中印对话

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METAVERSE: FUTURISTIC INTELLIGENT REALMS

PICKING UP THE PIECES AFTER THE META CRISIS

Embracing the Metaverse

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已达80%，
栽种树木按1米株距排开，
可绕地球赤道12圈。

Saihanba is a cold alpine area in northern Hebei Province bordering the Inner Mongolia Autonomous Region. It was once a barren land but is now home to 75,000 hectares of forest, thanks to the efforts made by generations of forestry workers in the past 55 years. Every year the forest purifies 137 million cubic meters of water and absorbs 747,000 tons of carbon dioxide. The forest produces 12 billion yuan (around US$1.8 billion) of ecological value annually, according to the Chinese Academy of Forestry.

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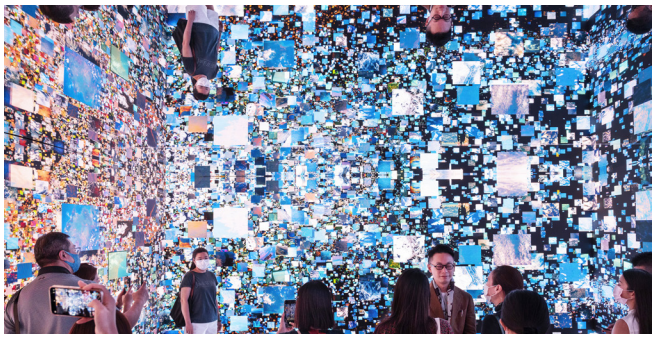

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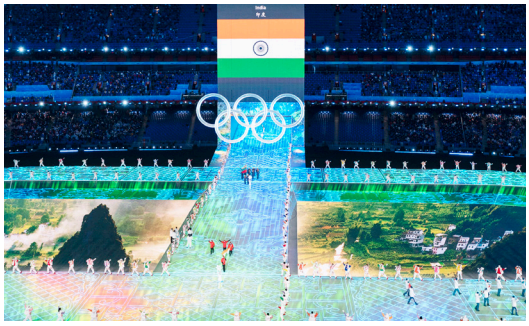
TOP 10 China-India News Stories of 2022

The year 2022 marks the 72nd anniversary of the establishment of diplomatic ties between China and India. Despite occasional border clashes, China and India have been engaging in friendly exchange in fields like trade, economics, culture, and sports and maintaining close cooperation under international mechanisms such as BRICS, G20, and the Shanghai Cooperation Organization (SCO). As the world enters a new period of turbulence and change, the two major developing countries share identical or similar views on major international and regional issues, which would inject positive energy into the turbulent world. CICG Center for Europe and Asia (China Pictorial Publications), the Institute of South Asian Studies under the Yunnan Academy of Social Sciences, and India-China Economic and Cultural Council jointly compiled a list of the top 10 China-India news stories of 2022, reviewing the most memorable moments and milestone events of the two neighbors in 2022.

The 14th BRICS Summit 1

Chinese President Xi Jinping chaired the 14th BRICS Summit in Beijing on June 23, 2022 via video link. South African President Cyril Ramaphosa, Brazilian President Jair Bolsonaro, Russian President Vladimir Putin, and Indian Prime Minister Narendra Modi attended the summit. Themed "Foster High-quality BRICS Partnership, Usher in a New Era for Global Development," the summit empowered the leaders of the five countries to conduct in-depth exchange of views on BRICS cooperation in various sectors and major issues of common concern, reaching important consensus. (Photo from Xinhua)

India Sends Delegation to 2022 Beijing Winter Olympics 2



India sent alpine skier Mohammad Arif Khan to participate in slalom and giant slalom events at the 24th Winter Olympic Games held in Beijing and Zhangjiakou from February 4 to 20, 2022. It was also the first time an Indian athlete qualified for two different events at the Winter Olympics. Arif Khan ended his men's slalom event with a DNF (Did Not Finish), but finished 45th in the men's giant slalom event, the best finish by an Indian athlete in that event at the Winter Olympics.
(Photo by ChenJian/*China Pictorial*)

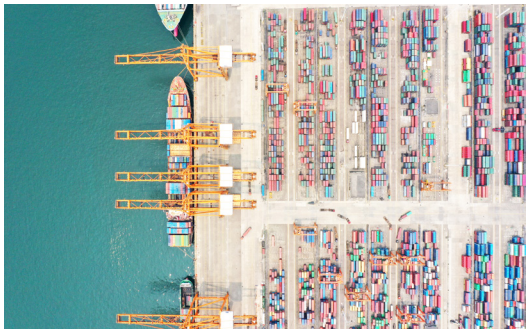
China and India Work Together to Restore Peace in Border Areas 3

Chinese State Councilor and then Foreign Minister Wang Yi met Indian External Affairs Minister Subrahmanyam Jaishankar in New Delhi on March 25, 2022 during his India visit. At the meeting, the two sides agreed that it is in the common interests of both countries to restore peace and tranquility in the border areas and that they should achieve regular management and control there on the basis of disengagement and take effective measures to avoid misunderstanding and misjudgment. Chinese and Indian troops disengaged after a conflict near the Line of Actual Control (LAC) in Dongzhang area in the eastern section of the China-India border on December 9, 2022. The 17th

round of India-China Corps Commander Level Meeting was held at Chushul-Moldo border meeting point on the Chinese side on December 20, 2022. The two sides conducted frank and in-depth discussions, in line with the guidance provided by leaders of the two countries to work for resolution of the remaining issues as soon as possible to help restore peace and tranquility along the LAC in the western section of the China-India border and enable progress in bilateral relations. (Photo courtesy of Ministry of Foreign Affairs of China)

Bilateral Trade Exceeds US$100 Billion

4



China-India bilateral trade continued to boom, reaching US$103.63 billion in the first nine months of 2022, a year-on-year increase of 14.6 percent, according to data released by China's General Administration of Customs. This marks the second consecutive year that two-way trade turnover has exceeded the US$100 billion milestone after a figure of US$125.6 billion in 2021. (Photo from Xinhua)

Cultural and People-to-People Exchange Deepens

5

The 2022 International Yoga Day & China-India Cultural Exchange Event was held on June 21 in Kunming, southwestern China's Yunnan Province. Themed "Enhance Mutual Learning between Civilizations through Yoga, Work Together to Strengthen People-to-People Bonds," the event was attended by

more than 100 Chinese and overseas guests, both in-person and virtually. During the event, Yunnan Minzu University signed a memorandum of understanding with Dev Sanskriti Vishwavidyalaya University, an online photography exhibition themed "Incredible India" was launched, and martial arts and yoga were performed. (Photo courtesy of Yunnan Minzu University)

China Relaxes Visa Restrictions for Indian Students

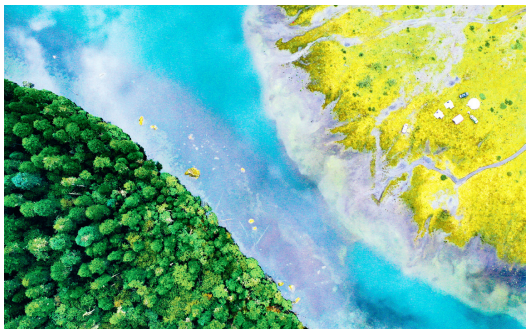
6

The Chinese Embassy in India updated application procedures and requirements for Chinese visa on August 22, 2022, relaxing visa requirements for Indian students who were unable to return to China to resume their study due to COVID-19 restrictions. About 23,000 Indian students are enrolled in Chinese universities, mostly medical students. (Photo from VCG)

Commemoration of the 80th Death Anniversary of Dr. Kotnis 7

Dr. Dwarkanath Kotnis Memorial Committee of West Bengal held a commemoration marking the 80th death anniversary of Dr. Kotnis in Kolkata, India on December 9, 2022. Dr. Kotnis joined the medical aid team working in China during the Chinese People's War of Resistance Against Japanese Aggression. He dedicated his youth and life to the cause of national liberation of the Chinese people and served as a monument and bridge of China-India friendship. (Photo courtesy of Chinese Consulate General in Kolkata)

China-India Cooperation on Climate Change 8



The Institute for South Asian Studies at Sichuan University in China and the National Maritime Foundation in India jointly released a report on cooperation on climate change on December 10, 2022, assessing the profound impact of global warming on China and India and prospects for cooperation on addressing climate change. (Photo by Larongchuipi)

China and India Host One-third of the World's 8 Billion Population 9

The world's population reached eight billion on November 15, 2022, one-third of which lives in China and India. To confront development challenges, China proposed the Global Development Initiative, the Global Security Initiative, and the idea of building a community with a shared future for humanity. Pooling the strengths of China and India will inject momentum into global development. (Photo by Qiao Zhenqi/*China Pictorial*)

Chinese Mobile Phone Makers Are Restricted in India 10

Normal production and operations of Chinese mobile phone companies in India including Xiaomi, Huawei, Vivo, and Oppo were disrupted as a result of repeated inspection and fines by Indian authorities in 2022. (Photo from VCG)

Progress Through Stability

By **Rama Chandran**

After the Central Economic Work Conference called for an overall improvement in economic operations in 2023, confidence in the rapid recovery of the Chinese economy has grown, and hope for a robust GDP growth rate in the coming year has been kindled.

The recent Central Economic Work Conference announced that China aims to focus on restoring and expanding consumption and strive for "progress through stability." After the conference called for an overall improvement in economic operations in 2023, confidence in the rapid recovery of the Chinese economy has grown, and hope for a robust GDP growth rate in the coming year has been kindled.

The conference admitted that China's economy faced difficulties in 2022 due to a contraction in demand, supply shocks, and a volatile environment in the aftermath of COVID-19. The decline in demand reflects a decrease in purchasing power, which in turn calls for financial support during a crisis. The supply shock occurred due to closed factories and resulted in the restructuring of the global supply chain and an outflow of international orders.

KEY TAKEAWAYS

Despite pandemic disruptions, China's economic output is likely to exceed US$17.2 trillion in 2022. Over the past three years, China's annual GDP growth rate averaged 4.5 percent, higher than the global average. The Chinese economy advanced 3.9 percent year-on-year (YoY) in the third quarter of 2022, exceeding the market consensus of 3.4 percent and picking up from a 0.4-percent growth in the second quarter in response to significant measures by the government. But, according to the National Bureau of Statistics (NBS), China's November retail sales sank by 5.9 percent YoY, showing a declining trend in domestic demand. So, the creation of a resilient domestic market is critical.

Against this backdrop, the 2022 Central Economic Work Conference was held. The conference is an annual meeting held by the Chinese government to review the country's economic performance in the passing year and set economic policy for the next year.

The conference announced

that in 2023 China will focus on expanding domestic demand, rewarding investment, and increasing exports to boost confidence in development, prioritize the restoration and expansion of consumption, increase the income of urban and rural residents through various channels, and encourage more private capital to participate in the construction of key national projects.

The conference also emphasized "robustly promoting rural revitalization and resolutely preventing large-scale regression into poverty." In addition to expanding domestic demand, the five main tasks for the year 2023 include accelerating construction of a modern industrial system, implementing the "two unwavering" principles, more actively attracting foreign investment, and effectively resolving major economic and financial risks. The two unwavering principles are "to deepen reform of state-owned enterprises and improve the competitiveness of state-owned enterprises." In addition, the conference stressed that "private enterprises' property rights and entrepreneurs' rights and interests must be protected by law."

A bird's-eye view of the semi-final of the "Beautiful Countryside" Basketball League, dubbed "Village BA" by the netizens for its warm atmosphere, in Taipan Township, Taijiang County, in southwestern China's Guizhou Province, August 1, 2022. Thousands of spectators cheered on the impressive performance of players around the basketball court. (Photo from VCG)

RESILIENT INDUSTRIAL CHAIN

In response to Western technological sanctions, the conference emphasized the importance of a resilient industrial chain. With the announcement of sweeping fresh controls on sales of semiconductors to China in October 2022, the U.S. approach has been a regression to the Cold War playbook. A growing pile of U.S. measures now aims to slow China's development as a high-tech economy.

Over the past six years, China's technology sector has faced multiple challenges due to sanctions imposed by the U.S. The increase in tech sanctions by the U.S. coincided with the rise of China's Digital Silk Road (DSR) under the Belt and Road Initiative (BRI). The U.S. blacklisted Hikvision, a Chinese security equipment maker involved in DSR, in 2021. Alongside Hikvision, companies like Huawei, Alibaba, Tencent, Baidu, and ZTE are the main drivers of the DSR.

After Trump took office, several measures targeting Chinese science and technology policies were taken. In May 2019, Huawei was added to the U.S. Commerce Department's Entity List, leading to stricter export controls. It was left unable to do business with any U.S. firm.

The DSR not only facilitates the export of Chinese technology to previously untapped markets but also allows private Chinese firms to expand extensively. This enables China to expand its influence in the global tech sector, which has been

A high-speed train on the Beijing-Tianjin intercity line passes in front of the Yongding Gate on the Central Axis of Beijing, November 10, 2017. (Photo from VCG)

dominated by the West since its inception. Chinese tech companies have already taken major business away from Western companies like IBM and Cisco.

