system.

1. **Boundaryless:** The metaverse should eliminate boundaries between the virtual and the physical world; ideally in terms of the activities supported by the platform and the number of concurrent users – thus it is also interoperable amongst various platforms pitching for a next gen web 3.0 platform which is intelligent and cross-platform compatible.

2. **Persistent:** The metaverse is in a state of constant continuum and cannot be reset or rebooted. User actions within the metaverse have a real-time impact on the platform and the 'history' cannot be deleted. However, there can be certain instances where the mutability of a contract helps define user's choices for being tracked or followed in web 3.0.

3. **Immersive:** As the metaverse seeks to provide a realistic experience, it will need to be immersive and interactive with human senses fully engaged so that the users feel present in their experiences. Extended reality devices - VR headsets, AR glasses will be needed to fully deliver an immersive experience where identity, entitlements, ways of communications, payments, objects, history and other nuances are available.

4. **Social experiences:** Users will express their personalities through avatars (sporting accessories and embellishments) and engage with other users in a spatial form through facial expressions and body movements.

5. **Decentralised and redressable:** The metaverse isn't controlled by a single entity. Metaverse as a concept intends to move towards autonomous platforms where users having certain ownership rights – like voting on decisions related to platform development, right to revenue generated by the platform. This is likely to be implemented by issuance of platform specific tokens. The decentralised autonomous organisations (DAOs) with member owned communities and blockchain based governance are expected to set the tone for a truly decentralised construct of metaverse.

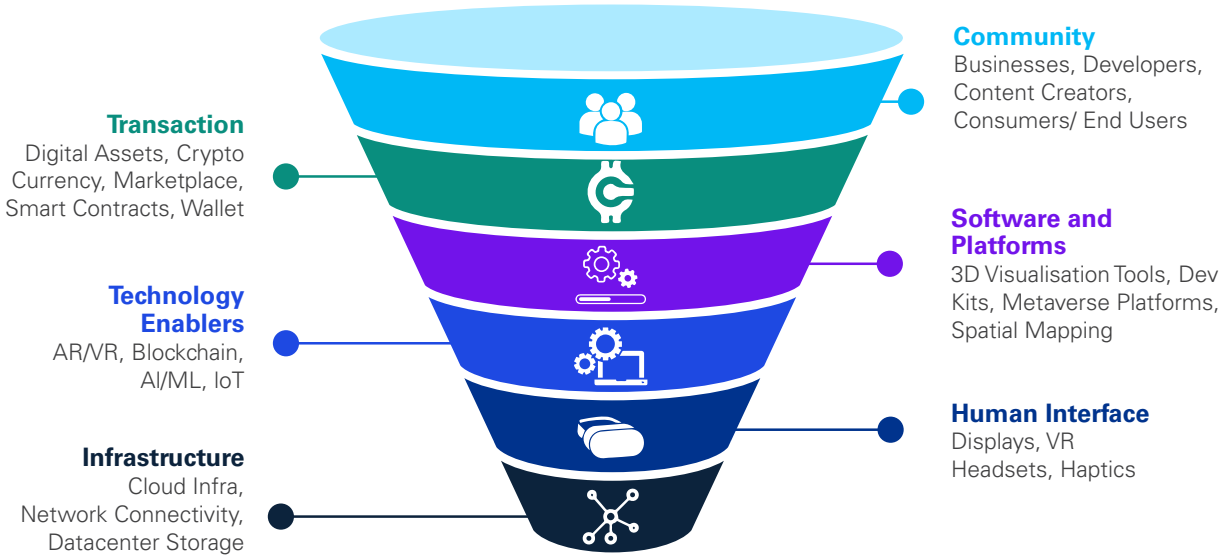
6. **Economic system:** The metaverse can have its independent currency using which transactions can be conducted on the platform. These are usually crypto tokens/currencies.

Metaverse platforms have started attracting attention across industries. However, with the whole concept in an early stage in India, there are different views on what the metaverse is, its practicality and how it can add value to businesses.

Metaverse and web 3.0 stack and design elements

Metaverse promises to be the virtual platform of the future — for interactions, collaborations, partnerships, and joint ventures – in a truly connected and intelligent next gen web 3.0. To power this, metaverse needs a strong and viable ecosystem that will drive mass adoption. Below are the major categories of stakeholders fueling the ecosystem.

Figure 1: Metaverse and Web 3.0 stack



Metaverse offers immense opportunities for everyone - right from businesses and governments to individuals in driving stronger engagement, efficiency and effectiveness. Many organisations are currently deploying metaverse and other web 3.0 technologies from branding to sales and marketing, operations and customer service.

Further, with decentralised architectures slowly getting embedded into the traditional businesses, the web 3.0 lends a quick boost to the community driven creator economy.

Web 3.0 will further empower the creators of products and services and drive a much more inclusive economy.

With the continued focus on skilling, India is strongly positioned to take advantage of the growing web 3.0 ecosystem.

Akhilesh Tuteja

Partner and Head, Technology Media and Telecom
KPMG in India

Web 3.0 is adding new value to metaverse and shaping new propositions

Table 1: Elements and characteristics of web 2.0 and web 3.0

Elements	Characteristics	Web 2.0	Web 3.0	
Power	**Organisation structure**	Shared services, centralised global capability centres	Governance through decentralised autonomous organisations (DAOs)	**New functions**
	Infrastructure	Centralised	Decentralised	
Design	**Platform Ownership**	All companies (hyperscalers, gaming companies, etc.)	Community of developers, users and companies	**New capabilities**
	Identity and digital assets mobility	Platform-restricted operability	Interoperable	
Enable	**Interface**	UX/UI, XR, VR, AR, console, mobile app	Same as Web 2.0 and developing with decentralised structures	**New Operating models**
	Transaction/ Ownership	Traditional payments	Cryptocurrency as well as fiat	
Deliver	**Digital Identity**	In-platform avatars	Anonymous hierarchical identity-based encryption	**New Revenue streams**
	Digital Asset	Token/ Reward points, collectibles	Same as Web 2.0 plus the ownership remains with the user instead of the platform	
	Digital experience	Socialising, gaming, e-sports	Same as Web 2.0 plus e-fashion, trading, working, designing, etc.	

Source: "Opportunities in the metaverse: How businesses can explore the metaverse and navigate the hype vs. reality," Onyx by J.P. Morgan, JPMorgan.com, January 19, 2022

As per KPMG's enterprise digital transformation survey fielded from April to May 2022 across 350+ respondents, amongst all the base technologies (cloud, big data, industry 4.0/IoT) and augmented technologies (blockchain, metaverse/NFTs, AI/ML, AR/VR/MR), the maturity of the metaverse/NFTs was at the lowest – with almost 35 per cent of global large enterprises still lagging on implementation. It is thus imperative to break the hype versus the reality.

Metaverse and web 3.0: hype versus reality

Most of the metaverse platforms today are almost entirely in 2D Roblox and Sandbox platforms, have specific VR use cases but are largely built for 2D users. The reason for this is lack of mainstream adoption of VR devices. Most applications from Horizon Worlds, VRChat, Rec Room, Fortnite, Roblox, Sandbox, Axie Infinity, Decentraland and Second Life aim at activities ranging from exploring, socialising, playing/ creating games and role playing with VR usage.

Live events like Travis Scott concert on Fortnite metaverse, which had 12.3 million live viewers as per media reports, are unable to provide a truly shared, social experience. Most platforms create multiple 'realms' of the virtual world, with each realm concurrently hosting only 100-200 players at a time. Also, user actions within the realms are constricted. This is because most user devices do not have sufficient computing power needed for motion capture and translation of actions of other users in the virtual vicinity.

The table illustrates the metaverse use cases today and potential use cases in the future with VR device maturity.

Table 2: Hype versus reality

Parameter	Perception	Reality	Time for maturity
Hardware	Increased availability of VR / AR/ XR hardware devices; price points catering to various society sections are omni-present	Except Meta's effort in US, none of the big tech companies have succeeded in large consumer adoption; hardware requirements are limiting access to hyper-reality environments	**4-6 years**
Software	Repackaging of AR/VR environments is widely done; gaming environments already provide enough software platforms to the ecosystem	3D file formats are still emerging; gaming companies are just one part of the metaverse, and different experiences form the ecosystem	**4-6 years**
Networking	Cloud, 5G, software defined networking are already available to enterprises and masses	Although cloud and network models are evolving and supporting the move towards web 3.0 along with tokenisation and NFTs, blockchain based decentralised business models and user dominated control mechanisms are yet to emerge on a full scale	**4-6 years**
User adoption	Similar to the growth of daily account user on social media platforms, metaverse platforms are having a huge success	The growth in user base is quite different on online, immersive platforms; although the consumer awareness is growing, that doesn't account for growth in the user base, the use cases are niche too	**4-6 years**

Interoperability and standardisation	Since brands are running campaigns through metaverse platforms, there is widespread interoperability amongst identities and platforms. User data can still be exploited as it has been with platform driven models	Interoperable identity, mobility of avatars, payments and permissioning systems are still work in progress; standards on 3D assets, privacy & security, identity and movement between physical and virtual worlds is still in infancy; data needs to be looked from a new lens as user privacy is critical	**6-8 years**
Crypto currency	Buying and selling of merchandise and digital/ virtual assets has proliferated with crypto currencies	While NFTs and crypto currencies are a part of the metaverse and web 3.0 ecosystem, they are not necessary; central banks are still trialing CBDCs, hence widespread adoption is missing	**4-6 years**
Security and governance	Since the web 2.0 constructs are available, the same can be replicated or shifted to the web 3.0 immersive world; DAOs give rise to a new governance mechanism	Governments, enterprises, lawmakers and regulators all need to be in sync for a secured web 3.0 world. Building for 360-degree full proof solutions is always a work in progress; digital IP rights, tax, sale of tokens need more time to mature	**4-6 years**
Ease of use	Roblox, Fortnite, and Decentraland-like virtual worlds give a sense of hype that everything that is there can be simulated in a virtual world in a single platform	Most metaverse solutions are feature-based on single platforms and not full-blown product based - hence not easily widespread and curtailing ease of use; further, owning an NFT doesn't guarantee loyalty hence brands are still experimenting on deepening two-way value-based relationships; only some building blocks are present today	**4-6 years**