U.S. sanctions also emerged in the context of Chinese policies issued since 2015 emphasizing technological self-reliance. These policies aim to help China skip the middle-income trap by installing technology-powered production as opposed to labor-intensive production. China's 14th Five-Year Plan (2021-2025) also emphasizes the strategic importance of the development of science and technology and will further drive the implementation of policies such as the "Internet+" and the New-Generation Artificial Intelligence Development Plan.

Distressed by China's technical prowess, Biden signed an order in June 2021 prohibiting U.S. investment in Chinese tech companies, adding 59 entities to its so-called "Chinese Military-Industrial Complex Companies List." But, U.S. chip sales to China surged as demand for China-made laptop computers, video games, and other home technology soared during the COVID-19 pandemic. In 2022, U.S. sales began to plummet, with chip sales to China dropping by 25 percent and semiconductor equipment sales falling by 15 percent. Boston Consulting Group estimated that a complete ban on U.S. chip sales to China would cost U.S. semiconductor firms 18 percent of their global market share and 37 percent of their revenues.

The U.S. strategy is to contain China's ability to make or acquire logic chips below the 14-nanometer node, well above the current leading-edge capabilities of 5 nanometers or less. The smaller the node, the more advanced the chip. But Semiconductor Manufacturing International Corporation (SMIC), China's largest chipmaker, announced in August 2022 that it had started shipping 7-nanometer semiconductors, just one generation behind the most advanced chips. It has done so, using production techniques less efficient than the current standard since U.S. controls have blocked SMIC from acquiring the most advanced lithography equipment.

The Central Economic Work Conference assures that the Western sanctions will remain futile because China is extensively integrated into the global economy and supply chain. China has been gradually showcasing domestic alternatives.

Chinese technology has a far-reaching impact on the developing world because the BRI exports domestic technology globally. Since the Chinese tech ecosystem has extensive footprints globally, U.S. sanctions will not achieve the goal of isolating China technologically. The impact of any sanctions will be minimal. The conference mentioned that China's science and technology industry should be self-reliant and must effectively coordinate education, science and technology, and talent work to improve the quality and ability of independent talent cultivation. This means China's high-tech industrial chain cannot be decoupled from the global economy.

Many sectors will benefit from next year's policies, as the conference hinted. New-energy cars and elderly services will enjoy preferential policies. At the same time, policies will better support research and development of technology services and products in line with the conference's emphasis on protecting private enterprises' legal rights. Overlap of the two policies implies that platform companies may get a boost in China in 2023.

The platform economy is reshaping global trade. Global platforms such as Alibaba empower countless smaller enterprises to participate in global trade without the need to invest in supply chains. In a world dominated by platform companies that offer ways for customers and businesses to connect, countries that want to act as global trade hubs must think like a platform nation.

In China, an example of a traditional corporation transforming its business model is Ping An Insurance based in Shenzhen. It has created a portfolio of platform businesses directly related to insurance: in healthcare, connecting patients with doctors; in automotive retail, facilitating car purchase and sale; and it even dabbles in entertainment. Ping An is now one of the most valuable insurance companies in the world. Platform technology is showing that sanctions are absurd and China will march forward.

RECOVERY AHEAD

Amid multiple domestic and external headwinds, China's GDP growth rate is estimated to slow sharply to 3.3 percent in 2022, according to the International Monetary Fund.

According to CEIC data, Chinese households are limiting their spending on non-essential items, and industries such as catering, accommodations, and aviation are suffering most as a result. Industrial production has so far enjoyed a stronger trend than retail sales. NBS data showed that measured by the added value of industries above the designated size, industrial production increased by 3.8 percent YoY in the first 11 months of 2022. The slow recovery of industrial production was broad-based among state-owned enterprises and private sectors. Retail sales of consumer goods decreased by 0.1 percent YoY in the same period.

In response to critical headwinds, China has increased macroeconomic policy easing with higher public infrastructure spending, tax rebates, policy interest rate cuts, and relaxing local purchase restrictions in the real property sector.

CEIC's China Ports Data shows that the government measures are paying off. China's trade turnover improved in November 2022 after three months of sluggish growth in both exports and imports. Real-time port statistics provided by Elane Inc. show that China's top 20 ports saw a steady increase in volume of arriving and departing ships in November 2022. The total number of arrived ships that month reached 147,054 while the departures stood at 163,182, both all-time highs. Not only absolute numbers, the YoY growth rate for both arriving and departing ships also jumped in November, expanding by 29 percent and 44 percent respectively, levels that have not been seen in more than a year and a half. The rise in terms of volume, measured in deadweight tonnage, is even more pronounced.

The conference assured everyone that China will further increase policy support for economic growth in 2023. Proactive fiscal policy and prudent monetary policy will continue to be implemented. Meanwhile, efforts will be made to intensify macro-control and coordinate various policies to form the synergy for high-quality development. Vigorous support is expected to boost consumption and other areas that have been hit hard.

When the recovery of regular life and production gains steam, it should release pent-up vitality into the economy. China is poised for an accelerated economic recovery in the first half of 2023.

The author is a business writer at KrASIA and former chief editor of the Indian daily *Janmabhumi*.

Metaverse: Futuristic Intelligent Realms

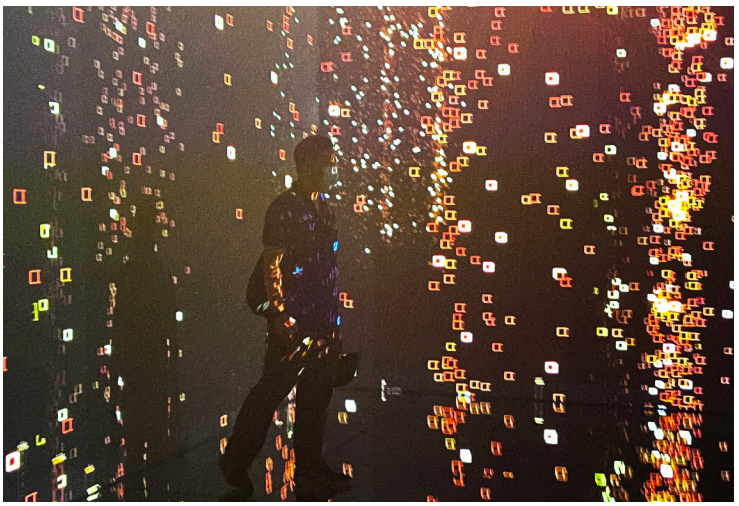
By **Aravind Yelery**

The metaverse offers an immersive future managed by smart tech in diverse ways. It represents virtual reality beyond the tangible world.

The advancing fields of technology and innovative design have been instrumental in closing the gap towards achieving sustainable, desirable, and futuristic living experiences. The rise and development of the metaverse is set to redefine the dimensions of technology. The scope of metaverse technologies has been scaled high in every aspect. Discussions on the human, scientific and innovative foundations beneath the metaverse are imperative and inexorable, alongside talk on the challenges.

COMBINATION OF VIRTUAL WORLDS, AR, AND INTERNET

Human civilization has always valued innovation and technological advances. In a cyclical pattern, civilization has brought newer forms of innovation into reality, thereby revolutionizing human progress and development. Communication is the core of human civilization. From wires to satellites, the world has evolved into a complex web of inlets and outlets of communication with varied dynamism and utilities. Invention and adoption of technologies have been



In the metaverse, consumers, as the end users, acquire easy access to immersive experiences with the help of new technologies. (Photo by Tian Xiao/*China Pictorial*)

happening in tandem and at a faster recurring rate. Today, wireless technology accessed by phones, tablets, and computers is hinting at the possibility of ubiquity throughout society. Technology has already taken over human imagination on future cognitive thinking, making it inseparable from everyday life. Today's gadgets harness multiple service platforms, exerting a transformational impact on society as a whole and the lifestyle patterns of people.

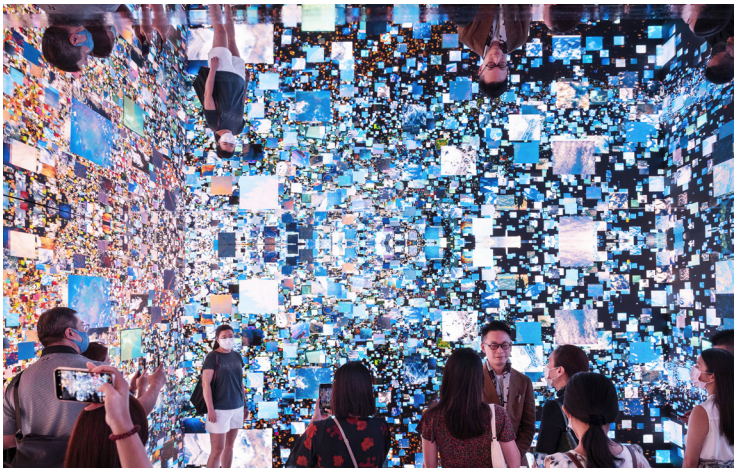
The future is catching up with the present at lightning speed, and technological horizons are broadening, making them illusionary to human eyes. The avenues these revolutions take have lately been more dynamic and impactful. Technology usage has passed the stage of pure sciences and saving lives to become capable of adding immense value to our entire living space. Technological progress has been rapid and unprecedented in scale, helping connect people and offering them opportunities to enrich their lives. Technologies are no longer a matter of convenience but an integral factor in living standards. It is exerting a profound impact on how people live and think.

In terms of technology, communication, and the real and virtual spaces of human imagination, technological tools play a vital role in making things possible. A stop short of the metaverse, the transformative stage includes all forms of "extended reality," i.e., XR. XR is a widely used term referring to a revolution towards fully immersive virtual reality (VR) and augmented reality (AR) forms of technologies. All these techniques and forms lead to integrating diverse services and technologies towards the metaverse, an immersive future managed by smart tech in diverse ways. The metaverse inherently represents VR beyond the tangible world: life beyond (meta) the universe (verse). It combines virtual worlds, AR, and the internet.

Many have argued why the metaverse matters, but it will certainly cause challenges alongside all the opportunities. Although the metaverse spans connected virtual worlds to offer a complementary space to the real world through digital environments, it will surely suffer meta-challenges.

RAPID RISE OF THE METAVERSE

The rise of the metaverse has led tech companies to explore designing and optimizing popular services and products. The metaverse is expected to revolutionize



Digital Art Fair Asia attracts a steady stream of visitors in Hong Kong, China, October 8, 2021. The exhibition displayed new trends in modern art. (Photo from VCG)

technological levels and cause increased necessity to adopt new products and services. It offers innumerable opportunities for the global economy as well. Rising demand for newer technological horizons will force tech companies to elevate their capabilities in offering innovative products and services. Thus, the metaverse will lead to a rise in immersive technologies and devices. The immersive technologies market is predicted to reach the US$2 trillion mark by 2030. The world of immersive technology tools including head-mounted displays (HMD), powerful computers or consoles, and sensors will see rapid transformation.

The metaverse promises an unprecedented level of content creation and management. All forms of metaverse will allow users to access and engage in a rich variety of content. The current wave of metaverse is riding high on prospects of high investment returns and recurring revenue growth. Investing in content is driving the early trend, which now covers entertainment, creators, sports, and XR, VR, and AR experiences virtually anywhere in the world. Alongside the makers of immersive technology tools, telecom providers are betting on immersive media. Rising demand for entertainment, gaming, and media has accelerated the growth of the metaverse market and spawned evolving opportunities for digitalization of fashion, art, and retail industries through AR, VR, and mixed reality (MR).

Consumers will be immersed in a variety of technological avenues. The metaverse will harness immersive technologies to render services through different applications to offer consumers access to content in countless ways. Global brands and service providers will embrace advertising that leverages immersive technologies, and global consumers will get content and information through streams of channels and ecosystems before choosing. As immersive technologies observe and meticulously store consumers' emotions in unprecedented ways, they will be able to effectively provide the most tailored content. Happier and more content consumers tend to grow the economy. The economy needs consumers to keep the market running, so that money has liquidity. The metaverse is causing market maneuvers and consumerism at the same time. With the virtual world expanding global access, tools and content in the metaverse are sprouting everywhere. Customers are buying not only groceries and consumer goods but also credit cards and personal loans. The metaverse is expected to create new seamless and interactive experiences.

MORE APPLICATIONS

While the metaverse promises multiple benefits for consumers, the COVID-19 pandemic has intensely highlighted the importance of such immersive technologies. Healthcare has become a central concern for every country and business. Even before the pandemic hit, new technology and instrumentation was

changing the nature of healthcare. The intensity of such influence varied to some extent among countries, but the future of healthcare already clearly depended on technological aspects. During the pandemic, a broad technological revolution boosted the development of healthcare and clinical laboratories. In ordinary times, distance breaks communication and information flows, which are critical for healthcare providers. Doctors and healthcare providers have discovered that immersive technologies can help provide treatment at a distance and monitor patients in real-time.