Source: KPMG in India

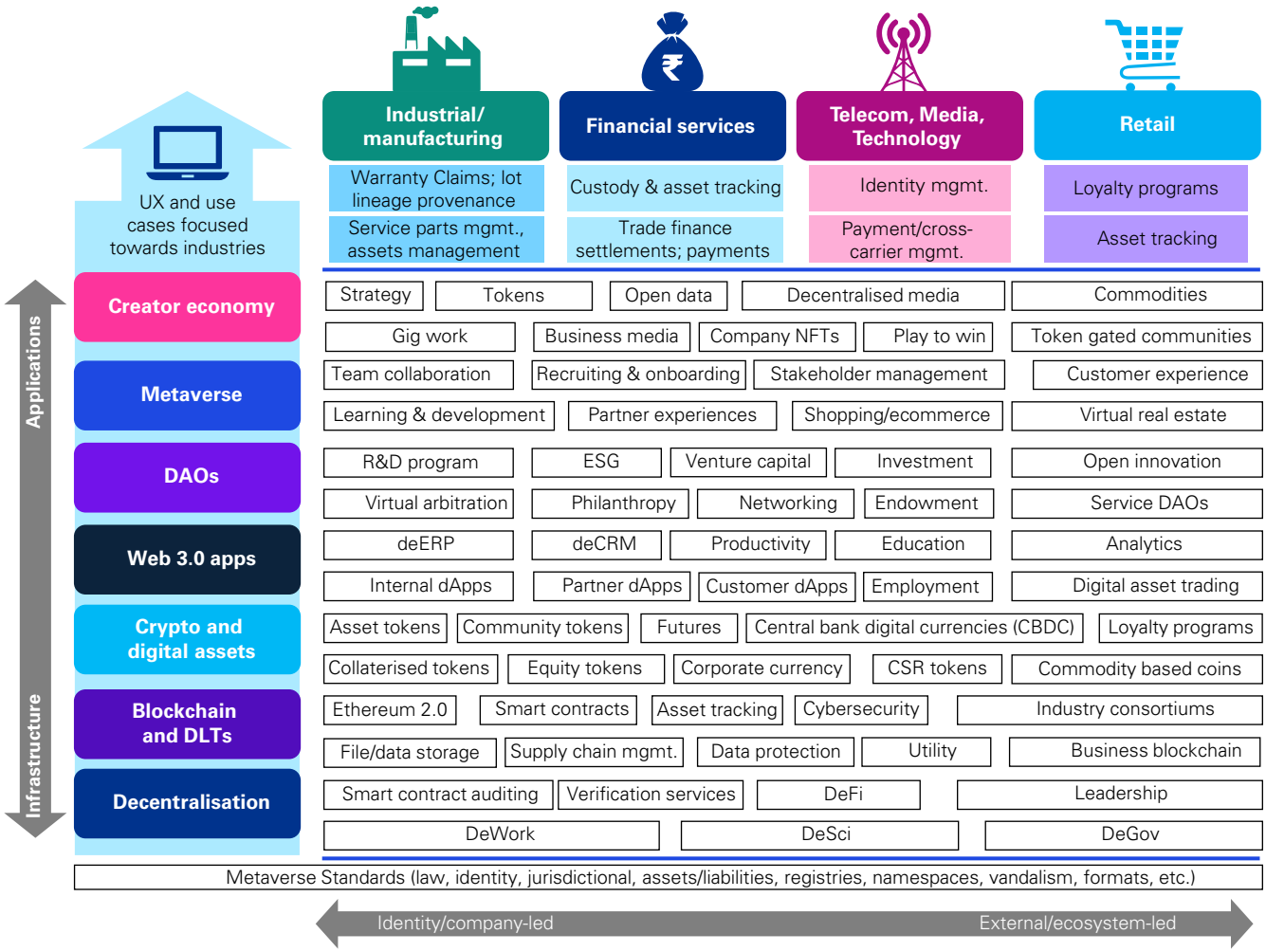
Along with AR/VR/MR device maturity, enabling these use cases will need coming together of 5G, AI, next-generation processors and edge computing. These technologies are not advanced enough to scale en-masse at an affordable price, and as a result, an all-encompassing immersive metaverse experience is likely to be possible only in the long run.

The metaverse as it stands now for companies

Leading brands across food and beverage, jewellery, ecommerce, automobile, OTT platforms, broadcasters, movie production houses have started metaverse activations across global and Indian platforms. These efforts are in a nascent stage, aimed at building new avenues for consumer engagement while also enabling online commerce.

Below are some examples of use cases, both internal and external, which are emerging for all the companies from basic decentralised horizontal use cases to more nuanced web 3.0 and metaverse oriented horizontal use cases.

Figure 2: Metaverse and web 3.0 use cases



Source: Dion Hinchcliffe, Zdnet, June 2022, KPMG in India

Monetisation models for metaverse activations

Additional revenue streams

The monetisation models that are being implemented by global and Indian companies for their metaverse activations include revenue from NFT sales, online commerce and higher engagement for products/services leading to potentially higher revenue from the existing sales channels.

Revenue from NFT sales: Brands do NFT drops on the metaverse, whether as a standalone activation or as part of persistent activations like a virtual store. Revenue from primary issuance of the NFTs as well as royalty on secondary sale are monetisation opportunities from NFT drops. NFT DROPS – NFT on popular content from movies, web series, books and other digital/print media are likely to be dropped on metaverse platforms. These drops could be a part of a timed or persistent activations either by the content owner or by a third party. For example, Marvel NFT dropped as part of a virtual literary fest on the metaverse.

Ecommerce: Brands showcase products as part of one-off events like a themed party or persistent activations like a storefront. They provide option to the users to browse the products in the metaverse and order them online from their websites or app (users are redirected to the brand's website or app based on the user device and whether the app is downloaded on the user's phone). OTT content, commerce and connectivity can also be bundled together as showcased below:

GUCCI (Industry – Luxury lifestyle)

Major activation

i. **Nature of activation:** In 2021, Gucci unveiled Gucci Garden, a two-week art installation, on Roblox metaverse to mark its 100th anniversary. Gucci Garden was a virtual recreation of a real-world installation in Florence and offered various themed rooms showcasing the brand's campaigns. This launch coincided with Gucci dropping virtual items on Roblox.

Users could browse, try-on and purchase digital Gucci products (NFTs) to dress their blank, genderless avatars before entering the themed rooms. As they made their way through the rooms, their avatars would absorb elements of each area.

Monetisation avenue: All virtual items were sold via a revenue share model. However, the NFTs were not tradeable among users, hence there was no royalty mechanism built on prospective secondary trades.

ii. **Nature of activation:** In 2022, launched Gucci Town, a persistent digital space on Roblox, themed as a virtual piazza. Gucci Town features activities like games; creating art pieces experimenting with patterns, colours and shapes; virtual representation of Gucci's concept store where latest the products will be showcased; browse and purchase digital items for avatars.

In essence

Nature of activation	Duration	Monetisation model
NFT drops of Gucci virtual wearables for user avatars	Peristent	Revenue from primary issuance. Revenue share with platform
Themed experience to promote NFT drop	Time-bound	No standalone monetisation (support NFT sales)
Virtual town for themed experiences, product showcasing, digital product/NFT purchase	Peristent	Revenue from primary NFT issuance. Revenue share with platform

Direct customer engagement

Higher user engagement: The metaverse activations done by brands focus on increasing user engagement which might potentially lead to higher revenue from existing sales channels. Brands are building experiential zones, product showcases, one-off events to increase recall and create a buzz, that might translate to higher sales. Brand integrations are also being done as part of events held by various companies. While standalone monetisation models for the metaverse might be implemented in the future but in the near term, the primary near-term aim is likely to be user engagement.

SAMSUNG (Industry – Electronic goods)

Major activation

i. **Nature of activation:** In 2022, Samsung created a virtual store, Samsung 837X, on Decentraland metaverse platform. This store is a digital twin of the company's flagship office in New York City. Quests, NFT drops, events, and live performances are available at the store. In addition to major social media platforms such as Twitch and others, Samsung streamed the unveiling of the new Galaxy smartphones in the Samsung 837X. Attendees were allowed to personalise their avatars after arriving at the event by purchasing hairstyles, clothing, and accessories from the store.

In essence

Nature of activation	Duration	Monetisation model
Themed experience in sync with the company's annual reveal of new products	Time-bound	Revenue from primary NFT issuance (character skins etc.)

Community led global footprints

With the creation of forums such as Distributed Identity Foundations, community standards are evolving on claims, credentials, identity, discovery, secure data storage, applied crypto and wallet security. More decisions are based on the priorities of the community. Such open-source platforms create a community of power within the set of rules established. A community also brings a sense of ownership rather than being a user.

Potential monetisation opportunity:
To capture this psyche of belongingness, companies today are cementing their strategies with community centred conversations. Based on the design justice principles centred around community-led controlled outcomes and non-exploitative solutions, companies are eager to know more from the marginalised, indigenous and local population to capture meaningful growth.

NIKE (Industry – Retail)

Major activation

NIKELAND, an interactive world where visitors play mini-games and immerse themselves in a lifestyle centred on sport and play, opened in November 2021. NIKELAND is hosted on Roblox, a metaverse platform recognised for providing users with immersive experiences. By expanding its market to the digital arena, the business may engage more individuals in its products and services. NIKE provides a digital token for fervent brand lovers and allows them to give suggestions and opinions on new product launches.

Further, with ".Swoosh", Nike is not only creating a web 3.0 education resource as well as a platform to buy and sell digital collectibles, but also a medium for users to build their own assets and earn royalties.

Enhanced user experience

Experiential zones for content: Virtual amphitheatres, movie screenings, picture galleries are likely to be metaverse activations by companies in TMT space. For content distributors like OTT platforms, telecom operators etc., the metaverse is likely to be an additional consumption medium apart from TV, mobile apps, etc. For content creators like movie studios, the metaverse is likely to be an opportunity to promote upcoming content or re-hash popular content to explore monetisation potential.

Potential monetisation opportunity: Advertising revenue is expected to be a monetisation avenue for experiential content activations by content owners/distributors in the form of co-branded activations.

Online commerce related to the content can also be a potential activation within the experience zones.

SOTHEBY'S (Industry – Auction house)

Major activation

Nature of activation: In 2021, Sotheby's launched a virtual gallery, a digital twin of its London headquarters in Decentraland metaverse. The launch coincided with the launch of an NFT auction by Sotheby's which was live streamed on Decentraland. Users can showcase and sell NFTs, socialise with other users in the gallery.

In essence

Nature of activation	Duration	Monetisation model
Themed experience to exhibit collections , livetream auctions	Persistent	Revenue from primary NFT issuance

For content/IP owners like movie studios, NFT drops related to popular content from movies and web series like music, digital posters, video moments would be a monetisation avenue. Upcoming movies can also release NFT ahead of the movie release. Movies can also be crowdfunded – movie tokens are issued which give the token holder right to vote on select movie matters and entitles them to benefits like access to movie screenings, special NFTs, share of movie revenues, etc.

Sector-wise coverage on the metaverse and web 3.0 opportunity for brands

Table 3: Select vertical use cases for metaverse and Web 3

Select vertical use cases for metaverse and Web 3				
Use cases / Outcomes	**TMT**	**Financial services**	**Consumer and Commerce / Retail**	**Industrial**
Customer engagement / product marketing	√	√	√	
Developing new products and service lines through open innovation	√	√	√	√
Developing new sales channels	√	√	√	
Revamping supply chain and core operations	√		√	√
Tokenisation and fractionalisation	√	√	√	
Research and development	√	√	√	√
Digital twins, virtual ops, and troubleshooting			√	√
Revamping back-offices (HR, L&D, Finance,Compliance etc.)	√	√	√	√

Source: KPMG in India

Technology, media and telecom

Metaverse is an avenue for user engagement and content distribution. Thus, it lends itself very well to media and entertainment companies, whether for sports broadcast, movie streaming, music launch, OTT shows, etc. The metaverse, apart from being an additional distribution channel (and therefore supporting traditional monetisation avenues like subscription and advertisement revenues) also provides opportunities for content monetisation through fungible and non-fungible tokens. Tokenisation of content also enables users to trade and invest in content in the form of NFT.

The benefits of tokenisation extend to gaming as well and the ability of metaverse games to support the play-to-earn proposition has led to gaming becoming one of the earliest use cases of metaverse platforms. Media and entertainment industry inherently has a role in bringing people together, and the new experiences provided by the metaverse will enable this further.

Metaverse adoption by telecom companies is in a comparatively nascent stage as compared to media and entertainment players. Technology companies have made a foray into the metaverse by way of product launch and showcasing in one-time virtual events or virtual stores.

In the following section, we will look at the metaverse plays by global and Indian companies in the TMT space.

Examples of metaverse activations by TMT companies

SK TELECOM (TELECOM OPERATOR)

The biggest telecom operator in South Korea has launched a metaverse platform focused on social media interactions

Use cases supported by the platform – Users can meet in virtual spaces and use customisable avatars and virtual items. Users earn in-platform currency by completing 'missions' on the platform and this virtual cash can be used to host virtual meetings on the platform.