NFT digital works exhibited at Shougang Industrial Park, one of the two venues of the China International Fair for Trade in Services, in Beijing, September 1, 2022. (Photo from IC)

Moreover, during the pandemic, the limits of VR in medical training were lifted. Usage of robotics in surgeries could see qualitative change by embracing AR technology. Surgical simulations will soon be a feature of the healthcare sector. Simulations and immersive technologies can help doctors watch other surgeons perform operations and carry out clinical procedures remotely.

We have already investigated many possibilities to deploy metaverse realities. Education is another field where immersive technologies could greatly enhance the act of imparting knowledge. The global outbreak of the pandemic forced humans to rethink how we teach and learn. Immersive content allows a person to learn through the best methods. When applied to e-learning, a remarkable advantage is students seizing a sense of reality during virtual classes. Virtual learning environments (VLEs) have seen qualitative makeovers after using newer and cutting-edge immersion tools. The VLE+ presents opportunities to bring together students and educators from disparate geographical locations and diverse cultures and backgrounds to participate in a learning experience. The metaverse version of education would be reaching out and embracing every potential benefit of such novel ideas. The metaverse is expected to influence the future of learning. Also, for problematic educational materials, the metaverse could be an effective supplement to enhance current educational outcomes.

Many have argued why the metaverse matters, but it will certainly cause challenges alongside all the opportunities. Although the metaverse spans connected virtual worlds to offer a complementary space to the real world through digital environments, it will surely suffer meta-challenges. Care and vigilance are needed to monitor the emerging challenges in the metaverse. Guaranteeing the safety of users' privacy and data in this new, virtual "universe" will be crucial. Questions concerning ethics and morality should present challenges to every stakeholder — governments, businesses, and individuals alike. The recent expansion of the enormous metaverse is set to define virtual space and human life at a dramatic scale.

The author is a senior research fellow at Peking University and an adjunct fellow at the Institute of Chinese Studies, New Delhi.

How Will the Metaverse Grow?

By **Ma Hongbing**

Both China and India have large populations, massive data resources, and strong demand for digital infrastructure. Telecom companies in the two countries will play a crucial role in building the digital economy within the metaverse, which will probably empower global economic and social development.

In 2021, the metaverse swept across the world with its grand and beautiful vision, becoming the new holy grail for tech companies and financial capital alike. Hoping to seize new business opportunities, Facebook changed its corporate name to Meta to highlight its focus on the metaverse, Microsoft unveiled big metaverse development plans, and countless venture capital firms have been searching for unicorn metaverse start-ups. In 2022, product development, marketing, and academic research on the metaverse continued to thrive. Convinced that the metaverse will inevitably lift the internet to the next level, those in the industry are banking on accelerated integration with human society and more proliferation of the virtual in reality.

REWRITTEN LIFE

From the perspective of economic and social development, the greatest inventions of the 20th century were computers and the internet. The former revolutionized information processing with enormously enhanced efficiency, and the latter brought humanity into the information age, transforming traditional production relations and

social systems. As a widely recognized form of next-generation internet, the metaverse will open a new digital world beyond the physical one that fuses virtuality and reality and accelerates the flow of people, objects, and spaces between the two worlds. The metaverse will also enhance integration of the industrial internet and the consumer internet, forming a new economic and social paradigm.

In recent years, we have experienced flexibility and convenience brought by digitalization. In the metaverse era, humans, in the form of digital avatars, are expected to further break through the boundaries of space and time to enjoy immersive virtual experiences in social realms, entertainment, and work activities. Enterprises will continue to strengthen the links between the real economy and digital bodies to refine and intelligentize production and services in the real world. Wielding tremendous possibilities, the metaverse will lead the human world into the "post-human era" in which all digital elements are integrated into life, production, and social governance.

The Chengdu Giant Panda Museum in southwestern China's Sichuan Province reopens to the public after renovation, December 2, 2021. The renovated museum uses VR facilities to demonstrate the body structure of giant pandas, including bones, muscles, digestive system, and their habits. (Photo from Visual People)

JOINT EFFORTS AND SHARED DEVELOPMENT

In terms of technological development and business practices, the metaverse is still in its embryonic stage. Various technologies are constantly integrating to derive new applications, new business models, and new paradigms. Jon Radoff, a well-known investor and metaverse researcher, proposed a seven-layer industrial chain of the metaverse, namely, infrastructure, human-machine interaction, decentralization, spatial computing, creator economy, discovery, and experience. As the metaverse evolves, the industrial development model of the Web 2.0 era, which is dominated by platform enterprises, will be upgraded to a new model of industrial co-creation. Metaverse society, which integrates virtuality and reality, requires collaboration across all sectors of industrial chains to build digital infrastructure, share digital resources, and promote industrial development.

Faster joint construction of digital infrastructure is needed to develop the metaverse. The digital world of the metaverse poses huge challenges in terms of computing power, storage, and transmission, which demands developing digital infrastructure first. Consider the application of holographic communication: It will generate no less than 4GB of data per second, which requires a transmission rate of 1 Tbit/s and a transmission delay of 1-5ms. Scenarios of massive concurrent communication raise the requirements for digital infrastructure. With massive demand for computing power, the metaverse will require 1,000 times more computing power than is currently available. Demand for computing power varies in different scenarios, so more types of computing power and computing paradigms are expected to emerge. In the metaverse

As demonstrated by the advance of VR technology in recent years, a growing scale of technological progress can be anticipated alongside the development of metaverse. (Photo by Dong Fang/*China Pictorial*)

era, the core task will be to accelerate construction of digital infrastructure and create demand and space for development of metaverse applications of all types.

Easier sharing of digital resources is also important. Metaverse technologies represented by digital twin, extended reality (XR), and brain-computer interfacing are driving human society into the era of all-real internet and fostering new technologies and business models. Cutting-edge digital technologies are exploring higher arithmetic efficiency, faster transmission, stronger value systems, and better user experience. In the technological system of the metaverse, Web 3.0, with blockchain as the core, will accelerate construction of a fundamental digital system of trusted computing. The capabilities of digital platforms will continue to grow, data mining and graph computing technology will steadily develop, and strong demand for artificial intelligence (AI)-generated content will promote the engineering and generalization of large-scale AI models. Players hope that the metaverse will facilitate immersive experiences and comprehensive interactions through increasing types of data resources and applications, accelerate integration of all digital elements, and improve capabilities in the sharing of digital resources.

Collaboration across industries is expected during development of the metaverse. Combining cutting-edge technologies such as virtual reality (VR), augmented reality (AR), 5G, AI, and digital twinning, the metaverse has created new space for deep integration of the virtual world and the real world. Engineers are blazing two new trails: the consumer metaverse and the industrial metaverse. Today, the metaverse is not only penetrating highly digitalized industries such as film and television, gaming, social networking, and livestreaming, but also manufacturing and even agriculture. The consumer metaverse empowers individuals and families to enjoy more immersive and interactive service experiences. The industrial metaverse builds a digital twin of the physical world based on realistic needs to facilitate simpler, faster, and more effective work as industries upgrade by reshaping work scenarios, processes, and models. The metaverse is providing new tools for intelligent manufacturing, unmanned control, and lean management. The industrial metaverse will boost applications in more scenarios and provide stronger support to accelerate the process of new industrialization and promote the integrated development of the digital economy and the real economy. Although the metaverse emerged from the information and communication technology (ICT) industry, it requires close collaboration from all industries to achieve the most prosperous future.

TELECOM DRIVE

Transforming their businesses to wield stronger digital capabilities, global telecom companies are

working to create new applications for new scenarios with communication networks as the foundation. Based on their current efforts to build the metaverse and what it will eventually require from various fields, telecom companies are expected to play a significant role in the following areas:

Telecom companies could be a major driving force in the construction of new digital infrastructure by enhancing computing and network integration. To build a solid digital foundation for the development of the metaverse, telecom companies will strive to build high-quality networks with wider coverage, faster speed, better experience and higher efficiency, and provide services that integrate computing and networking based on connectivity, perception, computation, and intelligence. After extensive exploration of the realm, global telecom companies have become major players in the construction of network and computing infrastructure. In October 2022, the Telecom Infra Project (TIP), launched by Facebook in 2016, announced a new group focused on developing metaverse-ready networks. The group aims to accelerate the development of solutions and architecture to enhance networks that support the readiness of metaverse experience. China's telecom companies have built the world's largest commercial 5G network now boosting the digital economy and are actively developing metaverse infrastructure for 6G and computational networks to promote the digital and intelligent transformation of society.

Integration and innovation of digital technologies will accelerate development of the industrial metaverse. Chinese telecom companies are continuously increasing investment in digital technology innovation to strengthen research and development of key metaverse technologies. For instance, telecom companies are building smart factories supported by complete 5G connections with manufacturing enterprises and creating a variety of innovative applications related to data collection, remote control, and VR inspection. In the current stage, global telecom companies are vigorously paving roads to build the digital economy. In the Chinese market, telecom companies are leading the development of cloud computing with an annual growth rate of more than 100 percent. Leaping from basic connectivity to smart connectivity for everything, telecom companies will become key enablers and incubators of innovative businesses in the industrial metaverse as basic connectivity integrates with massive data resources as well as technologies including big data, AI, and blockchain, among others.

Efforts should be made to innovate core technologies for security and trustworthiness and continuously improve security governance of the metaverse. Development of the metaverse demands faster integration and expansion of digital infrastructure as well as a combination of various emerging computing technologies and storage technologies. Theories, technologies, and management related to security need to constantly upgrade to adapt to this trend, enhancing metaverse security with continuous improvement. While promoting innovative applications of the industrial metaverse, telecom companies will also actively contribute to building security capabilities to realize secure and credible data transmission and harness the arithmetic power of blockchain and other technologies.

The essence of the metaverse is to build a new digital world to serve human society and foster better development and transform the physical world in a better way. The metaverse has emerged as a promising industry with limitless business opportunities, but it is still in an embryonic period with the future development path and goals still unclear. China and India are both major developing countries with large populations, massive data resources, and strong demand for digital infrastructure. Telecom companies in the two countries will play a crucial role in building the digital economy in the form of the metaverse and empowering global economic and social development.

The author is general manager of the technology innovation department of China Unicom.

Buckling Up for the Metaverse

By **Maitri Sharma**

The metaverse is a highly immersive way of experiencing the internet. As a result of its vast number of websites and applications, its advocates consider it the next-generation internet.

In the real world you can touch and feel everything, but the metaverse is quite the opposite. The metaverse is a virtual world that relies entirely on high-speed internet. It is not possible to experience this world without high-speed internet and specific devices. In the real world, to visit a place, you have to physically travel there, but in the metaverse, you can visit anywhere while sitting at home. You can even experience outer space from the comfort of your couch. Everything is virtual and nothing is real in the metaverse. It is a world in which you and things exist without being physically present.

Consider an example: In the metaverse, a student on one side of the planet can attend a college class on the other side while sitting in a classroom like normal. However, the student would not be physically present in the class. Surprisingly, even people who have departed this life can be accessed in the metaverse. To revive a person in the metaverse, a hologram is created from that person's picture, the voice is cloned from records, and artificial intelligence (AI) empowers the figure to speak. To help readers understand the metaverse, *China-India Dialogue* (CID) spoke with Rohan Verma, CEO and executive director of MapmyIndia, also called Mappls, an Indian Deep-Tech firm.

CID: MapmyIndia is an interesting concept. How did it develop and how did you begin working on it?

Verma: MapmyIndia was started in 1995 by my parents. Back in the early 1990s, they noticed that 80 percent of all data could have a location component. Harnessing the power of this location could be immensely useful to everybody. At that time, India did not have any digital maps, but my parents still thought it was important to build a digital map for the country on which infinite use cases could be created. So, you could consider that idea the initial genesis of the company. By 2004, the company had already built a large repository of digital map data and was serving

An immersive art experience featuring masterpieces by Paul Cezanne harnessing the most cutting-edge glassless 3D technology in the computer and information services exhibition hall of the 2022 China International Fair for Trade in Services (CIFTIS) at Shougang Park in Beijing, September 3, 2022. This year, CIFTIS attracted more participants and achieved more cooperation than last year. (Photo by Duan Wei/*China Pictorial*)

enterprise customers. We started focusing on bringing it online for internet users. This is how MapmyIndia was created.

CID: Why does the metaverse matter to the first-ever digital mapping service provider in India?

Verma: As far back as 2017, we were contemplating the metaverse. It's a journey about creating not only two-dimensional maps, but also three-dimensional, high-definition, and 360-degree maps, creating a digital model of the world which is high-definition, four-dimensional, and AI-powered. For about a year, this has been discussed as a metaverse project. But what it is really about is the real world.

CID: Is the concept similar to Baidu Maps in China, where searching for a location could actually lead to 3D images of the place or real-time images?

Verma: That's exactly how it relates to digital mapping services. It is the process by which a collection of data is compiled and formatted into a virtual image. The primary function of this technology is to produce maps that give accurate representations of a particular area, detailing major arterial roads and other points of interest.

CID: How are people in India driving construction of the metaverse?

Verma: India is a technology hub and provider for the world. We are open and supportive of initiatives around the world—things that can advance humanity. I remember Prime Minister Narendra Modi talking about it in terms of Vasudhaiva Kutumbakum, a Sanskrit phrase found in Hindu texts, which means "the world is

The exhibition "Alice: Curiouser and Curiouser" at the Victoria and Albert Museum actualizes the wondrous world described in the classic novel *Alice's Adventures in Wonderland* with the help of VR technology, May 18, 2021. (Photo from VCG)

one family," and we want to play a role in support of such initiatives.

CID: Could you elaborate on how the metaverse could one day become an indispensable part of daily life?

Verma: Several different philosophies about how it could go have been bouncing around, including one centered on Web 3.0, cryptocurrency, and virtual reality. It could be a state of being digitally embedded in a virtual world. Moreover, there's another school of thought which looks at potential applications to promote human advancement. Whether it is virtual travel, evaluating real estate, real-world gaming, helping with emergency response, business analytics applications, or governmental planning, the more you start thinking about the real-world metaverse, the more potential scenarios emerge.

CID: Is the metaverse real? What can I do with it?

Verma: To understand the concept of metaverse in real life, let me illustrate with a relatable example: If you are looking for a property, you should consider which neighborhoods are good to live in, where you should go, what schools are nearby, and what kind of vibe the neighborhood has. You could potentially live anywhere in the world, so how do you shortlist the perfect location? To save you from such circumstances, you could turn to the real-world metaverse. The primary benefit is that you will be able to learn more about this place and how it differs from other places. For another example, if there was a fire in your home and you call the fire department, they could see where your apartment is from outside, how high it is from the base-level, and what the access road looks like to determine where the fire truck should go. The length of a hose or ladder needed for emergency response may be totally different, and there are many other situations similar to that. This is just an example to show how the metaverse could be used in emergency situations.

The metaverse also allows you to immerse yourself virtually, as if you were looking around and being in a real world. It's a combination of the real world and the digital world that unlocks a lot of new experiences. It offers new ways of seeing and interacting with the world.

CID: Why is the metaverse such a revolutionary concept?

Verma: The foremost reason is that it is technologically complex. For a revolution to begin, a society must face down difficult challenges. Such is the case with the way AI has revolutionized computing in general semiconductors compared to operating systems that revolutionized mobile phones. The metaverse has the potential to revolutionize the world as much as smartphones have. I think the complexity is digitizing or creating one or multiple versions of the real world, which makes it even more challenging. But over time, it will get commoditized, democratized, and easily accessible for people. It's a new concept with so much promise that it's an exciting notion.

MapmyIndia Founding & Leadership Team (from right to left): Rohan Verma, CEO and executive director, Rakesh Kumar Verma, co-founder and CMD (chief managing director), and Rashmi Verma, co-founder and CTO (chief technology officer). (Photo courtesy of Rohan Verma)

CID: What can people build in the metaverse that we can't build on the internet or in virtual reality today? What current limitations does it break through?

Verma: The metaverse is an immersive way of experiencing the internet. As a result of its vast number of websites and applications, it is like the next-generation internet. You create your own websites, you build your own applications, and you browse it through a variety of devices like desktops, mobile phones, and tablets. The metaverse also allows you to immerse yourself virtually, as if you were looking around and being in a real world. It's a combination of the real world and the digital world that unlocks a lot of new experiences. It offers new ways of seeing and interacting with the world.

CID: Is it true that the metaverse will lead to more theft and crime?

Verma: You could imagine that kind of dystopian outcomes. That is why it is important to be responsible in terms of creating such tools and technologies and be thoughtful about the impacts or outcomes. The same debate or discussion is happening in the AI world on developers being aware of what is being created and what the externalities could be. Responsible technologists, entrepreneurs, government agencies, and fundamentally good citizens will all be thoughtful about potential misuse of the metaverse.

CID: In the age of social media, what does the metaverse mean for influencers?

Verma: The metaverse is essentially creating more time retention for people in the digital world, which means that influencers will boom. In the same way that we watch movies at a cinema or a play on a stage, it should be interesting to watch them through the metaverse. It will be great for creators and influencers, but it could also have drawbacks, so we have to be careful.

The Next Wave of the Digital Economy

By **Huang Rihan and Bai Ruishan**

Developing new things takes time. The relationship between the metaverse and the digital economy will continue tightening until it eventually bursts onto the scene.

In recent years, the metaverse has been one of the most popular concepts in the internet realm. The idea originated in the 1992 sci-fi novel *Snow Crash* by Neal Stephenson. The novel envisioned a world in which people interacted and competed via digital identities in a three-dimensional space to improve their real-life social status. To define the metaverse, it is an immersive, virtual digital community created by users and based on data and algorithms. In this world beyond the limits of space and time, people make virtual interactions to gain a new sense of identity and belonging. In simple terms, the metaverse could be a more personalized and updated version of *The Sims*. Participants could come from all over the world and interact on a single platform.

PUSHING DEVELOPMENT OF METAVERSE

Many consider 2021 the first year of the metaverse. That year, famous U.S. gaming company Roblox went public on the New York Stock Exchange with the concept of the metaverse as its central purpose, and its stock price surged. Then, Mark Zuckerberg announced that his company Facebook would be rebranded as Meta. It seemed like overnight, the metaverse became mainstream all over the world. What areas will metaverse change, and how can this novel concept connect to the digital economy?

The world economy has suffered a major setback due to the COVID-19 pandemic, and global economic recovery has been sluggish in recent years, which has exerted a particularly acute impact on enterprises in the digital economy. Many global internet giants, such as Meta, Twitter, YouTube, and Instagram, are facing the problem of weak growth and pressure to transform. The era of rapid growth for internet enterprises has come

to an end. The internet began to boom at the end of the 20th century, and continued with successive Web 2.0 and 3.0 updates. New forms of internet businesses seem to have hit a ceiling. Although most Generation Z users born after 1995 are some of the most active users on the internet, they have shown little interest in the current business forms.

Therefore, high-tech companies are desperately seeking a novel concept to boost the development of the digital economy. The emergence of next-level innovations should bring people a sense of freshness, attract new users as well as international capital, and create a new "blue ocean" for development. This is all good news for enterprises in the sector. For them, the new concept of the metaverse has arrived just in time.

Although the metaverse is still only a concept and lacks specific support, some industry insiders firmly believe that it will become a reality one way or another. The digital economy has been relentlessly progressing in recent years, leaving consumers overwhelmed by capital-driven innovations. A decade ago, it was hard to imagine people traveling around China without a wallet or using WeChat to make calls and send messages. New things are always questioned when they first emerge. Although the metaverse remains in its infancy, it has a good chance to become a reality in the future.

A 5G-based smart city model at the China International Import Expo 2022 attracts plenty of visitors. (Photo by Xu Xun/*China Pictorial*)

FEATURES OF METAVERSE

It is important to understand the future development model of the metaverse. From the technological perspective, the core of the metaverse is a digital world integrating virtuality and reality. It contains three meanings: First, it is a digital world modeled after the real world. With the digital twin technology as the core, the metaverse simulates and mirrors the real world, transferring social and business activities from the real world into the virtual world. Second, it is a digital world beyond the real world. With advanced computer game technologies as the core, the metaverse creates characters, objects, and environments which don't exist in the real world and forms new subjects and new rules. Third, it is a digital world that overlaps with the real world. Taking augmented reality (AR) technology as the key, the metaverse combines information from both real and virtual worlds. Essentially, the metaverse is neither a parallel world nor a completely virtual world, but a combination of reality and virtuality.

Four elements are required for the metaverse economy to properly function: digital creation, digital assets, a digital market, and digital currency. Specifically, digital creation is the front end of the metaverse economy. Without creation, there would be no products to be traded in the metaverse. Products here refer to digital contents such as short videos, images, and text. Digital assets generally include the production mode and confirmation of rights of

The emergence of new digital devices in recent years is bringing VR and AR technologies to handheld devices and headsets accessible to millions of users. (Photo by Xu Xun/*China Pictorial*)

digital assets. Digital creation and digital assets will become the premise of digital market transactions.

The digital market will create space for more people to operate in the metaverse. The digital market is also the foundation of a prosperous metaverse and can be considered the infrastructure of the metaverse. Also, digital currency will align with the development of the metaverse, and the metaverse will provide a test field for the digital economy. The metaverse, constructed based on these four elements, will provide new space for more countries, enterprises, and individuals to create unlimited possibilities and even a new world.

Generally speaking, the metaverse will foster new forms of business, and research in this field is still nascent. And whether one likes it or not, this new form of business has emerged and will probably become the mainstream in the future. Thus, people must gain an in-depth understanding of the impact of the metaverse on the digital economy as well as on the traditional economy.

IMPACT ON THE ECONOMY

The digital economy refers to economic activities with data as the essential production factors. It involves the production, distribution, and consumption of material products as well as the creation, exchange, and consumption of digital products. In plain terms, if digital technology or data is used in any link of production, distribution, or consumption, it is a form of the digital economy. The metaverse is a special form of the digital economy. With the spiral development of the metaverse, its impact on the economy and society will become more evident.

First, in the initial stage of exploration, the metaverse will gradually change the factor input structure of the economic system. In the traditional production system, the most critical production factors are land, raw materials, labor, and energy. Development of the digital economy makes data another essential factor. At present, however, the restriction effect of data on the supply of traditional production factors is limited. A new production mode needs to be introduced to solve the imbalance between supply and demand of production factors.

The development of the metaverse may change the relative price and demand structure of production factors and ultimately change the factor input structure of the global production system. In the process of the phased development of the metaverse, some industries will be relocated to the metaverse, so the economy and society will reduce demand for input of traditional factors such as land and raw materials. At the same time, the development of the metaverse will also lead to large-scale construction of new information infrastructure, which will enhance the scale effect of data production and significantly reduce costs. Data will eventually become

one of the most essential factors in the economy. Data resources will also gradually become the core competitive resources of an enterprise and even a country, and data-based technology development and application models will become the core competitiveness of an enterprise or country.

Second, during the phase of rapid development, the metaverse will promote the transformation of traditional social and economic structures. The metaverse will provide new digital life experiences for members of society and redefine the physical properties of assets. Using blockchain-based digital assets such as non-fungible tokens (NFT) as a new transaction tool, the metaverse can reshape the social and economic structures in multiple dimensions. First, in terms of consumption and service upgrading, it is possible for assets and goods in the metaverse to be compared, exchanged, and distributed in the real world. Second, the flow mode will change. In the metaverse, the concept of cities will change. Rural residents will have access to the same educational services as those in cities. Physical distance and space may no longer be obstacles to economic activities, and people do not need to spend huge on houses in metropolises. Innovative ideas will become more valuable. Third, production in the digital world will lead to larger-scale collaboration and cooperation, and the importance of teamwork will become more prominent.

The Wuzhen Summit for the Digital Economy Industrial Cooperation Conference of the 2022 World Internet Conference is held in Jiaxing City, Zhejiang Province, November 10, 2022, at which many digital economy cooperation projects were signed. (Photo from VCG)

Third, in its mature stage, the metaverse will change how the real economy operates. Due to the high synchronization of production and consumption, the metaverse will transform the system of the real economy. In the industrial era, separation of production and market resulted in lots of ineffective production and waste which in turn led to cyclical economic crises. By promoting information sharing, reducing transaction costs, and meeting individual needs, the digital economy has greatly broken down the barrier between production and consumers. Due to the creation of digital economic space and digital mapping of the production transaction system, the metaverse will further break the traditional industrial system's dependence on physical time and space and form a new industrial layout and production system. In the digital manufacturing and transaction system formed by the metaverse, producers can operate virtual digital devices and control real devices remotely just as consumers buy and customize from home, forming a global synchronous production and trading system.

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Picking Up the Pieces After the Meta Crisis

By **Rama Chandran**

The computing experience that is with people all the time wins; Computing that accompanies people into the real world will always win over computing that takes them out of the world.

Meta, the parent company of Facebook, cutting over 11,000 jobs, or 13 percent of its workforce, recently did not come as a surprise to global tech watchers. Although the tech giant spun the reorganization as a move to become "leaner and more efficient," it is well-known that American tech companies are in the throes of an unprecedented crisis. Will Facebook's belt-tightening dampen the enthusiasm of the tech companies in China and India as they increase experimentation in the metaverse?

META CRISIS

The Meta crisis is the beginning of a turbulent era in Silicon Valley, which had long represented solidified and growing economic power. The United States had always boasted this sector as recession-proof, but the fort has been breached. According to the prospecting platform Crunchbase, 50,000 U.S. tech workers have been laid off in 2022 alone. Elon Musk gave marching orders to half of Twitter's workforce. Peloton, a maker of internet-connected exercise bikes, has more than halved its workforce. Robinhood, a popular stock-trading app, has cut its labor force by 23 percent, and fin-tech platform Stripe has also announced layoffs.