Traction - The platform, initially launched in its home country, is expected to be extended to 80 countries. The number of users on the platform was around 8.5 million as of July 2022

DISNEY + HOTSTAR (OTT PLATFORM)

Launched metaverse activation for OTT show (Rudra – The Edge of Darkness)

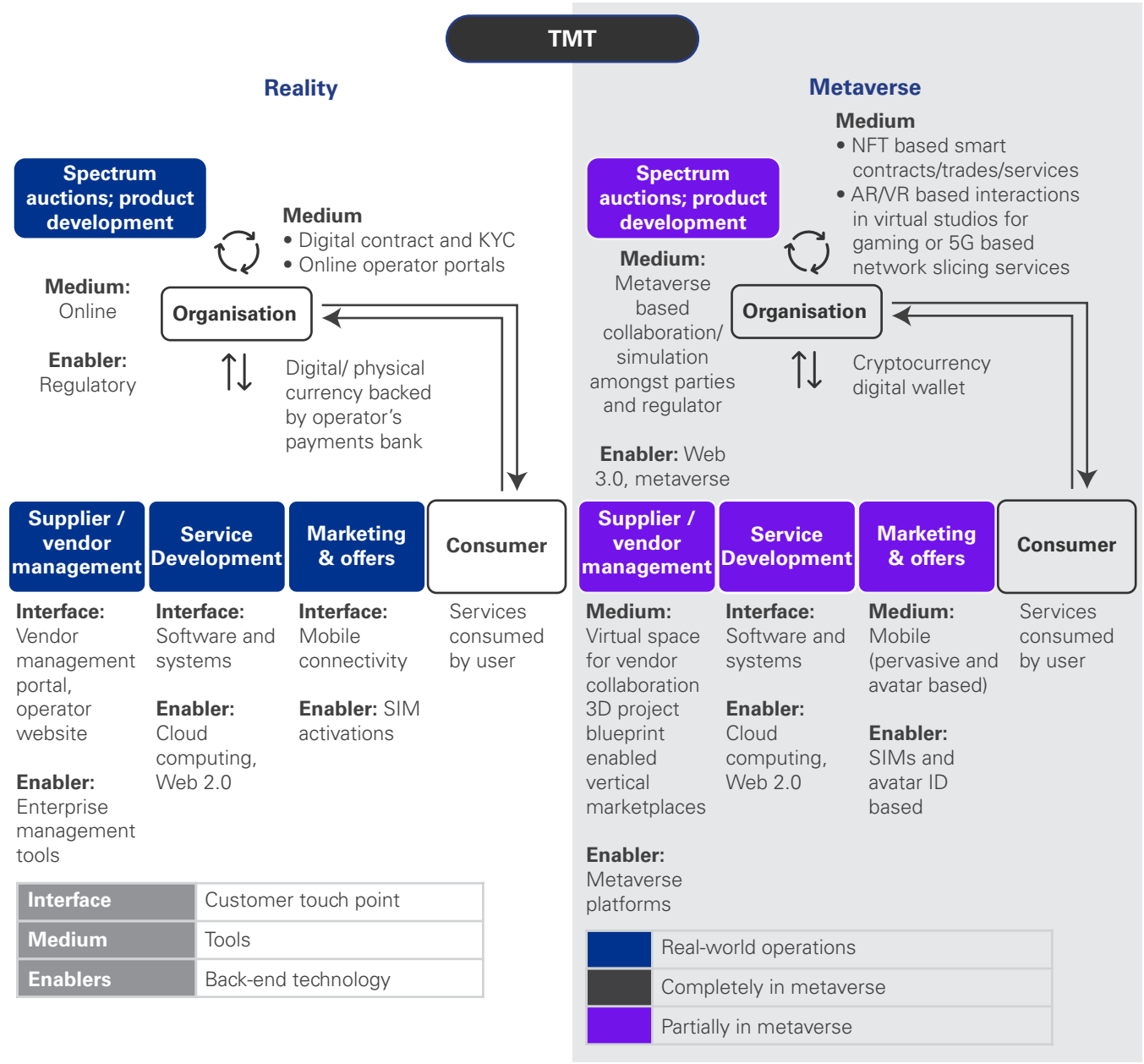
Use cases supported by the event – Users could witness the trailer, songs, behind-the-scenes videos etc., in virtual reality. Digital avatars of the cast were created, and the event offered an immersive glimpse into the world of Rudra to its viewers. The event also hosted a gaming and entertainment centre based on the theme of the show.

Companies across telecom, media and technology space that should consider metaverse activations

Telecom companies that have content offerings like apps for music, movies, web series etc. should consider the metaverse as an alternative consumption mode to mobile apps and TV.

Media and B2C technology companies, namely content owners like production houses and content distributors like OTT apps, have an opportunity to monetise content through NFT drops, generate buzz for upcoming movies/web series through metaverse activations, and aim for higher brand engagement via timed or persistent activations.

Figure 3: Transition of metaverse component – TMT



Financial services in the metaverse

Metaverse has acquired market momentum in a variety of areas, including banking and financial services. While the metaverse connects the actual and virtual worlds through advances in hardware and software, it also requires an economic system to function. As the metaverse grows, a variety of financial services will be required to support its operations. Metaverse finance (MetaFi) will most likely be a hybrid of decentralised finance (DeFi), centralised finance (CeFi), and traditional finance (TradFi), with new products tailored to the specific requirements of the new ecosystem. Financial services can play a major part in this evolution, from initial capital formation to enabling trade inside the metaverse. Banks in the metaverse could provide advice and develop relationships at a time when banking has become commoditised and emotionally depleted.

As banks look to deep dive into the metaverse, it's critical that they consider the evolution of banking and their maturity levels over time and make appropriate progress:

- **Present the existing services in metaverse**: Given the vast opportunities to grow banking services in metaverse, banks should first start focusing on upgrading their existing products and transforming their traditional services by using AR/VR technologies and MetaFi offerings
  - Banks should also look to enhance customer experience with their digital presence in the metaverse. They can create a virtual workplace to remotely interact with their stakeholders, including customers.
  - Banks can elevate employees' experience while educating them and to drive innovative interactions. Branch staff receive immersive training that simulates genuine customer service situations, with the use of VR technology, so they can recognise emotions and modify their conduct in a risk-free setting.
- **Develop new products and services:** Banks may think about creating their own private metaverses, which would enable new marketplaces and products while connecting them to their existing infrastructure. Some illustrative list of the products/ services which banks can look to provide are:

Digital payments

a. Digital cards

b. Digital wallet to hold multicurrency CBDC and other digital assets

c. FX and securities settlement

d. Customised bank coins

Digital assets

a. Custodial services

b. Lending against digital assets

c. Collateral registry to combat fraud

d. Fractional securities

e. QIP platform (Qualified Institutional Placements)

Digital twins

a. Recreating virtual twin to meet banking/insurance requirements

	New functions	New capabilities	New operating models	New revenue streams
Opportunities	• Service delivery new channel for hyper-personalisation • New product development • Enhanced user experience with smart contracts	• NFT marketplaces for minting and trading of NFTs • Digital IDs and centralised KYC for trusted transactions • Digital collateral to manage virtual real estate lending services • Data protection and masking capabilities	• Decentralised environment for transactions to move across financial institutions	• Hyper-customisation of financial services across the new metaverse channel • Metaverse-enabled borrowing and lending of cryptocurrencies • Peer-to-peer collaboration and lending of assets
Challenges	• Product delivery in new constructs • New payments, regulatory • Availability of services • New infra requirements • Modernising legacy	• The difference between wholesale and retail channels could diminish • Digital self-sovereignty by blockchain	• Could result in reduced inter-bank settlement rates, commissions, and charges pertaining to x-country payments	• Maintaining zero trust security and always secured postures • Providing same experience in analogue and virtual worlds

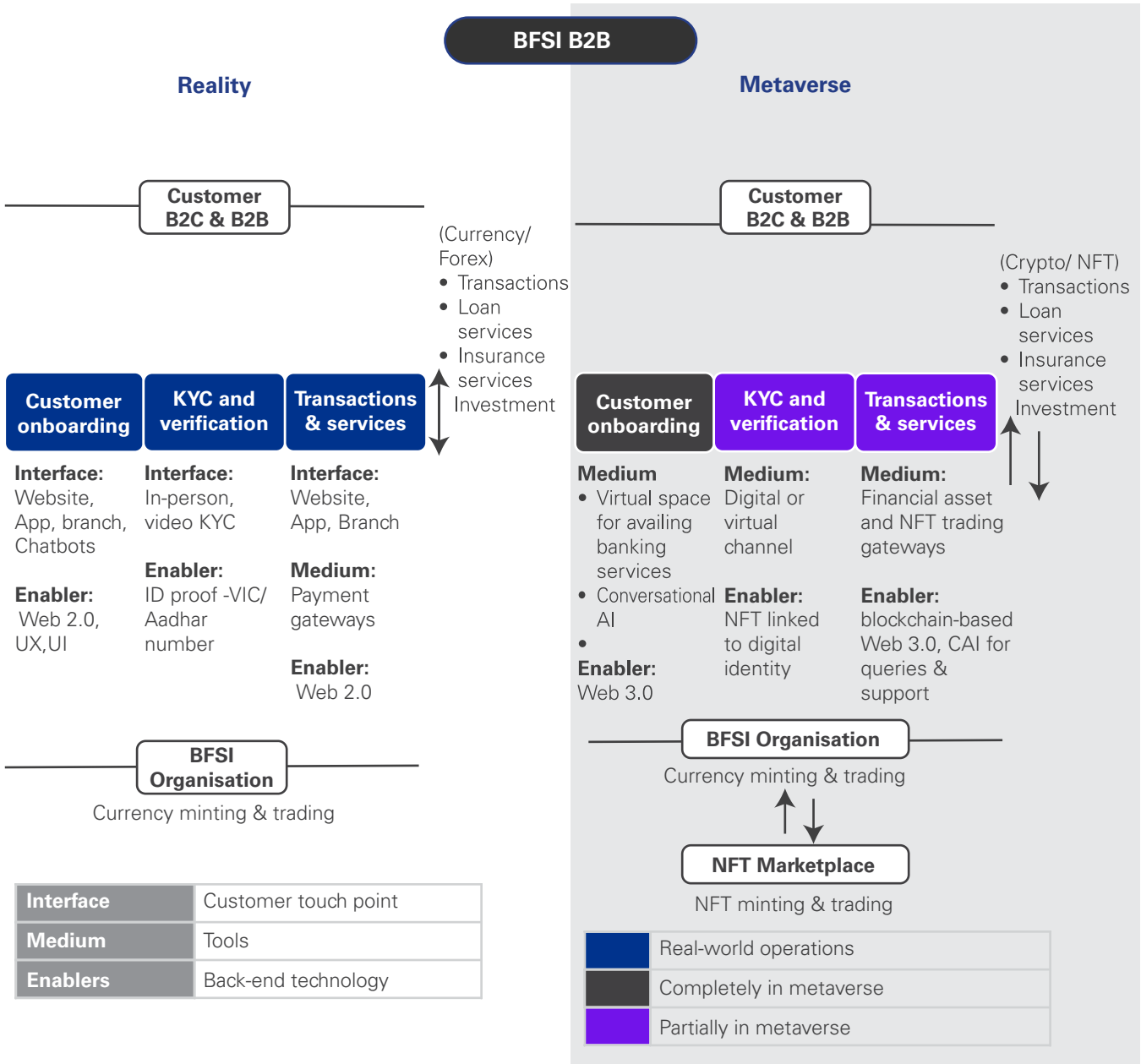
Transitioning to banking in the metaverse is one of the most complex operations for major companies to realise today. First, the Indian consumer should have the propensity to own or invest in digital assets. Second, the user should own or understand the concept of transacting with cryptocurrencies. Lastly, India's IT regulations should support entities facilitating operations in metaverse, set standards and protocols for NFT minting, issuance and trading under a secured framework. Borrowing/ lending finance – consumers will require cryptocurrencies to purchase digital assets and land rendering loan services an essential requirement to fuel the economy.

New avenues such as NFT minting and NFT wallets are nascently burgeoning, giving rise to NFT marketplace for facilitating the creation and trading of NFTs. The financial actors in the metaverse earn majorly on core functions (minting NFT, issuing crypto/tokens) as well as transactional/trading fees on non-core functions (lending, borrowing, payments).

- **NFT marketplace/distributor:** These platforms charge a fee for NFT minting and primary NFT issuance and secondary trade
- **NFT trading:** Speculation-based investment and selling of high-value NFTs across different sectors
- **Digital custodians:** The autonomous organisations control how crypto-based tokens can be purchased through open-source smart contracts based on blockchain.

The figure below represents how the metaverse components are transitioning across the value chain in the banking sector.

Figure 4: Transition of metaverse component – BFSI

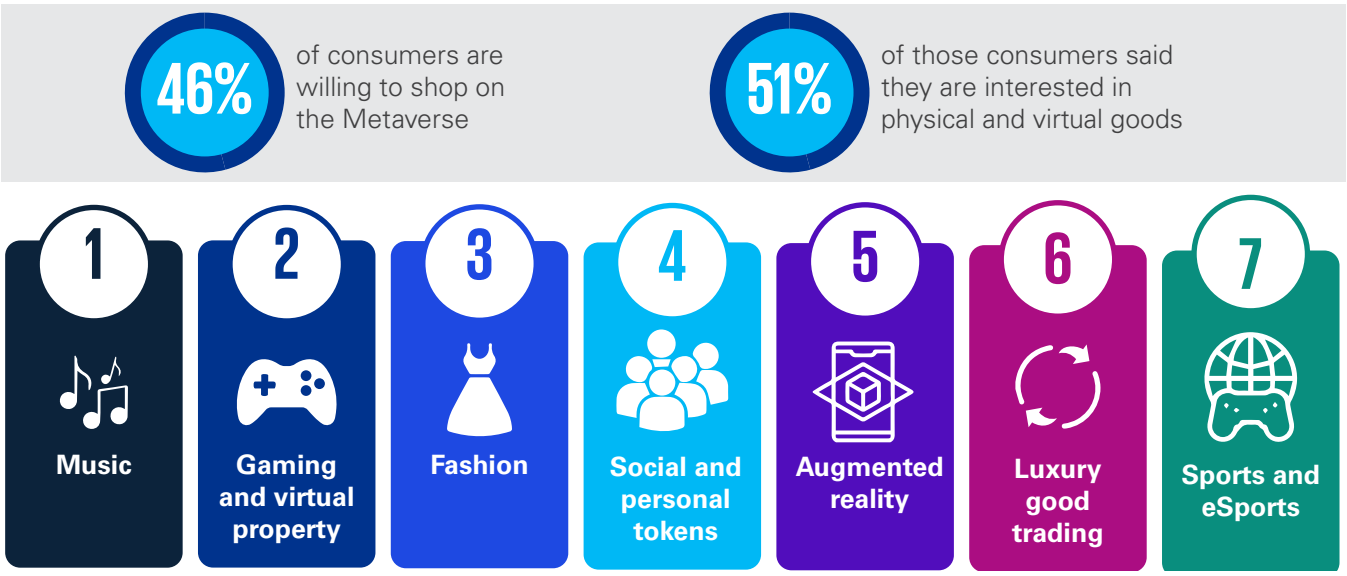


Consumer and commerce

India has been ranked fifth only behind the US, Indonesia, Japan and the Philippines in terms of consumer interest in metaverse projects. Almost 100,000 Indian users have been involved in Decentraland and AxieInfinity and 500K Indian users have shown interest in NFTs as of Nov 2021[2].

Insight into customer behaviour around metaverse

Preference order of purchasing NFTS **GenZ** are the most familiar with NFTs



Source: BigCommerce Consumer Report (March 2022)

While connecting with other people remains a top preference, consumers are also keen on exploring digital worlds, meeting and collaborating with remote colleagues, trading NFTs, create games and experience other VR/AR/XR apps. However, the most important element of metaverse is experience. Brands are understanding consumer touchpoints and are building on new levels of interactions, hardware ergonomics, to deliver an immersive experience. Experience has translated into the war for consumer attention through better graphics, layers of features, or intuitive interfaces. With customer focus being the key driver along with the gaming culture in India , metaverse is witnessing accelerated adoption and use cases across retail, consumer and commerce markets.

2. Sources: DappRadar , Publicis

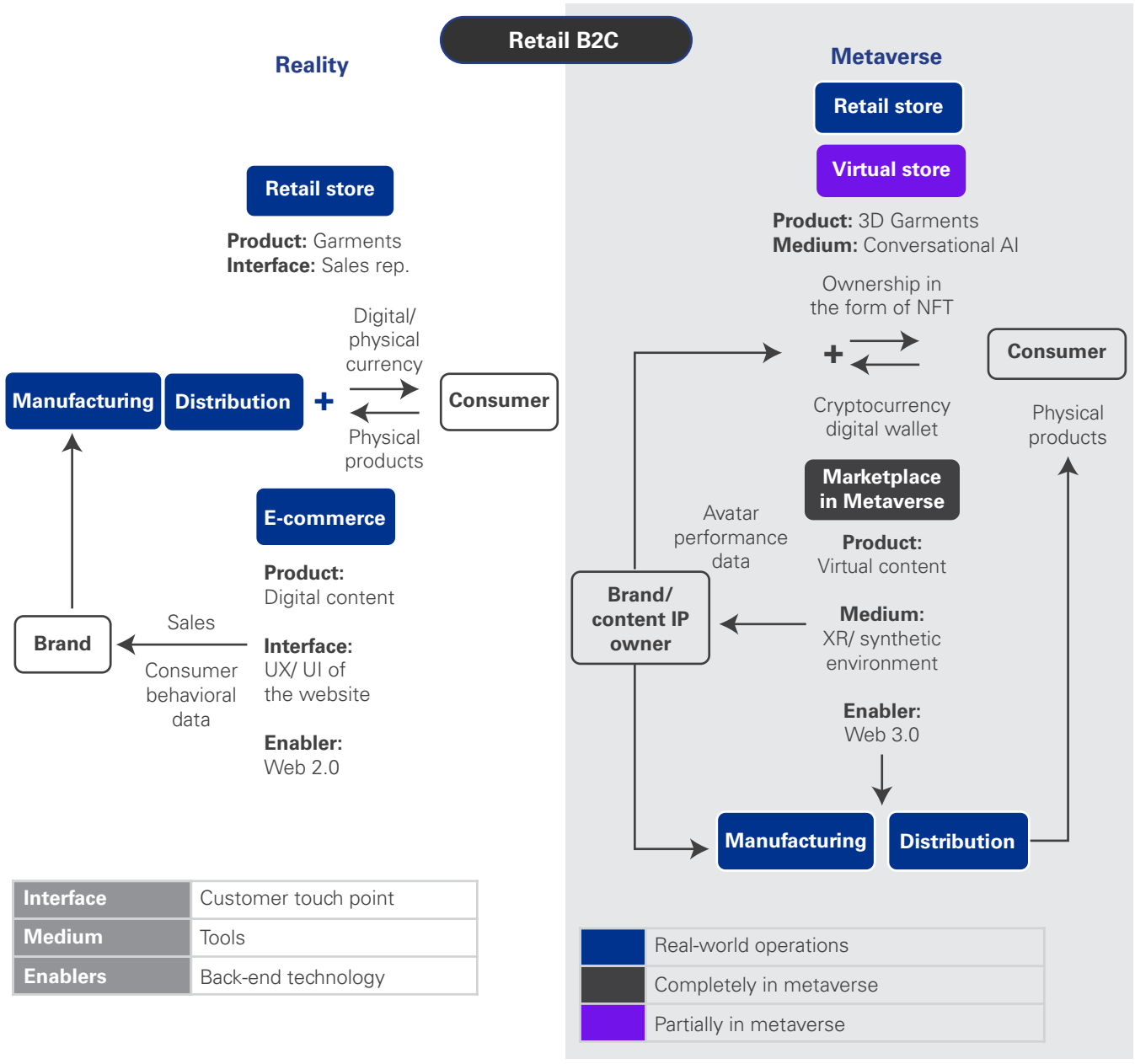
	New functions	New capabilities	New operating models	New revenue streams
Opportunities	• Tech architecture and IT service desk to support the operations on virtual galleries	• Facilitation open NFT trading Digital asset ownership	• Direct-to-consumer shopping marketplaces enabling virtual aisle navigation • Virtual marketing and brand promotion • Customer service on virtual identity verification, and VR support	• Tokens-based play and earn games as loyalty programmes • Virtually enabled social events for personalised customer experience • Loyalty programs
Challenges	• Respond to customer preferences in real time	• Interoperability of merchandise in a phygital world • Data privacy	• Maintaining a seamless and always-on customer service	• Issues related to taxation on new revenue streams and cross-country selling

Web 3.0 is offering an immersive communication experience among customers, brands, machines and creators. Brands are holding marketing campaigns in the metaverse arena with the potential of monetising on social curation and vocalisation (word-of-mouth) which are difficult to achieve through social media. Below are a few examples of whitespace opportunities in retail:

As graphic computing is evolving, virtual fashion is expected to witness tremendous growth in revenue streams. Major fashion houses are tokenising brand identifiers and are offering exclusive access to events, limited edition avatars, and voting rights on new merchandise. FC Barcelona fan tokens gave voting rights on the design of team locker rooms. GAP is launching NFT hoodie designs to unlock digital clothing

Social experiences being the foundational element for metaverse adoption, have seen tremendous innovation, especially in retail. For the past few years, everyone has been talking about their omnichannel experience strategies. Now, with the 'virtual first' approach, brands are skipping past the phygital/ connected retail and are focusing on enhancing the service and behavioural components of metaverse. However, organisations need to assess viable opportunities to capitalise on the differentiated experience. The figure below represents how the metaverse components are transitioning across the value chain in the retail sector.

Figure 5: Transition of metaverse component – RETAIL



Industrial/manufacturing

Industrial metaverse includes digitising of information and assets, visualisation of a physical object, simulating it on a 2D environment, emulating it with a real 3D model, extracting real-time data streams with IoT/sensors, orchestrating virtual models to update physical models, and finally predicting future behaviour of physical model via AI interpretations.

Figure 6: Definition of industrial metaverse

Imagine building a rocket for a mission, which needs a space launch system capable of carrying a couple of hundred tons of material. Such a mission would be the target space for most space and rocket manufacturing companies globally. The remote working and remote manufacturing trends not only give a push to a 'digital twin' concept for this rocket design process but make sure the experts (government and commercial spaceflight) come together and brainstorm the design, start sketching, carve out possibilities for creating the best rocket design, 3D manufacture it, and finally work towards planned maintenance, preventive and corrective maintenance that include rigorous inspection, detection, correction, adjustments, repairs, replacement for extending the life of parts. Remote parts from all the world can be extended into this hyper reality space to join the missing pieces. The metaverse and web 3.0 technologies further promise immersive hyper reality for not only space missions but also interplanetary missions.

With the industrial metaverse, manufacturing processes and supply chain scenarios can infinitely be simulated in the cloud before committing to actual prototype of the product. This means lower carbon emissions with better product designs and better customer satisfaction.

Since the metaverse is synchronous, live, combining digital and physical world (triangulating data, assets, and content), it is imperative that the use cases are unique to the industrial sector – more so with respect to the geography or even a line of business. It is the industrial vertical that will form the test bed for scalable widespread adoption across vertical and consumer markets. Most industrial manufacturing companies are on a mission to create digital twins of their assets (fixed and mobile) that enable greater transparency of supply chain. This enables them to make the highest quality equipment and monitor front-line operations for quality checks and data traceability.