High inflation, rising interest rates, recession, and aggressive pandemic-era expansion all played roles in the Meta crisis. Meta increased its workforce by nearly 60 percent from 2020 to 2021. Facebook grew its staff by 28 percent to more than 87,000 in the 12 months ending in September 2022. "At the start of COVID-19, the world rapidly moved online, and the surge of e-commerce led to outsized revenue growth," wrote Mark Zuckerberg, founder of Meta and Facebook, announcing the layoffs. "Many people predicted this would be a permanent acceleration that would continue even after the pandemic ended. I did too, so I decided to significantly increase our investments. Unfortunately, this did not play out the way I expected. I got this wrong." He got it wrong because he was not pursuing realistic dreams. The social media platforms of Meta, such as Facebook, Instagram, and WhatsApp, have a traditional business model that relies on

advertising. It was hit hard by the recession. Several digital advertisers pulled back in the face of inflation and the instability caused by the Ukraine crisis, and customers scaled back spending. As the tech companies tightened their belts, the labor force became the first casualty.

In October, Meta posted its third-quarter revenue decline and its profits were half the same period last year. Valued at more than US$1 trillion in 2021, Meta's market value has since plunged to around US$250 billion. It is no longer the behemoth it once was.

BETTING ON THE METAVERSE

Once a niche concept from the cyberpunk novel *Snow Crash* in 1992, the metaverse became a buzzword when Facebook rebranded itself as Meta on October 28, 2021.

The metaverse is a virtual world that exists parallel to the physical world. In the metaverse, our digital and physical lives overlap in the domains of work, socialization, productivity, shopping, and entertainment. It is enabled by advanced technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR). It is seen by many as the next-generation internet for businesses, investors, and developers. The entry point for the metaverse is extended reality (XR), which is a combination of VR, AR and MR that are accessible and interactive in real time. This is the pioneer of inventive applications in fields such as gaming, entertainment, enterprise solutions, and simulations.

Blockchain technology will also play a major role in building the metaverse. While the proponents of this aspirational technology are Western companies, global metaverse discourse has been influenced by economic giants such as China. An array of positive factors suggests that India has a key role to play.

Meta's crisis came as it is taking a gamble on building the metaverse. The hiring boom at Meta focused on building immersive digital realms accessed through VR. Zuckerberg has maintained that it will be the next great computing platform after mobile phones. He expects the metaverse to replace some in-person communication. Since it is a gamble based on a stale vision, the crisis was inevitable. Renowned technologists studying usage behavior in virtual worlds have long considered Zuckerberg's vision stale and the future of Meta questionable. Analysts blame the stale vision for the current crisis more than the global recession.

Some 3D multi-person chat environments were popularized by online games such as Second Life and more recently Horizon Worlds. Microsoft's V-Chat, Comic Chat, V-worlds, and tools for creating and customizing digital avatars were the early forays into Zuckerberg's dream world. But it became evident to Microsoft way back in the 1990s that trying to harness the potential of the metaverse amid dramatic shifts in our digital lives was not worth the extravaganza.

The metaverse combines cutting-edge technologies including virtual reality, augmented reality, 5G, artificial intelligence and digital twins to create a new space integrating the virtual and real worlds. (Photo by Xu Xun/*China Pictorial*)

The dreams seem endless, like kids creating and abandoning worlds in Minecraft. The magical architecture of virtual worlds is possibly a critical ingredient in the user experience and hence Meta is keen on creating 3D environments in which people would hang out. But employees at Microsoft found that these "stage sets" did not play a particularly critical role in shaping user behavior. Instead of roaming the virtual space, one must work one's way into the social structure to figure out how things happen. People don't encounter any sense of real life while wandering around for hours in virtual life. The virtual gathering space becomes boring, and ultimately, empty and abandoned. This was termed a "cold state problem" by former Microsoft technology expert, Robert Fabricant.

But Meta pumped in US$36 billion between January 2019 and September 2022 to prop it up in the hopes that, at some point, some people would be the fools to show up at the party.

When Facebook reached a critical inflection point as a desktop web platform with a very limited HTML5 browser-based mobile offering a decade ago, their leadership failed to recognize the smartphone revolution. They didn't shift their focus to a mobile-first product offering in time. By pursuing the metaverse, Zuckerberg is imagining that Meta is defining the next paradigm. But in doing so, Meta has forgotten the fundamental lesson of mobile computing: The computing experience that is with people all the time wins; Computing that accompanies people into the real world will always win over computing that takes them out of the world.

Thus, Zuckerberg's metaverse vision is just a nostalgia trip to escape a world of complex, multilateral reality, and his metaverse has progressed very little.

METAVERSE IN CHINA

China's Fintech Development Plan (2022-2025) announced by the People's Bank of China in January 2022 mentioned the metaverse while discussing reshaping financial services with intelligence as a key task. The plan proposes that "relying on the features of 5G with high bandwidth and low delay, visual technologies such as VR, AR, and MR will be deeply integrated with banking scenes to promote physical branches to upgrade to multi-horizontal, immersive, and interactive smart branches."

On November 1, 2022, several Chinese ministries and administrations including the Ministry of Industry and Information Technology unveiled a five-year plan for 2022 to 2026 for the development of the VR industry, aiming to achieve a target exceeding 350 billion yuan (US$48.1 billion) by 2026. The document seeks the creation of fundamental technologies that support immersive AR, VR, and MR experiences and calls for innovation in fields like full-body motion capture, gesture, eye and expression tracking, and technologies for rendering graphics.

In China, over 16,000 metaverse-related trademark applications had been filed by February 21, 2022, according to China National Intellectual Property Administration. Six of China's tech giants including Tencent and Baidu ranked among the top 10 firms globally in filing VR/AR patent applications in 2020 and 2021. In 2019, most of these developments happened in the fields of retail shopping, education, gaming, marketing, information display, and industrial manufacturing. Big Chinese firms lack the expertise to develop VR devices, and they are investing in startups. China has over 900 million smartphone users, making VR accessible through smartphones a priority.

Deloitte China estimated that the metaverse market in China will hit 40 trillion yuan (US$5.79 trillion) by 2030, equivalent to 20 percent of China's GDP, and that electronic products and wearable devices related to the metaverse would be worth US$100 billion. According to a report from Morgan Stanley, leading Chinese tech firms have already begun to invest in a metaverse market that would be worth about US$8 trillion. J. P. Morgan, in a September 2022 report, suggested that the metaverse could triple China's online gaming market to US$131 billion from US$44 billion. The American investment bank estimated a total US$4 trillion addressable market for the metaverse in China from "converting offline consumption across physical goods and services." Metaverse development will exert a notable impact on the entire technology, media and telecom ecosystem. Tencent, NetEase, and Bilibili stocks could all benefit from the metaverse.

Software and service vendors such as Sight Plus, Hisense, and Mayitegong have entered the AR market. Baidu launched a metaverse app "Land of Hope" on Chinese history in December 2021. Tencent, the creator of WeChat, launched a new feature called Super QQ Show to introduce a 3D interactive space where users can interact and play games together. ByteDance, the parent firm of TikTok, has designed

two metaverse-like social networking apps: Paiduidao, meaning Party Island, for the Chinese market, and Pixsoul for Southeast Asia.

The metaverse was a key theme of the 5th World Artificial Intelligence Conference in Shanghai in September 2022. Chinese internet platforms offered a "metaverse-like" viewing experience enabled by 5G and VR during the Qatar World Cup carnival.

METAVERSE IN INDIA

China's neighbor India is also among the leaders on building the metaverse. With the government seeking to foster a digital economy worth up to US$1 trillion, the market for video streaming and gaming is seeing fresh heights. Reports project that the Indian gaming market will more than triple to US$7 billion by 2026.

India released its National Blockchain Strategy in December 2021. The pilot of the blockchain-backed Digital Rupee is set to be issued by the Reserve Bank of India in December 2022. Spectrum auctions to rollout 5G mobile services are expected to accelerate demand for cloud apps including those for gaming and the metaverse. The operational challenge of building the metaverse remains, and if India is to take a leading role, investment in the private sector needs to accelerate.

Deloitte has predicted that the metaverse industry in India could have an economic impact worth between US$79 billion and US$148 billion by 2035. The report noted that India is among the pacesetters in the industry and that it was one of the first jurisdictions to include the metaverse in its policy considerations on cyberbullying and sexual abuse. With the country inching toward unveiling the Digital India Act, a proper framework is expected to be established to prevent crimes like inciting violence and spreading misinformation in the metaverse.

India has pledged to provide an enabling environment for Web 3.0 firms to experiment with new offerings for consumers in the industry. Union Minister of State for Skill Development and Entrepreneurship Rajeev Chandrasekhar announced that nothing would prevent firms from exploring the metaverse or non-fungible tokens (NFTs). However, the country has signaled that it would use its G20 presidency to push for global digital asset regulations. The Indian government has been relying on distributed ledger technologies in recent months, using them for its central bank digital currency and streamlining local land registries' operations.

India is already debating regulation of technologies that underpin the metaverse. Owning and trading NFTs is a path towards a new digital economy that will impact the development of the metaverse. Beyond crypto, the metaverse raises ethical questions on privacy and security. Online risks may worsen if the metaverse allows pervasive, intrusive, and unwanted contact. Pioneering efforts to find governance mechanisms for virtual worlds must be in place and should be supported with digital literacy, safety, security, and privacy to guarantee meaningful participation in online communities and minimize harmful content and behavior.

Within the tech ecosystem, several standards have been proposed for the metaverse, but incentives for adopting them are governed by the interests of a few Western companies maintaining control. It will not be possible for a single metaverse to exist if laws for monetizing and moderating the metaverse are enacted and enforced differently around the world. India has always espoused the doctrine of Vasudhaiva Kutumbakam, a Sanskrit phrase found in ancient texts such as *Maha Upanishad*, which means "the world is one family." This policy of oneness should be applicable to the metaverse too. All Indian scriptures expound on the victory of good over evil. In a war between the reality and the metaverse, reality must be victorious and spread its wings even behind mythical and mysterious horizons.

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Metaverse in China: Digital Economic Pillar

By **Liu Yushu**

Rather than a single industry or a handful of technologies, the metaverse is regarded as an important cornerstone for building Digital China.

Based on its prevalence online, the term "metaverse" really started attracting attention in China at the end of June 2021. In early September 2021, the concept of the metaverse drove a rise in China's A-shares as the term first became popular in the country. Since Facebook was rebranded as Meta in 2021, Chinese and overseas stock markets have seen sharp ups and downs related to the metaverse. All of these factors helped the term attract a ton of attention. "Metaverse" emerged as one of the biggest buzzwords of 2021.

However, unlike in many other countries, the metaverse is not a new concept in China. In the early 1990s, Qian Xuesen, a renowned scientist in China, learned of the development of virtual reality and predicted its potential application in human-computer integration and human brain development, naming it the "Spiritual Realm." Qian forecast the emergence and development of a "Spiritual Realm" that would expand the perception of the human brain and improve the experience of human-machine integration, bringing deep integration between humans and computers. More than 30 years before the concept of the metaverse became mainstream globally, fields related to the metaverse such as virtual reality, high-speed internet, and high-performance computing were already receiving great attention from Chinese scientists.

RAPID DEVELOPMENT OF METAVERSE IN CHINA

In 2022, the number of Chinese companies related to the metaverse increased more than eightfold. According to data from Tianyancha.com, an online platform offering data on registered Chinese enterprises, about 440 enterprises in China were engaged in metaverse-related endeavors by early January 2022. And as of mid-December, more than 3,600 companies in China focused on metaverse-related operations. The firms also showed some interesting characteristics: First, 64 percent of them were established before 2021. They only shifted to the metaverse in the past two years, and 45 percent have survived for five years or more. More and more

Chinese companies are finding opportunities in the metaverse sector and beginning to expand metaverse-related operations. Second, China's metaverse-related companies are mainly based in first-tier cities and southeastern coastal provinces. Among them, Beijing and Shanghai as well as Guangdong, Zhejiang and Jiangsu provinces have the most metaverse companies. Third, private enterprises are currently the main driving force for China's metaverse development. They are mainly involved in software and emerging technology development, business services, internet and related services, culture and art, press and publication, and metaverse technology research and experiments.

A metaverse industrial chain has already taken shape in China. On September 1, 2022, the China Academy of Information and Communications Technology released the *2022 Metaverse Industry Landscape*, which focuses on bottom-layer technology, products and services, and applications covering all key links upstream and downstream of the industry chain. The bottom-layer technology sector involves four pillar technologies: graphics and images, sensory interaction, digital twining, and trusted data traffic. The products and services sector mainly consists of four major systems of metaverse products and services: digital human systems, intelligent hardware, immersive audio-visual software, and content creation platforms. The industry application sector includes three major areas: manufacturing, personal consumption, and public services. The release of the *2022 Metaverse Industry Landscape* showed that China's metaverse industrial chain has begun to take shape and could soon welcome an era of rapid and comprehensive development.