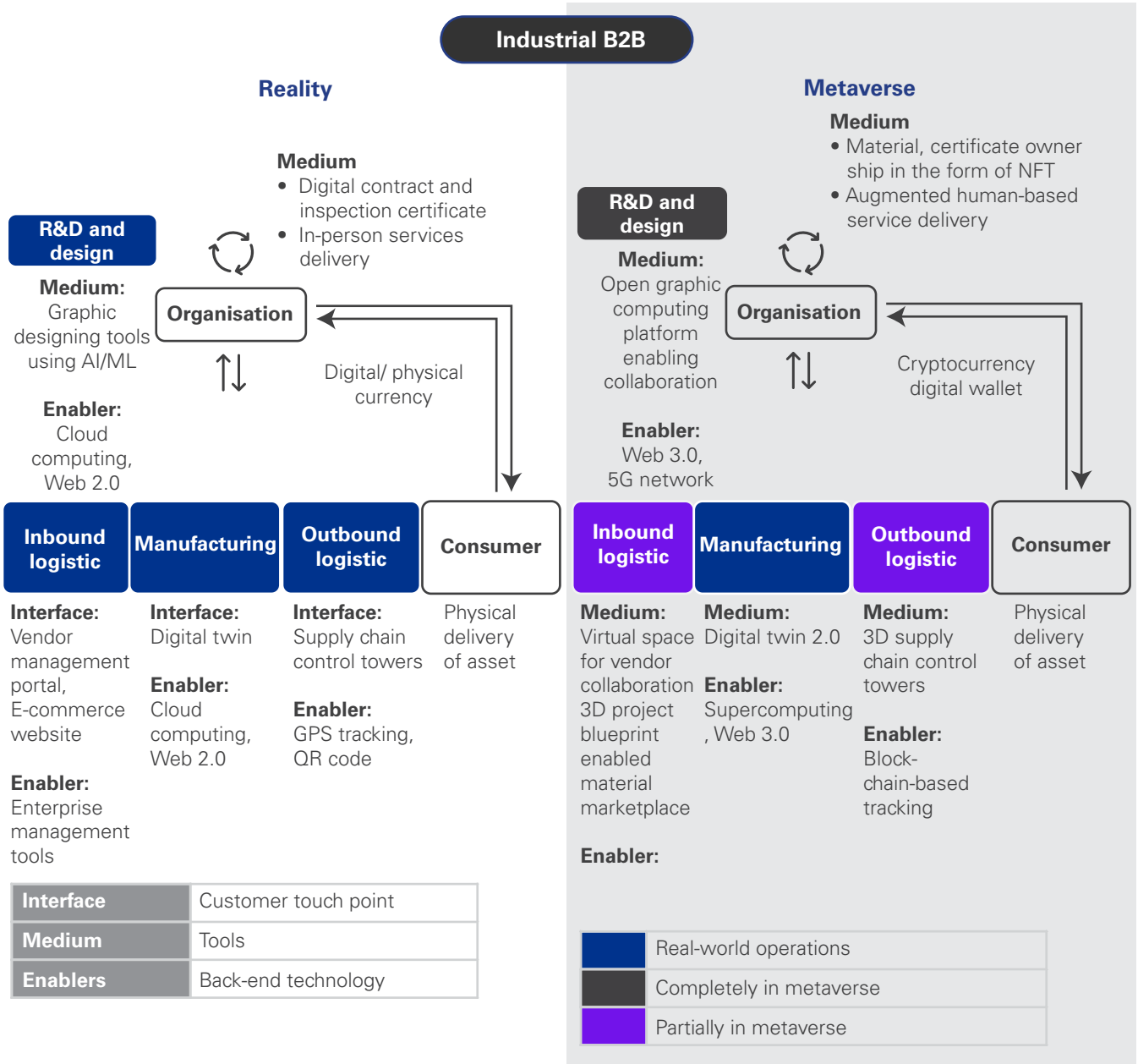
- For its automotive factory, BMW built a digital twin using NVIDIA's Omniverse which helps in creating a simulation for better planning, testing, efficiency (robots are given missions via the Omniverse), and worker safety. The synthetic data generation can help robots in real time to improve their machine learning intelligence quotient.
- Siemens is concentrating on building a curated range of IoT-enabled hardware, software and digital services via its Xcelerator platform. The company has already certified 50 of its 4,000 partners to sell products in the market. With NVIDIA as its technology partner, it will be possible to win the industrial metaverse game without sacrificing customer experience by enhancing experiences that give customers a flexible vision of a future factory.
- Denmark-based leading producer of diabetic medications worldwide Novo Nordisk uses tools like Dynamics 365 and HoloLens 2 to streamline production procedures while upholding the highest levels of quality and abiding by legal and regulatory obligations.
- Triveni Engineering, a sugar company, invested in JetSynthesys, a game developer with a social media video commerce platform. This is a complementary strategy from the company – away from its core operations.

As most of these players have Indian presence, these companies can pave a digital-first roadmap in India and just as companies own private 5G wireless spectrum, enterprises will start owning private metaverse for digital twins, XR, collaboration and various other aspects. So, while the connectivity enables low latency, high throughput and extreme availability of devices and applications, it is the metaverse which will improve the customer experience and lend new ways of collaboration, innovation, customer reach and monetisation capabilities. The fact that a majority of the industrial houses have either their back-office operations in India or they see India as a huge potential as a market is itself a bedrock of opportunities. States such as Tamil Nadu clearly stand to benefit within the space as automobiles and industrial manufacturing picks up within the Make in India movement.

	New functions	New capabilities	New operating models	New revenue streams
Opportunities	• Collaborative R&D enabled on metaverse platform • New product development and model testing in an intelligent simulated environment	• Robotic process automation through IoT sensors connecting the production line with the digital twin for efficient planning, operation and maintenance	• XR enabled service delivery and remote assistance • Virtually enabled third party management platforms for personalised solutioning	• Platform-as-a-service for hosting virtual environments with pre-designed templates for user to create their own unique space
Challenges	• Mindset shift from silo-ed working environment to collaborative working	• Increasing scale with security in a decentralised environment	• Skillset availability • Heavy consoles and VR headsets that take time to adjust	• Customer education and awareness

The figure below represents how the metaverse components are transitioning across the value chain in the manufacturing/industrial sector.

Figure 7: Transition of metaverse component – INDUSTRIAL MANUFACTURING



India metaverse and web 3.0 ecosystem maturity, considerations, opportunities and challenges

Four key catalysts can translate our existing technology strengths into an accelerated value capture:

Market Access and Maturity	Indian market maturity	The government of India has aimed to foster a digital economy worth a trillion dollars. The next step is to increase access to US and EU markets as they hold most of the total addressable market in the metaverse. Currently, around 70 per cent of the global capability centres in India are headquartered in the US[4]. However, India needs to move beyond outsourcing talent and aim to become the leading global delivery centre for metaverse. The training on web 3.0 needs to improve and scale up, helping India become a talent hub.
Skilled resources	Demographic dividend with talent availability Vibrant ecosystem	Global firms, including Meta, are collaborating with Indian VCs to upskill and scale young businesses to develop an ecosystem in India. In the past year • Demand for blockchain professionals has increased by 2100 per cent[7] • Unity 3D engine professionals rose 1600 per cent[7] • Broad support package engineering rose 550 per cent[7] • 55 per cent founders are focusing on Web 3.0 and metaverse for opportunity However, neo-skilling remains key in attaining a ready workforce for 2030
Robust infrastructure	ICT infrastructure Connectivity network	The Indian IT industry spend was forecasted to be USD81.9 billion in 2021 and might further increase to USD101.8 billion in 2022[5]. With 5G spectrum fetching a record investment of INR1.5 lakh crore, India is now equipped with low latency, high bandwidth network to support operations on Web 3.0. Additionally, with INR1.2 lakh crore6 investment in the pipeline for data centres in India, the data storage and infrastructure scalability will not be an issue, even for supporting remote operations. Swift and stable policy making remains key.
Governance framework	Regulatory and policy framework Ease of doing business	Since 2015, India has risen 40 places to 46th rank in the Global Innovation Index and 79 places to 63rd Rank in Ease of Doing business. In Union Budget 2022, the government has created a task force with a specific focus on enhancing domestic capacity in the animation, visual effects, gaming, and comic (AVGC) sectors. With the National Blockchain Strategy (NBS) released in December 2021, and the formation of Bharat Web3 Association (BWA), India is one step closer to setting protocols for a regulated metaverse ecosystem in India. Further, MeitY has put up a startup hub with Meta, RBI has come up with an innovation hub in Bengaluru for conducting trials on blockchain-based trade financing projects.

4. The Business Line, June 2022;
5. IBEF
6. Financial Express, May 2022
7. Quess IT Staffing, The Week, May 2022

Metaverse has resulted in demand for services that did not exist previously or are unique to that platform. Since this could be delivered either to an Indian or global audience, below are some opportunities to grab coupled with some challenges. Some common benefits include consumer traffic uptake with better UX capabilities, capturing of micro and niche markets within metaverse, and better monetisation opportunities available for corporates.

Metaverse could be the next trillion-dollar opportunity for the Indian services sector over the coming decade. Globally, it is already valued at USD60 billion, with a CAGR of more than 40 per cent. The US dominates the TAM share, which is expected to cross USD1 trillion by 2030.[3]
An aggregate of USD54 billion has been spent on virtual goods in 2021.

India as a service destination

India is a primary IT service delivery destination, with many global capability centres and IT MNC giants tapping into their extensive talent pool for large US or European market requirements. As of 2021, there are 5.8 million developers in India[4]. India has the biggest developer's ecosystem and can be leveraged to scale small businesses, create an influencer ecosystem and converge metaverse across all sectors.

Metaverse's software or hardware components, i.e., architecture, decentralisation modules, graphic computing and physical intersections/ interfaces to access metaverse, are natural adjacencies to current services offered by Indian IT companies. These coupled with new roles, e.g., metaverse architects, social scientists, XR artists and metaverse event directors are likely to give the IT companies an early mover advantage in this space.

The services or behavioural components of metaverse, i.e., creator economy, medium and experiences are the next set of exponential growth opportunities, which are in the early stages for India. These require the above five catalysts to come together to provide the right impetus and capture loyal customer base in the high-value TAM use case.

The opportunity for India is in providing back, middle and front office services that transcend geographical borders and directly capture a loyal customer base in high TAM use cases.

3. Source: Citibank, Ronit Ghose
4. Economic Times, 2022

Table 4: India service opportunities

Opportunity	Typical players	Value delivery (examples)	Monetisation models
Global delivery centres	• Indian IT Companies	• TCS XR Lab and Avapresence ecosystem • Infosys's Metaverse foundry • Tech Mahindra's TechMVerse • Indian IT companies have delivered metaverse solutions for retail shops, events like Australian Open and French Open	• Consumption based • Licence, subscription • T&M (for resources) • Outcome-based
Social experience & curation	• Indian startups • Conglomerates	• Tanishq 'Rivaahverse', is an example of implementation, however, it is closer to XR • Mondelez India created a metaverse experience of a dinner date on the moon • TATA Tea also hosted Holi party on metaverse • ShortGun platform for gaming, shopping and investments • Next-gen gaming metaverse focused on live social engagement, e.g., Tamasha and LOKA • 'Oliverse' - Olive group, an Indian restaurant, joined hands with HeyHey, platform powering experiential engagement between celebs, influencers, and creators, to venture into metaverse	• Fixed fee+ service charges • Transaction based • Subscription, including freemium • Outcome-based, e.g., per footfall • Royalty, reseller margins • Special perks, e.g., access to VIP clubs, voting right
Skill development	• Indian universities • R&D labs • Startups	• Nvidia and Google are offering training and certification in deep learning, data science, graphics & simulation, and digital building blocks for metaverse • Hong Kong University launched first metaverse campus • Wharton Business School has become one of the first Ivy League colleges to launch a programme on "Business economy in metaverse" • Edverse, a Gurugram-based startup is bringing educators, learners and key institutions on a common platform • Mahindra University signed an MoU with Tech Mahinda to set up 'Makers lab' for development in metaverse • IIT-Jodhpur launched a semester in their M-Tech programme for working professionals in AR/ VR	• Freemium for capability development initiatives • Fixed fee for university learnings
Complete whitespace	• Yet to emerge	• New use cases in banking, education, retail, healthcare, gaming	• Nonlinear monetisation models like multi-sided platform businesses

Considering the market access and maturity of the domestic market, skill availability in web 3.0 technologies such as blockchain and Unity 3D, robust ICT infrastructure and a maturing governance ecosystem place India in a unique position to exploit the opportunities emanating from the space.

As India assumes the G20 presidency starting December 2022, the theme of 'Vasudhaiv Kutumbakam' needs to resonate with metaverse initiatives of India companies. As such,

- Because of its cultural heritage and deep understanding of various global and local cultures, India can leap forward in designing the governance principles as they apply to each geography or territory
- Engage deeply in Metaverse Standards Forum to explore outsourcing opportunities
- States will need to align their respective industries where metaverse has the most potential for exports and industry transformation.