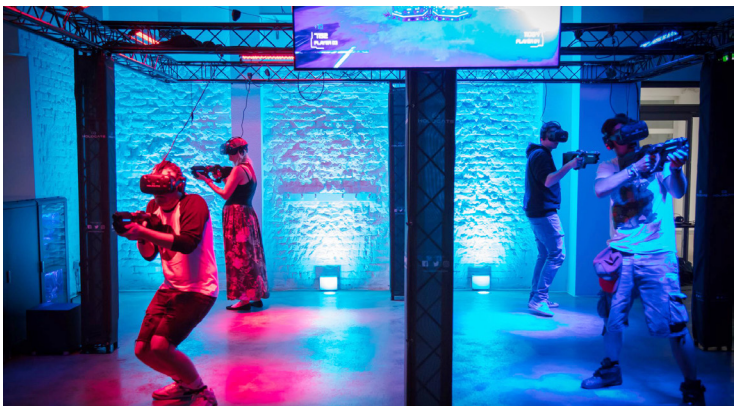
The development of China's metaverse adheres to the idea of "walking on two legs." China seeks to integrate the metaverse and the real economy. According to the 10 application scenarios for the metaverse in China released by the World Artificial Intelligence Conference in 2022, China has already begun to adopt large-scale exhibition hall smart support systems for some major events. These systems feature human-machine coordination technologies such as virtual reality and intelligent robot-assisted management. At the same time, various technologies from the metaverse have also been applied to construction and management of smart cities. And a new production mode of digital and intelligent steel-making processes will be created in heavy manufacturing. Supported by images and data, heavy manufacturing will rely on digital twining, industrial internet, and robot technology. If existing cases are any indicator, the merging of the metaverse and industry will lead to new upgrading of the digital transformation of China's traditional industries with multiple technologies including digital twining.

China is also committed to creating an independent, controllable virtual metaverse world. Over the past two years, Chinese internet companies have been competing to build independent and controllable metaverse realms. Tencent introduced "Immersive Convergence." ByteDance released a series of products such as social networking apps Party Island and Pixsoul and virtual person called "Li Weike."

GOVERNMENT SUPPORT

China has a clear strategic plan to support the development of the metaverse. In fact, China's central government and local governments have designed a tacit division of labor in support of the development of the metaverse industry. The central government focuses on long-term support for the development of "meta technology (core basic technology)," while local governments are paying more attention to the cultivation of the metaverse industrial system. Coordination of development strategies between the central and local governments is a key reason for the rapid growth of China's metaverse industry.

Since the release of *Outline of the 13th Five-Year Plan for the National Economic and Social Development of China* in 2015, China has successively introduced more than 10 policies on basic technologies closely related to the metaverse, including high-speed internet, semiconductors, large-scale integrated circuits, big



Metaverse wearable devices are inching towards mainstream as many companies have announced plans to release AR and VR headsets in 2023. (Photo from Pinterest.com)

data, artificial intelligence, blockchain, cloud computing, Internet of Things, virtual reality, and augmented reality. China's *Industrial Metaverse Three-Year Action Plan (2022-2025)*, released on October 28, 2022, and *Action Plan for the Integrated Development of Virtual Reality and Industry Applications (2022-2026)*, released on November 1, 2022, paved the way for the development of the metaverse in China over the next three to four years.

Clearly, China does not regard the metaverse as a single industry or development of a handful of technologies, but as an important foundational platform supporting the construction of Digital China. The country regards the metaverse as the merging and upgrading of digital technology clusters related to life, social networking, next-generation internet, next-generation retail e-commerce, and next-generation industrial internet. China is promoting it as a new revolution that will change life and industry.

Local governments have been complementing the central government's firm and long-term strategic support for the development of basic technologies related to the metaverse. Over the past two years, local governments across China have introduced policies to promote the development of the metaverse industry as they strive to create new growth momentum for the digital economy.

For example, the *Action Plan for Innovation and Development of Metaverse in Beijing Municipal Administrative Center (2022-2024)* seeks to transform the city's administrative center into a demonstration area for metaverse application featuring cultural and tourism content. The *Action Plan for Cultivating New Track of the Metaverse in Shanghai (2022-2025)* vows to increase the size of Shanghai's metaverse-related industry to 350 billion yuan (around US$50 billion) by 2025. The *Action Plan for the Development of the Metaverse Industry in Henan Province (2022-2025)* pledges to increase the scale of the core industry of the metaverse to over 30 billion yuan (around US$4 billion) by 2025 and to increase the scale of related industries to over 100 billion yuan (around US$14 billion). In addition to Beijing, Shanghai, and Henan, cities such as Xiamen, Guangzhou, Chongqing, Nanjing, Hangzhou, and Shenyang have also mentioned the metaverse in their respective industrial planning and supporting policies and proposed building relevant pilot zones.

Local governments in China have clear policy directions to support the development of local metaverse activities. They are activating social investment and guiding capital to participate in the construction of local metaverse infrastructure through the combined propellers of policy and industry-guided funding. They also seek to establish a long-term financial support system for the development of the metaverse industry, constantly improve the business environment and service system, and support the construction of the metaverse ecosystem.

JOINTLY SOLVING PROBLEMS

Although China's metaverse industry is developing rapidly at present, the metaverse sector around the world as a whole remains in its infancy. At this stage, both China

and Western countries face a series of common problems in developing the metaverse that would be easier to overcome with all countries working together.

Closer international cooperation is needed. First, the metaverse involves technologies in various fields such as graphic and image processing, artificial intelligence, virtual reality engines, and high-speed mobile internet technology. The development of these technologies relies on faster innovation and development through international cooperation. Second, the metaverse needs high-speed storage, reading, writing, and computing of big data. Today, most metaverse applications and games rely on cloud computing technology to store and process data. However, the computing power and storage capacity of different countries vary, which causes a "computing power gap." Therefore, international cooperation is needed to solve such problems. Third, from a global perspective, the metaverse needs a more open ecosystem. There is a lack of such an ecosystem, and coordination and interaction between various countries in terms of metaverse-related technical standards and common interfaces are also insufficient. This hinders the internationalization of the metaverse.

The metaverse involves complex legal issues such as virtual assets, user privacy, and intellectual property rights, which demand international consensus. First, virtual assets remain legally uncertain. In the metaverse, users can purchase, sell and exchange virtual assets such as game props, equipment, and virtual currencies. However, current legal provisions in these areas are vague, and the legal status of virtual property is controversial, so all countries should make joint efforts to advance relevant legislation. Second, the privacy of users faces risks in the metaverse, where personal information provided by users could be stolen, resulting in the leakage of private information. How to protect users' privacy in the metaverse has become a global issue. Third, legal disputes over intellectual property rights in the metaverse have already arisen. It is a space in which participants can create, use, and exchange various virtual content such as in-game items, equipment, and images. Such operations involve intellectual property issues that still lack clear legal protection.

Many market problems in the metaverse need stronger international cooperation. A disunity of standards will ultimately increase the alternative costs of users. Because the technological base is still developing, unified standards for interaction and data flow among different platforms and devices have yet to emerge. So, if consumers want to move or share virtual assets and experiences across different platforms, it will be costly.

Moreover, market demand for the metaverse is still uncertain. With cutting-edge technologies related to the metaverse such as virtual reality and artificial intelligence still in an experimental phase, many flaws in the experience and stability of products will inevitably pop up. In addition to shortcomings in the physical sense among visual access devices, most devices including those involved in network speed, mobile power supply, tactile transmission, and taste simulation still lag far behind human sensory experiences in the real world. Elon Musk once said that no one would be willing to strap a screen to his face all day. The market expectations for products are still mostly random. And research and development of products related to the metaverse requires massive funding. If a metaverse product fails to meet market expectations after its launch, its producer might suffer great losses. The metaverse needs a broader market to enhance fault tolerance of the iteration of its first-generation products. In this regard, countries need to strengthen market cooperation, promote integration of the global metaverse market, and jointly promote prosperity and development of the field.

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Metaverse: Revolutionizing the Global Landscape?

By **Anuj K Sharma**

The metaverse has the potential to be the next major technological advance.

Imagine a world in which the mundane, tangible aspects of life as we know it are gone. People could work, play, unwind, and interact with others from around the world in a new parallel reality. The scale of the metaverse industry is expanding, and the digital world's blockchain-based metaverse concept has a deep history dating back many decades. Science fiction authors and visionaries have been working tirelessly on this idea, seeking a way to transcend the physical boundaries of the real world.

The idea enables people to explore infinite vistas and generate fresh opportunities to bring fantasies to life. The metaverse enables all of these things, whether you want to reach new heights in digital success, discover a brand-new universe, or connect with your loved ones in novel ways.

With considerable fanfare, Mark Zuckerberg joined the list of recent investors in the metaverse. In 2021, Facebook was even renamed "Meta." It joined a group of other tech giants seeking to control the metaverse once the novel idea is made available to the general public. It is not the first or only company, though, to be moving towards the concept of the metaverse.

This new technology represents the internet's most recent evolution. No single corporation or individual will possess it because it will be decentralized and diverse. However, any company seeking to participate will have to significantly contribute to building the metaverse's supporting infrastructure and determining how it will ultimately emerge.

WHAT IS THE METAVERSE?

The idea of a metaverse connected to a virtual world is intriguing. In this virtual environment, people would be free to enter a setting that closely resembles the real world, engage in a variety of activities, and even make money by monetizing their works in the metaverse.

In essence, it is an augmented reality (AR)/virtual reality (VR)-accessible environment that combines digital assets and digital worlds. Science-fiction authors and futurists see this as a hypothetical version of the web acting as a

single, all-encompassing digital universe made possible by the use of AR and VR technologies.

People can sign up for the metaverse at their leisure. Some metaverses require users to access simply using devices like a PC or smartphone. But the best way to experience the metaverse is using AR or VR headsets. People can access this virtual world by just lying on their beds; they do not need to move. They can engage in both work and leisure activities in the metaverse, just like in the real world, and both will have comparable rewards. People can interact with others virtually through digital avatars. Through their devices, they could use their own voice or text to converse with each other in the metaverse.

How metaverse technology might be applied in the real world is one of the most crucial topics to dicuss when it comes to the metaverse. The metaverse will heavily supplement the physical world eventually.

Right now, the primary applications using metaverse technology are open-world games and virtual worlds. But the metaverse is capable of much more than that, and by considering all the potential applications, we can anticipate how it could develop in the future. Some intriguing applications for the metaverse that IT experts believe would promote its development include: Metaverse apps powered by enhanced simulations that leverage better VR and AR technologies, creation of virtual stocks, products, and other things that are still linked to the real world, and user creation of virtual resources, experiences, and environments.

Many cities in China including Beijing, Shanghai, Xiamen, Guangzhou, and Chongqing have released development plans and support policies for the metaverse and proposed building experimental zones.
(Photo by Darlene Alderson/Pexels)

CREATING A METAVERSE THAT BENEFITS ALL

Since several applications are tapping the metaverse, the logical next step would be to leverage the top metaverse technology to advance this sector more quickly. But it is crucial to understand how to effectively combine the various technologies. One needs to understand the structure of the metaverse in order to proceed.

All present problems with remote work can be solved with the metaverse. In a virtual environment, managers could interact with employees by meeting them in the form of digital avatars, reading their body language, and maintaining real-world relationships. Additionally, by monitoring the team from a virtual office, the employer can deal with problems like time theft and goldbricking at work.

For healthcare professionals and medical staff who previously could not visit patients because of geographic restrictions, the metaverse could be a life-changing instrument. In the virtual reality of the metaverse, doctors could interact with the patients and learn more about their health. Traveling is fun, but not everyone has access to the destinations they wish to see. The metaverse would enable people to go to places they are physically unable to visit. Using the combined capacities of the metaverse, AR, and VR, a complex virtual environment for a first-person experience is being created.

Nowadays, the majority of metaverse games are

Technicians work in the newly-built Metaverse & Intelligent Industrial Zone in Suzhou-Suqian Industrial Park, April 8, 2021.
(Photo by Chen Jian/*China Pictorial*)

standalone applications with built-in economic systems that support pay-to-win play. In these games, players can use non-fungible tokens (NFTs) to buy, sell, and swap in-game assets. Gamers have been drawn to the idea of avatars exploring a huge virtual space.

Numerous people are curious about the metaverse. Some programmers seek to make use of the ecosystem to create apps specifically for the corporate world. Others are looking for ways to make money. Fortunately, the metaverse can meet the demands of both parties. Anyone could build a valuable project on top of the metaverse ecosystem due to its open-source nature. Regular users can enter the ecosystem and generate income by producing and exchanging NFTs.

INCHING TOWARDS THE METAVERSE REVOLUTION

Large tech corporations are already attempting to set the pace for the future. However, with blockchain's decentralized features, even minor actors are contributing to the metaverse's evolution.