More whitespace service opportunities for India

Metaverse has resulted in demand for services that did not exist previously or are unique to that platform. Since this could be delivered either to an Indian or global audience, there is an opportunity to grab first mover advantage and "Make in India" for the world. Here, we discuss three more verticals viz., healthcare, education and gaming, which have a larger propensity beyond the verticals already discussed above.

Table 5: Serviceable opportunities in India

Healthcare	Education	Gaming
XR enabled medical crisis management system (professionals can be trained in planning and delivery of response in a real-life simulated environment)	Gamified learning experience (locking chapters to earn points with high level of participation)	Content creation, marketing, portfolio management
3D virtualisation of scans and medical reports	Immersive labs	Designing and creating experiences
Assisted surgery	XR enhanced learning	Product offerings such as avatar skins, accessories, in-game objects, tokens
Virtualisation of human body functioning	Collaboration with other edtech platforms, international universities and government missions	Virtual property / real estate services
Medical avatar / identity	Use cases will revolve around the creation of virtual books, entrance test simulations, practical skill set training to evaluate on-job performance, and certification in capabilities of the future	Hosting vertical platform as a service (for example in banking to host blockchain based trades)
Zippy (offering a marathon experience for runners. The app is connected to the treadmill, and it transcends runners to scenic trails around the world)	Many gaming platforms are earning revenues through hosting classes and sessions on their platform or outsourcing their services to universities migrating their campus to the metaverse	Existing games are also evolving to accommodate business applications, such as loyalty programmes for a brand or NFT trading platforms. Users can now create their own, unique virtual environment using pre-designed templates. They can purchase and own objects to build social standing in virtual land

To achieve this vision, skills such as content designing, graphic computing, 3D modeling, and training in developing software are essential to delivering the back-end support. In all use cases, data continuity and user autonomy need to be balanced with experience-led collaborative need fulfilment.

Indian companies have a natural advantage while catering to metaverse's software and hardware enablement requirements. These are natural adjacencies for existing IT services companies. However, the larger pool of value comes from front office services in these four categories

- Change the way that work is done by utilising immersive collaborative experiences
- Create new goods and services, including digitally enhanced physical goods and a new class of digitally native goods like NFTs
- Modify the manner in which goods are advertised, acquired, and used
- Integrate responsibility into the way we create, construct, and run the metaverse

Key considerations and recommendations for leaders

Key considerations for companies for metaverse activations

- **Design/re-evaluate the long-term digital strategy** considering possible impact from metaverse and web 3.0 technologies
  - Have an organisational structure/team that favours gathering community insights and co-creation.
  - Develop pilots, sprints, and then scale with agility and security to compete in the marketplace
  - After starting small, map high value applications in the metaverse and their potential opportunity
- **Identify** possible areas of play – **monetisation models**, digital assets and IP rights, regulatory frameworks to align to, and implications around tax, legal and finance
  - Build ROI business cases for each digital transformation initiative with a focus on CX
- **Balance risk capital,** innovative applications and real-world experience can spearhead the vision for industrial companies
- **Partner with new-age companies**/ startups as well as big-tech in gaming, NFTs, web 3.0/blockchain, etc. to shape product, go-to-market and alliances strategies
- **Engage in building standards** for the metaverse. Consider the local / national government as your partner as you seek clarity on regulations in the space. Interacting with the ecosystem and the government to incorporate co-regulation, CISOs must switch from a company-specific paradigm to one that is "network driven" or "ecosystems-led" to achieve higher degrees of openness with governmental agencies, rival businesses, partners, and clients

- **Consider governance structure changes** with respect to metaverse and web 3.0
  - Decentralised autonomous organisations, decentralised functions, decentralised lines of businesses and decentralised applications all need to be in sync for a true immersive and open web 3.0 ecosystem
- Enhancing and investing in **upskilling** of talent remain crucial and nurturing a continuous training and awareness mindset is critical. Each activity linked to branding/ marketing/selling in metaverse means more training and awareness for the employees and customers
- Tackling **privacy and security remains quintessential**
  - Since there is a growing concern on security and identity hacks such as influence on self-esteem and harassment, social engineering techniques or identity theft tricks, risk of misinformation and conspiracy theories, cryptocurrency fraud that entails credential and identity theft, it is imperative that security comes by design and not as an after-thought
  - Securing the end user by adding layers with AI: As the compute gets cheaper, the bandwidth to support multiple apps on a single VR device increases even further. Hence, the end device inevitably needs to be wrapped around configuration data layer, source code layer and host data layer. This could also mean infusing risk-free AI based ethical synthetic decision making in the metaverse which require 'portable identity' – without sacrificing CX
- Under the Indian GST regime, the debate is likely to persist on the state where revenue should accrue, as each state in India has the power to **tax transactions** within its jurisdiction. Therefore, considering the peculiarity of these transactions, a wide **gamut of factors** such as entity responsible behind metaverse transaction, nature of commodity or service involved, mode of payment, location of service, etc. would require deliberation. While efforts are in progress to keep pace with emerging technologies to ensure that jurisdictions get their fair share of taxes, metaverse, with its evolving ecosystem, may pose further challenges which the current tax laws do not envisage. Tax administrations would have to ramp up their efforts to see whether the ongoing work to address the issues arising due to the digitalisation of business needs further work to cover the emerging possibilities under metaverse.

> *While some of the new technologies are going to open up new cyber and privacy issues, technologies such as web 3.0 gives better control to the user to manage their own data. Also, identity becomes back bone of the decentralisation, which will be key for the data protection.*
>
> **Mayuran Palanisamy**
> Partner, National Lead, Data Privacy
> KPMG in India

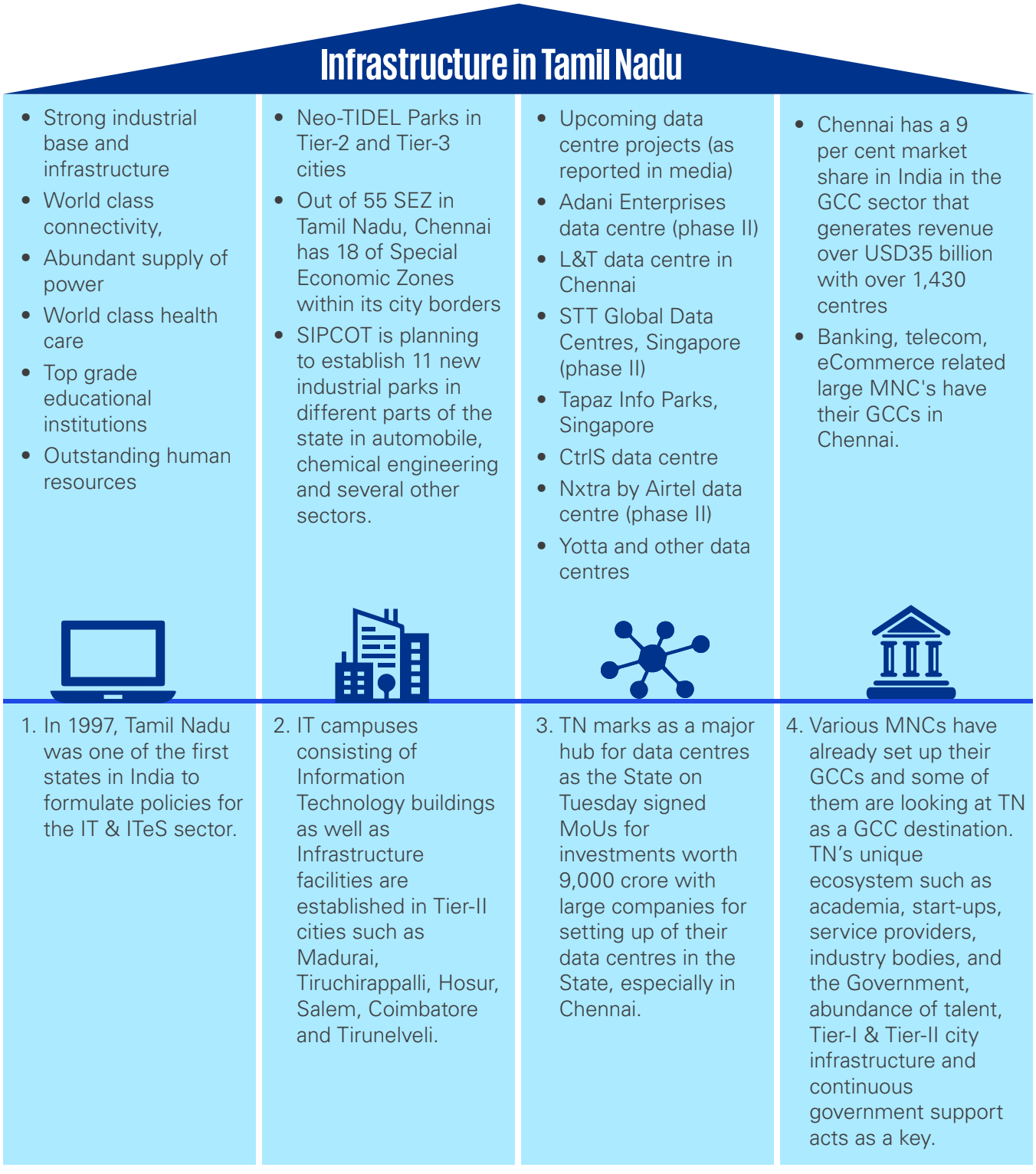
Part B

Nurturing Tamil Nadu's growth ambitions through next-gen tech

Current ICT infrastructure acts as an altar for innovation

Tamil Nadu leads all Indian states in ICT-enabled governance, having successfully implemented a number of state government e-Governance programmes and National e-Governance Plan projects (NeGP).

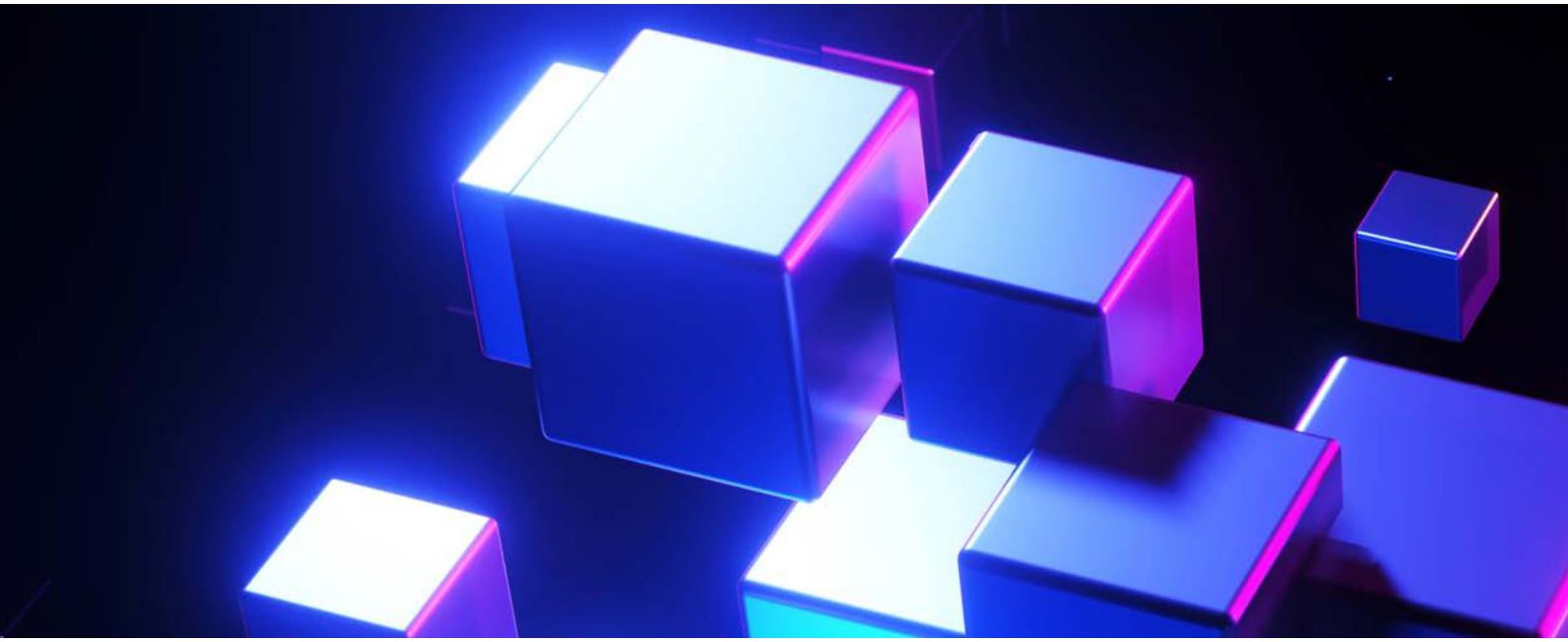
Figure 8: Infrastructure support in Tamil Nadu



In 1997, Tamil Nadu was one of the first states in India to formulate policies for the IT & ITeS sector. The industry has opened an opportunity for the promotion of software exports and services in the state. Strong industrial base and infrastructure, world class connectivity, abundant supply of power, world class health care, top grade educational institutions and available human resources have made Tamil Nadu a highly favoured destination in IT related activities[1].

- As per the policy directive of the Government of Tamil Nadu, ELCOT (Electronics Corporation of Tamil Nadu Limited) is promoting Information Technology parks in tier I and tier II cities.[2]
- Tamil Nadu is making its mark as a major hub for data centres as the state signed MoUs for investments.
- The electronics and automobile industry investment has risen in Tamil Nadu by attracting major projects from industrial giants like Ashok Leyland, Hyundai, BMW, Boeing, Honeywell, Renault Nissan,Yamaha, Royal Enfield, Daimler, Foxconn, and many more. These major projects triggered a multiplier effect by attracting numerous auto and other ancillary industries around locations such as Oragadam, Tiruvallur, Sriperumbudur, Salem, Ennore, Erode, and Coimbatore. Further, the State Industries Promotion Corporation of Tamil Nadu (SIPCOT) is in the process of establishing 11 new industrial parks in different parts of the state in automobile, chemical engineering and several other sectors. These industrial parks will generate employment for more than two lakh people. The new industrial parks will come up in around 13,500 acre of land parcel[3]. At present, there are 21 industrial complexes/parks and seven special economic zones spread over 32,000 acres of land in 12 districts. The new industrial parks will come up in Ramanathapuram, Tuticorin, Sivaganga, Kancheepuram, Nagapattinam, Theni, Krishnagiri and Trichy.

The IT department further seeks to bridge the rural-urban divide, provide government services to public (democratise IT), make Tamil Nadu the best in IT governance, increase software exports, improve computing services, and enhance quality of life through ease of IT services access.



1. Investing in Tamil Nadu, Government of Tamil Nadu website, 2022
2. Information Technology and Digital Services Department, Government of Tamil Nadu, 2022
3. Projects Today, Industrial Parks in Tamil Nadu, 2021

Futuristic policies position it as an emerging metaverse and web 3.0 hub

Chennai is a fast-emerging hub in engineering design, R&D and product development - companies across automobile, telecom, infrastructure, sustainable energy have set up their centres of excellence. But off late, a thriving and a vibrant culture has been noticed across the broad spectrum of new age technologies including metaverse, web 3.0, blockchain and others in the state.

- Tamil Nadu got its first virtual reality lab for education - Meta Kalvi on metaverse for government schools
- GuardianLink entered the NFT gaming space with the launch of its web 3.0 cricket game, the Meta Cricket League (MCL). The Tamil Nadu Cricket Association (TNCA) announced partnership with Giggr Technologies Private Limited to create a web 3.0 digital platform for the cricket ecosystem of Tamil Nadu in June 2022.
- TimesPro - offers future-centric and tech-driven programmes to learners. They have launched a web 3.0 learning initiative and a web 3.0 centre of excellence through a unique interactive experience in the metaverse, with the goal of ushering in unrivalled quality of modern and new-age learning through cutting-edge programmes in various web 3.0 technologies such as blockchain, crypto currency, metaverse and NFT, among others. This edtech works with numerous colleges and industry to capitalise on the booming skills.

All major IT companies in Tamil Nadu focusing big on metaverse and web 3.0 technologies via metaverse design, development, testing and support services along with XR, DLT, 5G, AI, IoT, quantum computing and blockchain.

Tamil Nadu has been a frontrunner in leveraging technology to offer cutting-edge solutions to governance problems in India. Some of the noteworthy recent policy actions include - Tamil Nadu Cyber Security policy 2020; Safe and Ethical Artificial Intelligence Policy 2020[4], Tamil Nadu IT Policy 2018[5], and Information Communication Technology (ICT) Policy of Tamil Nadu - 2008[6]. Another significant project is the Tamil Nadu Data Policy, which intends to offer a framework for data-owning departments in the Tamil Nadu government to share data with all stakeholders in a transparent manner while also protecting privacy in accordance with existing laws[7]. Tamil Nadu announced new industrial policy, targeting INR10 trillion investments by 2025[8]. Some highlights of the prominent policies are listed below:

Figure 9: Supporting policies in Tamil Nadu

01 **Tamil Nadu Data Policy** aims to provide a framework for data-owning departments in Tamil Nadu government to share data with all stakeholders in a transparent manner while ensuring privacy in tune with existing laws.

02 **Tamil Nadu announces new industrial policy 2021** to achieve annual growth rate of 15% in the manufacturing sector during the policy term and targets Rs 10 trillion investments by 2025

03 **Tamil Nadu Telecom Infrastructure Policy 2022** aims at developing a robust and secure state-of-the-art telecommunication network that would provide seamless coverage by easing the process of application, approval and installation of telecom infrastructure.

04 **Safe and Ethical Artificial Intelligence Policy 2020** recommends the Six-Dimensional TAM-DEF Framework for evaluation of AI-based systems such as transparency & audit, accountability & legal issues, misuse protection, digital divide & data deficit, ethics and fairness & equity, ensure that the evaluation is aligned to democratic values.

05 **Tamil Nadu Data Centre Policy** which aims to make Tamil Nadu numero uno in global data centre infrastructure.

06 **Tamil Nadu ICT Policy** 2018 aims to envision by 2023 for development of IT/ITeS sector by availability of a dynamic information architecture, availability of Skilled workforce, knowledge Ecosystem comprising research organisations, universities, think tanks, and business organisations.

07 **Tamil Nadu FinTech Policy 2021** aims to increase financial inclusion and fintech adoption rate in Tamil Nadu by promoting digital solutions for the traditional financial sector.

08 **Tamil Nadu Blockchain Policy 2020** expected to enable governments to build secure, auditable and efficient government workflows and processes that equip the government to design citizen centric applications that cater to different verticals of governance.

09 **Tamil Nadu Startup & Innovation Policy 2018-23** aims to establishing at least 5,000 startups, including ten global high growth ventures in social impact sectors by the year 2023. The initiative will include comprehensive measures for creating, supporting and nurturing a vibrant startup ecosystem in the State.

10 **Tamil Nadu R&D Policy 2022 aims** to transform Tamil Nadu into a knowledge-based economy and increase private sector R&D expenditure by 2030.

4. IT policies in Tamil Nadu, Information Technology and Digital Services Department, Government of Tamil Nadu
5. Investing in Tamil Nadu website
6. Information Communication Technology Policy of Tamil Nadu - 2008
7. The New Indian Express, May 2022
8. Business Standard, February 2021

Tamil Nadu government has also planned to come out with a policy on Global Capability Centres (GCC).

Tamil Nadu government is expected to launch GCC policy soon. "We are working on the policy and the draft is getting ready," IT Minister Mano T Thangaraj. " We want to give special focus to Global Capability Centres. We are analysing various aspects that are prevalent across the world and working on the right model. We will launch it in a month or two".

Quality technology skills, good infrastructure, and a reduced cost of living put Chennai on the radar of MNCs looking to establish "back offices." More than ten multinational corporations established new or expanded existing technology centres in the city between March and April 2022. Amazon, ZoomInfo, Kapitus, Tredence, NielsenIQ, and Mitsogo are among them[9].

Tamil Nadu and Chennai evolving as an industrial R&D tech hub of India

Chennai, known as the Gateway to South India, is one of India's largest metropolitan areas. Some of the biggest software, automobile, and construction corporations have landed in Chennai, the second-largest IT hub in southern India. One of Chennai's biggest IT parks, Tidel Park, is home to some of the city's well-known software companies. Leading IT companies with offices in Chennai include Accel Frontline Ltd, Adrenalin eSystems, Lister Technologies, and Redington (India) Limited, while MNCs include names such as BirlaSoft, Capgemini, Cognizant, HCL, Infosys, Larsen & Toubro, Tech Mahindra, MindTree, Oracle and Thought Works have also established nodal offices there. Chennai's lengthy and successful history in the industrial, healthcare, and retail industries helped it outcompete other IT hubs in luring the top 10 IT services companies. Leading engineering and scientific institutions in the state assisted the IT services and BPO industries in setting the standard for staffing. Chennai quickly grew to become one of India's top three locations for IT services as a result. With annual revenues under USD800 million, companies such as, Zoho, and Freshworks, which were once great startups in Chennai, are now major corporations, some even listed on US exchanges.

Recent growth in co-working firms is also a sign of the city's rapidly expanding startup scene, since new businesses view these spaces as cost-effective office space. Some of the ground-breaking firms from Chennai include Freshworks, Zoho, BankBazaar.com, Orange Scape, and Bharat Matrimony. Some of Chennai's more notable characteristics:

Wide range of skill sets: Chennai is also called as SaaS capital of India.

Educational and research opportunities: Chennai has 823 colleges, 46 research centers, 40 universities and more than one technologists are added to the workforce each year.

Infrastructure: Out of 55 SEZ in Tamil Nadu, Chennai has 18 of Special Economic Zones within its city borders, allowing plenty of room for new businesses and start-ups to thrive.

9. Global giants rediscover Chennai, Times of India, May 2022

Since India's R&D appetite lacks as compared to G7 countries, push towards emerging technologies will India stay in the innovation race. According to the India Innovation Index 2021, India has generally spent a small amount of money on research and development. The overall share of gross spending on R&D (GERD) as a percentage of GDP, which was around 0.7 per cent, reflected this. India's GERD needs to significantly improve and reach at least 2 per cent in order for the country to reach its goal of having a USD5 trillion economy.

To boost R&D in the private sector by focusing on new indigenous performance enterprises in both the manufacturing and service sectors, Tamil Nadu's R&D policy seeks to double expenditure for research by 2030 and increase inputs to R&D. It also wants to develop the state's knowledge infrastructure.

Tamil Nadu is ranked among the top three states in India for R&D innovation and first in human capital by India Innovation Index[33]. It is one of the few states which has more female researchers than male and accounts for 9 per cent share, the second highest state for R&D expenditure in the country, and far higher than the country average of 0.7 per cent.

The main objective of the new Tamil Nadu R&D Policy 2022 is to transform Tamil Nadu into a knowledge-based economy and increase private sector R&D expenditure by 2030. In a broader sense, it will increase the inputs including the appointment of new researchers and scientists in both government and private sectors and output for innovation such as patents and publications. Highlighting the benefits for the development side, it will be used for creating an ecosystem of research parks, research centres and innovation hubs. The policy promotes R&D in the private sector by targeting the existing R&D performing firms in both the manufacturing and service sectors.

Below are some salient reasons supporting Tamil Nadu's growth with R&D:

- According to fDi intelligence[10], Chennai emerged as the economical location for electronic R&D, with an estimated annual operating cost of USD1.24 million for a 50-person R&D centre[11].
- Tamil Nadu Start-up and Innovation Mission (TANSIM) has set an ambitious target to establish approximately 10,000 start-ups in Tamil Nadu by 2026. To improve the start-up ecosystem throughout Tamil Nadu, TANSIM will establish regional start-up hubs in several locations throughout the state, including Erode, Madurai, and Tirunelveli. Further, TANSIM shall support state engineering colleges to establish in-house innovation centres in key areas. For a monthly charge, these incubators will provide start-ups with the necessary infrastructure, networking opportunities, training, and legal and marketing support.
- The Tamil Nadu Technology Hub (iTNT) will act as a connecting point between the ecosystem of start-ups working in emerging and deep tech fields and the academic network of more than 570 engineering colleges, working with researchers and industry partners to foster innovation that will shape the world of tomorrow. iTNT has been developed to handle complex issues in a variety of industries, including agriculture, health, and education, using cutting-edge technology such as AI, data analytics and blockchain.
- The MSME Department will create a cutting-edge procurement-based programme that is innovative and competitive, aligned with the grand challenges, and will encourage MSMEs and startups to conduct R&D for the state that could lead to commercialisation[12].