India is not far behind and will play a significant role in driving the metaverse revolution. Indian IT companies are preparing to leverage the metaverse's prospects. The metaverse is being built by Indian businesses such as Hyperlink Infosystems, TCS (Tata Consultancy Services), Infosys, Zensar Technologies, Capgemini India Pvt Limited, HCL Technologies, and HData Systems. They work on a variety of technologies including blockchain, the Internet of Things (IoT), artificial intelligence (AI), VR, cloud computing, data science, and digital supply chains.

India is now home to one of the largest sports AR development groups and is predicted to become the largest app developer base worldwide by 2024. The metaverse will not be created by one firm per se; instead, it will take a number of businesses and millions of creators and entrepreneurs.

The metaverse is the next evolutionary step for the internet. The activities that people could enjoy with their friends and co-workers are the main focus. The exponential development brought by creators involves mixing and matching, embedding, and connecting via a new era of creator-oriented technology. People will be taken to locations they have never been before, which will be wonderful.

The virtual world of metaverse has the potential to be the next major technological advance. The metaverse's diverse qualities have already caught the attention of some of the biggest names in technology. It enhances user experience while also bringing people closer together. It has a great deal of potential to succeed in "reality" as a virtualized version of the internet where the majority of aspects of life are also virtualized.

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On Ethics of the Metaverse

By **Wen Xianqing**

The metaverse refers not only to a technology, but also to an ideological concept. We should build metaverse ideals around an improved ethical value system tuned to metaverse technology.

In 1992, Neal Stephenson coined the term "metaverse" in his sci-fi novel *Snow Crash* to describe a virtual world parallel to the real world. Since its inception, this concept has attracted widespread attention because of its extraordinary imagination and technological potential. The development of information and communication technology (ICT), especially 5G/6G communication, artificial intelligence, and big data, has witnessed breakthroughs in virtual reality, digital technology and sensor technology, making the metaverse a controllable technical concept. Through digital avatars, people can live hybrid lives in which physical and digital worlds interact. The blurring of boundaries and the fusion of the real and the virtual have resulted in reflection on the meaning of the metaverse as an ideological concept. Now is the time to discuss the ethics of the metaverse.

FROM SCI-FI TO SCI-FACT

The metaverse concept was first imagined in print by Stephenson. Why did he think of such a virtual space? Such a space could showcase the depths of human imagination and creativity, exerting transcendental power and value creation. However, it would also allow people to engage in infinite desire, greed, and conceit outside the constraints of the physical world.

The metaverse has shifted from a mere sci-fi concept to applicable technology, and it embraces a highly hybrid setting merging the virtual and the real. Innovations in ICT have powered a wholly simulated reality in the metaverse. Sensor devices and brain-computer interfaces connect users with the virtual world. Blockchain enables users to build their own metaverse independently. Digital and big data technologies help users live in the metaverse. However, as metaverse technology evolves, ethical issues will emerge. As much as we are cheering the era of the metaverse, we must also worry about the ethical implications it poses.

A user wearing an augmented reality (AR) headset immersed in virtual driving experience. Cars equipped with AR headsets will allow drivers to operate by swiping on virtual screen rather than pressing physical buttons. (Photo by Tima Miroshnichenko/Pexels)

ETHICAL ISSUES IN THE METAVERSE

The metaverse poses myriad issues for users. First, the metaverse challenges individual identity. The being in the metaverse is a digital avatar representing a real person. A person with such dual identities can travel between the real and virtual worlds ruled by different laws and regulations. The issue is how to hold users accountable if their digital avatars commit a virtual crime. Though guidelines and frameworks could be formed in the metaverse, digital avatars do not have real feelings or autonomy and that would lead to a regulatory failure. Users behind the digital avatars have to be held accountable for their virtual crimes, so there is a problem of shifting between regulation mechanisms in the two worlds. Second, the metaverse could make people struggle to live in both worlds. The immersive virtual world enables users to satisfy emotional needs that they cannot in the real world, and the overstimulation may cause psychological issues and online addiction. After experiencing an amazingly immersive world, coming back to the real world could leave people lost and depressed. Third, the metaverse will lead to alienation. The initial tendency would be to feel sorry for mistakes and crimes committed in the virtual world, but the more incredible the immersive experiences become, the more people will detach from reality and the less they will feel morally guilty about their wrongdoings. This double alienation may give birth to a weaker sense of responsibility and autonomy.

The metaverse magnifies tensions between science and society. First, the metaverse may lead to technological hegemony because whoever masters the technology will dominate the construction of the virtual space. The rules of the new ecosystem will be made by the first movers, and companies leading in metaverse technology are likely to dominate the industry. This technological hegemony will in turn influence the discourse of individuals, social organizations, and even governments. Second, the metaverse will disturb social balance. Real lives will be reshaped by the metaverse horizontally and vertically, which will inevitably require the readjustment of social structures to adapt to the development of the metaverse. However, considering the challenges of alienation and technological hegemony, we have reason to believe that the metaverse will disrupt the balance of social structure.

Some mysteries concerning metaverse technology remain unresolved. First, metaverse technology is beyond human comprehension. The virtual world seems to have been created by humans under certain rules, but how technology itself realizes human intentions has always been a mystery. The more a technology influences people in depth and breadth, the harder it is for people to understand it, and the biggest challenge is whether the technology remains under the control of humans. Second, the metaverse confuses interpersonal relationships. If the metaverse

is meant to provide a different experience from the real world, is it necessary for people to take risks when entering the uncharted realm? If the metaverse only replicates reality, is it still such an indispensable experience? If the metaverse is meant to create experiences unavailable in real life, they are likely to be unhealthy or risky.

Visitors watch a performance by robots at the Intelligent Industry & Information Technology exhibition area of the fifth China International Import Expo, which was held in Shanghai from November 5 to 10, 2022. (Photo by Xu Xun/*China Pictorial*)

GUIDE METAVERSE TECHNOLOGY TO SERVE HUMANITY

Despite such implications, the development of metaverse technology should continue in earnest. In fact, ethical concerns about the metaverse come in the wake of cheers for the new technology because it is clear that the metaverse can deliver tangible benefits. Individually, digital identity and immersive experiences help people transcend the limitations of body and space and liberate them in a broader sense. Socially, the metaverse helps create equal dialogue and social structure for human equality and social cooperation. Technologically, metaverse integration can enhance creativity by engaging people in the creation of the virtual and real worlds. Well-guided metaverse technology should serve human life better. In this sense, the metaverse refers not only to a technology, but also to an ideological concept.

We should build metaverse ideals around an improved ethical value system tuned to metaverse technology. The metaverse offers a kind of immersive experience that is direct and embodied. It achieves direct multipoint-to-multipoint connections between strangers thousands of miles away and liberates people from physical limitations to a great extent. The metaverse can deliver users digital senses and even let them feel other people's feelings, thus enriching life experience. A decentralized metaverse would provide greater autonomy, convenience, and openness. Everyone is a content creator in the metaverse. They can enter the virtual world anytime, create what they want and need, and enjoy a personalized immersive experience. Human beings are the bridge between the virtual and the real, and we should redefine ethical values for human beings. People in the real world are responsible for the behavior of their digital identities. In this sense, people in reality are the only subjects of responsibility. In and between the two worlds, we should design justice procedures based on the subject of responsibilities and form ideas about public good in the ultimate sense so that the subjects of responsibilities share a common future.

The metaverse has not yet fully welcomed people into a virtual realm, but it remains the gateway to a new era. "The most important thing in life is to stop saying 'I wish' and start saying 'I will'," wrote Charles Dickens in *David Copperfield*. "Consider nothing impossible, then treat possibilities as probabilities."

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From Vedas to Metaverse

By **Mohammad Ibrar**

From kindergarten to post-doc research, everything will change. The benefits of the metaverse could be unlimited.

One of the major participants of the January 2022 Republic Day parade in New Delhi was the Indian Ministry of Education. Their presentation sought to connect the past to the future by tracing India's history in education. The past was characterized by religious texts of the *Vedas*, believed to date back to circa 1500-1200 B.C., and the future was envisioned through the metaverse, echoing Mark Zuckerberg calling it the future of the internet. "From the *Vedas* to the metaverse, the Indian education system is bridging the past with the present and creating a new future embracing technology," wrote Dr. Subhas Sarkar, India's Union Minister of State for Education, in a tweet.

This transition from old to new is particularly visible in China and India, two countries with the oldest continuous civilizations. Both countries are navigating a period in which educational focus is digitalizing and modernizing. This is particularly true in the wake of the COVID-19 pandemic, which pressured the replacement of traditional classroom teaching with digital and online modes. This prompted some schools to seek technological advances in digital education. Some universities in several countries began conducting teaching and exams entirely online after necessary technologies and mechanisms emerged. In the metaverse, a network of 3D virtual worlds in which avatars representing real people could interact, could exert a massive impact on education. Indian ed-tech companies are already seeing exponential growth with no ceiling in sight. They believe that online video classes could be replaced by an augmented reality (AR) setup in which students and teachers could interact.

Growth is already visible. Nankai University in Tianjin, China announced a metaverse model for its School of Journalism and Communications in October 2022, which allows student avatars to navigate the virtual space. Similarly, in September 2022, Nanjing University of Information Science and Technology announced that it was changing the name of its Department of Information Science under the School of Artificial Intelligence to the Department of Metaverse Engineering.

Around the same time in 2022, in Chennai, India, the state school education department collaborated with a start-up to launch the Meta Kalvi program. Under this program, virtual reality (VR) laboratories have been set up in two city corporation schools and three government schools in Triplicane, Chennai. Focus is to enhance the learning experience by providing VR headsets with six inbuilt modules of science and math that offer visualization of

theoretical concepts to learn more quickly. In August 2022, Delhi Chief Minister Arvind Kejriwal launched the Delhi Model Virtual School (DMVS) and dubbed it the "country's first virtual school" harnessing AI and the metaverse.

In Bangalore, a "university" based on the metaverse called Invact Metaversity was set up to "revolutionize education." Tanay Pratap, founder of the initiative, said the metaverse's potential in education is high. He claimed that many professionals were signing up to participate in the venture.

Ben Harrison, CEO of the web design agency WebOptic, is eyeing the proliferation of Web 3.0. He also predicts that the metaverse will highly impact the education sector. "From kindergarten to post-doc research, everything will change, and the benefits will be unlimited," he said. "Educators can use data from students to find their hidden talents and push them toward a career path in which they can perform their best and provide the maximum to society." As an employer, he believes that in the metaverse era, fewer people will do irrelevant jobs due to poor self-assessment. "More people will be able to do what they love and earn a livelihood from it. Imagine a class with all students who wish to learn a specific subject, and it is taught by a professor of their choice. The outcomes will be exceptional."

Delhi, Ramgopal Rao, former director of the Indian Institute of Technology, also has high hopes for the metaverse. Rao commented that many in developing countries do not think highly of digital teaching and consider it inferior. He believes that the metaverse will enhance the experience to make online learning more like studying in a physical classroom. "In a country like India where the gross enrolment ratio is low compared to countries like China, there is even more potential for digital education," Rao said. "This is why the metaverse is critical for India, where there is a huge supply-demand gap. This is the way forward for India and any other developing country where education is important for growth."

According to researchers at the 29th ACM International Conference on Multimedia, in China and some countries, investment has already been attracted to develop the infrastructure to integrate the metaverse with education, so the potential is clear. Another study found that to make the metaverse a reality, most traditional teachers would need heavy training to properly use education technology. Research has proved that students learn considerably better through VR games, with their learning and educational satisfaction improved.

However, some are looking at the growth of the metaverse in education more cautiously. Chief analyst and CEO Sanchit Vir Gogia of Greyhound Research, an IT research and advisory firm, said that the idea of the metaverse is still evolving. VR and AR have been in existence for a long time and have been used in education, he noted, adding that metaverse's future relies on "user acceptance." Gogia opined that the initial success of the metaverse "will have to be in a hybrid fashion with its presence in classrooms to make content more interactive." He admitted that acceptance is widening because the pandemic taught so much about online education. He said that the impact of the metaverse "is not very huge but will be in a few years." "I am cautiously optimistic and believe that on-the-ground education needs more tangible changes," he declared. "Not everyone will get a degree entirely through the metaverse. You cannot replace traditional teaching."

Research has found that compared to traditional teaching methods, virtual reality provides learners with richer training content than ordinary pictures, text, audio, and video materials at a lower cost.
(Photo by Dong Fang/*China Pictorial*)

The author is an Indian freelance journalist and analyst currently based in the UK. He is an alumnus of SOAS University of London where he majored in South Asian Area Studies.

Sanxingdui Fantasy Journey: A Cultural Heritage Metaverse

By **Ding Gangyi and Pu Xuan**

The Sanxingdui Fantasy Journey offers an immersive experience in a high-precision 3D digital space. By overcoming challenges in computing, networking, and human interfacing, the project has achieved a major breakthrough in bringing the metaverse closer to users.