10. Asian locations top best electronics R&D ranking, fDi Intelligence, March 2022

11. The new Tamil Nadu R&D Policy 2022, Investing in Tamil Nadu, Industries, Investment Promotion and Commerce Department, Government of Tamil Nadu.

PLI alignment with the centre attracts new business opportunities, FDI and jobs

Tamil Nadu ended the 2021-22 fiscal with foreign direct investment (FDI) of INR22,396 crore, up about 30.1 per cent from INR17,208 crore in 2020-21[13].

Government of India announced PLI scheme for 13 sectors to create national manufacturing champions and generate employment opportunities with total outlay of INR1,97,291 crore. Since the main strength of TN is in cotton textiles and the industry has appealed to the centre to cover high-end cotton products too under the PLI scheme[14]. Designing of garments, merchandise and display of textiles in the metaverse and web 3.0 is expected to further boost the exports.

With many mobile device manufacturers now gaining advantages of the PLI scheme, Pegatron is one such player in the state. Its facility, operated by Pegatron India, a subsidiary of Pegatron, has committed to making an investment worth crores over the course of the plan and is anticipated to create thousands of direct jobs in the industry. It will be producing and assembling mobile phones, boosting the state of Tamil Nadu's exports and production of mobile phones. Along with Pegatron, other companies like as Foxconn, Dell, Ascent Circuits, and Bharat FIH have also committed to investing millions of dollars in Tamil Nadu through the PLI Scheme of the Centre to increase their production capabilities for the Indian market. The new Pegatron factory at Chengalpattu is anticipated to boost the momentum - both in terms of capacity and employment for the people of Tamil Nadu, which has emerged as one of the key states to produce electronics hardware, accounting for 20 per cent of India's output.

The PLI scheme for mobile devices now needs to extend to the entire hardware space catering to the AR/VR headsets, industrial cameras, sensors and the paraphernalia which cater to the metaverse ecosystem. The export opportunities emanating from the IT/ITeS MNCs and startups will help propel India to achieve a 20 per cent digital economy by 2025[15].

12. Tamil Nadu R&D Policy 2022, Investing in Tamil Nadu
13. FDI flow into Tamil Nadu increases 30.1% in 2021-22, The Hindu, May 2022
14. State to support industries investing under PLI scheme, The Hindu, September 2021
15. Ministry of Electronics and Information technology, Government of India, February 2019

Roadmap for developing Tamil Nadu's web 3.0 and metaverse ecosystem and increase the GSDP:

Tamil Nadu has become one of the fastest growing states of India in technology and digital innovations. In comparison to other countries such as Dubai, Japan and South Korea who have already started establishing policies on metaverse, cryptocurrency and Web 3.0, here are few suggestions that central/state government can follow:

Figure 10: Three I framework to embed India's talent into global value chains

01 - Incentivisation via policy

- First, India needs to formulate policies around capacity-building, robust infrastructure provision, subsidies, rebates and low rates for capital requirements that support businesses and startups developing solutions to support web 3.0 and metaverse ecosystem.
- Tax exemptions for companies who work on the emerging technologies such as AI/ML, metaverse, cryptocurrency and Web 3.0
- Clear regulations on the operation of virtual currencies and establish a regulatory agency to oversee the digital assets
- Encourage startups, entrepreneurship programmes and provide free or subsidiary office spaces to companies who work on metaverse, AI, Web 3.0 and other emerging technologies
- Consider measures to encourage overseas Human Resources who will pioneer the Web 3.0 era to move to India, through means such as the issuance of a special visa for personnel with a certain level of knowledge and skills in Web 3.0 related businesses

02 - Innovation via collaboration

- One stop consultation desk to be established that centrally receives consultations related to the emerging technologies from the private sector and seeks solutions to promote innovation in cooperation with the public and private sectors
- Have tie ups with MNCs and cloud hyperscalers who have already started working on metaverse. Internships programs, knowledge transfer sessions, Hackathons, brainstorming sessions can be arranged by government with large MNCs.
- TN to act as a collaboration anchor hub to attract MNCs, startups, academia, local MSMEs and state IT ministry bodies

03 - Integration into global value chains

- The key point is how to get involved in and lead international discussions in establishing de facto standards for setting up regulatory and operating frameworks for new age technologies which democratise the growth for all
- It is desirable to establish a forum for cross-industry information gathering and discussion involving metaverse, cryptocurrency and web 3.0 related businesses, and the government should actively take initiatives to realize such a forum and deepen such discussions
- Centre and state government alignment on web 3.0, crypto currencies and metaverse becomes crucial in setting up COEs and bringing investments by state governments by respective trading partners such as Singapore, UAE, the US and others

Benefits of Industry 4.0 within web 3.0 and metaverse still continue to be relevant

Business procedures and production methods under Industry 4.0 may differ from one company to another. It depends on which technologies are given higher priority, used more frequently, and how they impact the current workforce and work processes. Without getting into details, here are some frequently noted benefits that a firm realises when web 3.0 technologies such as AI, ML, cybersecurity and others are combined with cloud, connectivity and commerce:

Higher production (improved productivity / better ROI), optimisation, mass customisation, increased collaboration & knowledge transfer, agility and flexibility, quality of customer service, ease of doing business and compliance and cost reduction and efficiency

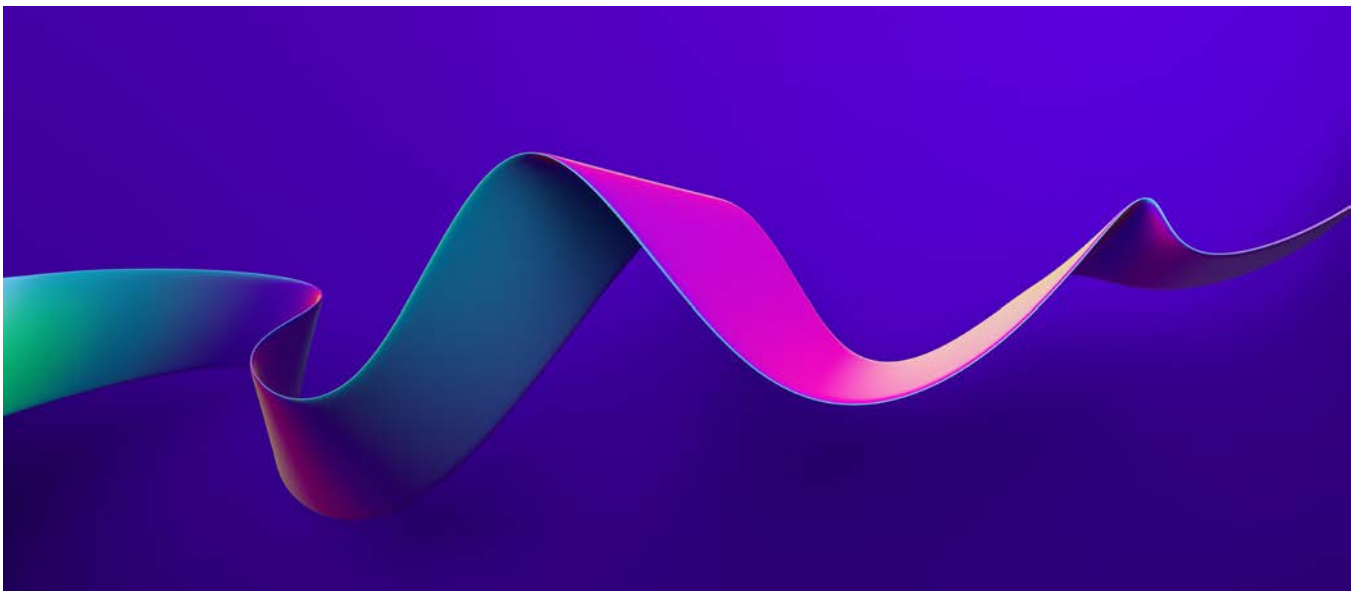
Tamil Nadu's GSDP gets a boost with new gen technologies:

Tamil Nadu's chief minister, respected Mr. M K Stalin, declared that the state's GDP would exceed a trillion dollars by 2030[16]. (GSDP). The goal is attainable for a country with abundant natural resources, significant intellectual capacity, favourable investment conditions and social equality. The present GSDP is anticipated to be USD290 billion, or nearly INR22.2 lakh crore, according to predictions for 2020-2021. Services account for 53 per cent of this, with industry (34 per cent), agriculture (13 per cent), and agriculture accounting for the remaining 13 per cent. The export component of the GSDP is USD51 billion, or INR3.8 lakh crore.

Respected finance minister Palanivel Thiaga Rajan points out it requires 13 per cent - 13.5 per cent of nominal growth to achieve this goal. "In the first year we have got 14.5per cent. We have had a good start. For the second and third year, we have projected 14 per cent. What matters a lot is what happens in the first few years."[17]

Metaverse, web 3.0 and related technologies will help propel the overall GSDP by a couple of percentage points (evidenced by research studies) as they boost efficiencies via virtual display and merchandise opportunities.

By bringing in these latest technologies like web 3.0, metaverse, AI, machine learning, Tamil Nadu will be able to contribute to India's growth on a higher rate and a firmer footing. Chennai is the largest industrial and commercial centre of South India. Recent estimates of the economy of the Chennai Metropolitan Area projects it around USD78.6-86 billion (over USD200 billion with industrial zones; PPP GDP), ranking it as fifth most productive metro area of India, and the third highest by GDP per capita. Move towards rapid adoption of web 3.0 and metaverse capabilities will help propel Tamil Nadu's GSDP.



16. Step up exports to meet USD 1 trillion economy by 2030, Indian Express, May 2022
17. $1-trillion dream and the way forward, The Hindu, April 2022

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Glossary

AI	Artificial Intelligence
AR	Augmented Reality
AVGC	Animation, Visual effects, Gaming, and Comic
B2B	Business to Business
B2C	Business to Consumer
BFSI	Banking, Financial Services and Insurance
CAGR	Compound Annual Growth Rate
CBDC	Central Bank Digital Currency
CeFi	Centralized Finance
CISO	Chief Information Security Officer
COE	Center of Excellence
DAO	Decentralized Autonomous Organisations
DeFI	Decentralized Finance
FDI	Foreign Direct Investment
GCC	Global Capability Center
GDP	Gross Domestic Product
GST	Goods and Services Tax
GSDP	Gross State Domestic Product
GERD	Gross Expenditure on R&D
ICT	Information Communication Technology
IIT	Indian Institute of Technology
IoT	Internet of Things
iTNT	Tamil Nadu Technical hub
KYC	Know Your Customer
MetaFi	Metaverse Finance
ML	Machine Learning
MNC	Multi-National Company

MoU	Memorandum of Understanding
MSME	Micro, Small and Medium-scale Enterprises
NASSCOM	National Association of Software and Service Companies
NBS	National Blockchain Strategy
NeGP	National e-Governance Plan
NFT	Non-Fungible Token
OTT	Over-The-Top
PLI	Production Linked Incentives
QIP	Qualified Institutional Placements
R&D	Research and Development
ROI	Return on Investment
SAAS	Software As A Service
SEZ	Special Economic Zones
SIPCOT	State Industries Promotion Corporation of Tamil Nadu
TradFi	Traditional Finance
TAM	Total Addressable Market
TMT	Technology, Media and Telecom
TN	Tamil Nadu
UI	User Interface
UX	User eXperience
VC	Venture Capital
VR	Virtual Reality
XR	eXtended Reality
2D	Two Dimension
3D	Three Dimension
5G	Fifth Generation

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