The metaverse project Sanxingdui Fantasy Journey has created a large-scale immersive and interactive digital space based on many exclusive and core archaeological excavations and digital resources. The project was developed by China Media Group in collaboration with the Sichuan Provincial Cultural Relics and Archeology Research Institute, the Sanxingdui Ruins archaeological excavation team, Sanxingdui Museum, Peking University, Sichuan University, Shanghai University, and Beijing Institute of Technology, among others. The digital space consists of three parts: the ancient Shu Kingdom representing "the past," the Sanxingdui archaeological excavation shed, "the present," and the Sanxingdui Digital Museum, "the future." After answering a few questions at the interactive surface, viewers can enter the space and watch live TV shows simultaneously with other netizens. There, they can also enjoy an immersive experience exploring the archaeological sites of the mysterious ancient Shu civilization, which facilitates an intimate look at the amazing cultural relics.

Using large-scale real-time cloud rendering technology for the first time, the project shifts graphic computing power and storage demand for large-scale immersive experience on the cloud so that all the images viewers see and interact with are rendered by real-time cloud calculation and delivered through real-time audio and video communication technologies. The result is easy access to immersive

and interactive experiences without the need of expensive hardware. To build the digital space, multiple technologies were used to create digital identities, virtual interactions, and digital assets, which paved the way for further exploration of combining the virtual and the real, generating content, and creating immersive TV programs. The project has also laid the foundation for intelligent media to upgrade traditional TV shows into integrated media content via both TV screens and mobile devices with AI-driven and real-time communication technologies.

MAKING THE METAVERSE REAL

Although core metaverse technologies related to real-time content generation, complex interactions, and cognitive drive are booming, a challenge remains to realize the interactions between the metaverse and its users.

The dilemma in the construction and promotion of a metaverse lies in whether to use 2D modeling, which is based on web technology, or 3D modeling. The former option sets a lower entry threshold to a lightweight system and mature applications fostering group intelligence, but it doesn't meet the demand for information at higher dimensions as is found in the physical world, which makes it difficult to drive future development. A high-precision 3D model would be a solution, but rather than lightweight mobile devices, it requires expensive hardware to support the high-quality images. This is a major barrier to make the metaverse accessible to common users.

To overcome this barrier, the Sanxingdui Fantasy Journey project made an important attempt with large-scale real-time cloud rendering technology, which is also a breakthrough for metaverse games.

BEYOND TV SCREENS

When watching a special live show called New Findings of Sanxingdui, viewers can enter a large-scale immersive and interactive digital space by answering a few questions on their devices. The multiple choice questions, received after scanning a QR code, were written by team members who worked on archaeological excavation at Sanxingdui for many years. After the quiz, the Sanxingdui Fantasy Journey experience starts.

The digital space was created based on high-precision modeling of a 30-square-kilometer excavation site with 300 pieces of unearthed cultural relics displayed with holographic images. It was the first time that viewers in front of TV sets became visible in the digital space and also the first time that simultaneous live broadcasting was carried out in a digital space, transforming the live broadcast into an interactive and open world. Utilizing large-scale real-time cloud rendering technology, the digital space upgraded from traditional linear video content to two-way interactive content and enabled each netizen to have a different experience—a great leap toward the era of more interactive content.

Major scenes that constitute the digital space of the metaverse project Sanxingdui Fantasy Journey.

The Sanxingdui Fantasy Journey project has built a high-precision model of 3D digital space and realized computing, networking, and human interaction for the metaverse. In accordance with the physical existence of Sanxingdui, various key technologies and cultural elements have been incorporated to create the digital space, a virtual world connecting the past, present, and future. A real-time interactive virtual space parallel to the real world, the Sanxingdui Fantasy Journey continues to evolve, meeting all visual, auditory, tactile, and cognitive needs.

Co-author Ding Gangyi is a professor of Beijing Institute of Technology and director of the Beijing Key Laboratory of Digital Performance and Simulation Technology. Co-author Pu Xuan is an editor and director with China Media Group.

Metaverse in Traditional Classrooms

By **Prathap Sekar**

The metaverse opens the door to a world of new experiences for self-motivated students, empowering them to learn anything from anywhere.

Imagine learning astronomy under a canopy of stars, stepping into the heart of a volcano to study geology, or swimming through blood vessels to learn about human anatomy. These fun, interactive, and immersive learning experiences—previously only depicted in cartoons like *The Magic School Bus*—can now be delivered through the metaverse.

The metaverse is like a stage inviting users to create virtual worlds, play different characters, and experience different realities alongside others. It could revolutionize education by enabling teachers and students to co-create learning experiences, gamify lessons, and collaborate and compete with peers all over the world at the same time, in the same virtual space.

METAVERSE ENHANCES TEACHING & LEARNING

Research by Roskilde University in Denmark shows that learning through immersive virtual experiences improves students' engagement, understanding, and retention rates by 30 percent compared to conventional methods. Numerous factors influence how the metaverse can enhance teaching and learning:

Personalization. Each student learns in a unique way. Visual learners prefer books and diagrams while auditory learners enjoy lectures. Kinesthetic learners learn by doing, while some learn through teamwork. Today, all these unique learners are crammed into a single classroom and taught in the same way. Metaverse platforms offer a range of tools for educators, allowing them to deliver the same lesson in diverse ways to suit individual learner profiles. For example, when studying drama, virtual learners can read the script, auditory learners can listen to the dialogue, and kinesthetic and social learners can become a character in a virtual play produced on Broadway and act alongside professional actors.

Gamification. The difference between rote learning and self-motivated learning is that the student progresses from remembering and understanding information to critically

evaluating it and creating something new using it. In the metaverse, teachers can add game-like elements such as rewards, virtual characters, and group challenges to motivate students to progress through these levels at their own pace. The metaverse would enable teachers to utilize flipped classrooms where students master concepts and materials on their own and then come together to discuss and comment the content.

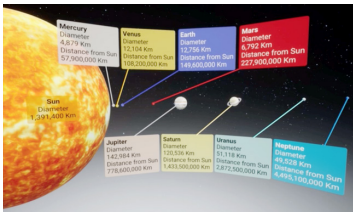
Breaking barriers. Children with learning difficulties or disabilities will be able to sit in the same virtual classroom. Imagine exploring a museum in the metaverse. The guide's description can be translated into sign language in real-time for hearing-impaired students. Mute students will be able to interact with peers through real-time sign-to-sound translation services.

Erasing borders. A student can be anywhere and study anything in the metaverse. During the COVID-19 pandemic, some universities created chemistry or biology lab simulations in the metaverse, empowering researchers from around the world to collaborate.

Increasing engagement in online learning. Multiple studies show that student performance declined when they switched to online learning during the COVID-19 pandemic because they had trouble concentrating on their coursework and felt less connected to their classmates and teachers. Now, most online courses are delivered using pre-recorded videos and notes. There is no real-time feedback on whether students are listening like in an in-person classroom.

The metaverse leverages extended reality (XR) to create immersive experiences using virtual reality (VR) or add an extra layer of information to the user's real-world surroundings using augmented reality (AR) or both (mixed reality). For example, when learning how to operate new equipment in a physics lab, each student will be able to try it for themselves through virtual simulation. Once they are done with the simulation and ready to try it in the real world, additional instructions about the next step can pop up as each progresses according to their individual pace. This enables students to actively participate in class instead of listening passively and provides teachers with real-time feedback on student engagement levels.

The metaverse is not an alternative to a good classroom. It is a tool that empowers well-trained teachers to deliver lessons that are more inclusive, engaging, and impactful.



An immersive solar system design project.
(Photo courtesy of Prathap Sekar)

Turning students into content creators. One project I worked on with my students involved creating a digital solar system (Figure 1). The sizes of planets and the distances between them we see in our textbook are not accurate. In this project, students used data from NASA to understand their true sizes, rotational speeds, and distances between them and created interactive 3D models of the planets and their moons. Students also learned 3D texturing to mimic the look and feel of each planet. Once created, the interactive exhibit was installed in the metaverse. Then they could invite friends to explore the solar system through a virtual space mission and learn through hands-on activities.

FROM INFANCY TO ADOLESCENCE

While the metaverse has the potential to revolutionize education, it remains in its infancy. Some have expressed

A metaverse classroom can offer an immersive experience with VR technology or overlay information onto users' view of the real world with AR technology. The combined use of these technologies in learning scenarios ensures better performance of students. (Photo by Julia Cameron/Pexels)

concerns that it could exacerbate the digital divide in education because the hardware and software tools needed to deliver immersive experiences are still very expensive. VR headsets available today are clunky and not very user-friendly. Only a small percentage of schools in India and China have VR labs, but the numbers are increasing.

Regulators are still grappling with preventing data theft, online abuse, and deepfakes in the metaverse. Many parents are also concerned about tech addiction and too much screen time that could affect children's physical and mental well-being.

Another major stumbling block for educators has been effectively integrating this technology into their classrooms to support learning both in the virtual world and the real world. I have seen several instances in different schools where the VR lab is only used for about 15 minutes each day to watch short videos bought from a third party. Basically, the VR lab serves as a fancy cinema. Teachers and students need better training on how to co-create their own content in the metaverse, personalize and gamify lessons, and create collaborative experiences.

The leap into the metaverse is not that huge for students who already spend time in virtual worlds such as those in games like Minecraft or Roblox. But it can be a bigger leap for teachers because it requires detailed lesson planning, with differentiated tasks to suit different learner profiles and competency levels.

According to Vantage Market Research's recent analysis, the metaverse in the education market was valued at nearly US$4.4 billion in 2021 and will grow to over US$32 billion by 2028. India, with a young population and booming ed-tech sector, and China, with heavy investment in virtual reality and hardware manufacturing prowess, will play key roles in shaping the future of this booming market.

Byju's, one of the world's biggest ed-tech companies based in the Indian tech hub of Bengaluru, is experimenting with gamified lessons. In China, the Nanjing University of Information Science & Technology now offers degrees in metaverse engineering, and Nankai University in Tianjin launched a metaverse school of journalism and communication.

The metaverse is not an alternative to a good classroom. It is a tool that empowers well-trained teachers to deliver lessons that are more inclusive, engaging, and impactful. It opens the door to a world of new experiences for self-motivated students, empowering them to learn anything from anywhere.

The author is an Oscar-winning 3D design and visual effects artist who has worked on films including *Gravity*. He is currently working as a design teacher and technology integration specialist in Shenzhen, Guangdong Province.

High-Tech Opportunities for Education and Training

By **Zhou Sheng**
Photos courtesy of **NIIT**

Training solutions based on VR, AR, and other metaverse-related technologies including gamified teaching programs will provide greater opportunities for talent development in various industries.

Immersive technologies are rapidly changing the way people work and play. New digital devices such as iPhone X have been released to facilitate technologies such as virtual reality (VR) and augmented reality (AR) on handheld devices and headsets. As these technologies gain popularity, more immersive experiences are expected to emerge. The education sector has already recognized the enormous potential of immersive technologies in teaching.

Research has shown that scenario-based VR training provides learners richer, lower-cost content than text, pictures, audio, and video materials in face-to-face training. It also influences learners' behavior more effectively than training in traditional classrooms or other digital forms. The biggest highlight of VR training is that it empowers learners with an immersive experience free from potential safety risks in real-life scenarios.

Unlike VR technology that creates immersive environments through computers, AR technology overlays information such as computer-generated images onto the user's view of the real world. AR training solutions need no human actions to provide context and relevant information at action points during instructional training. For example, warehouse workers and equipment maintenance personnel can be provided the necessary information to improve work efficiency, streamline communication, interact with customers, and optimize maintenance.

As hardware becomes more affordable and creative tools, mature, immersive technologies combining VR and AR have generated one of the most valuable methods of online learning. In the vocational training market, companies are showing a stronger interest and willingness than individual learners to explore and adopt immersive technologies and offer employees a highly simulated learning experience with ample opportunities for practice.

① A screenshot of a gamified training on business ethics and legal compliance.
② A screenshot of a VR game on safety in underground mining scenarios.
③ A screenshot of the VR game that simulates a house inspection.
④ The interface of an application that simulates electrical testing in real-life scenarios.
⑤ The interface of a data analysis course in the form of a metaverse learning community.

In many cases, virtual activities enabled by immersive technologies can replace costly real-life learning activities that require learners to gather in a certain spot with necessary equipment, technology, and safety experts. Such training usually demands on-site courses in specially designed venues. For example, an insurance adjuster learns to inspect vehicle damage in a full-size model room, and an engineer learns to handle emergencies such as a transmission accident or power failure using a generator that has been retired or dedicated to training.

Digital training based on immersive technologies can help learners grasp a variety of skills that in the past could only be honed in a real-life working environment. The ability of AR and VR technologies to reduce training costs by stimulating realistic scenarios and removing the need for physical equipment or massive personnel movement has made it a strategic focus for many companies. This is especially true in the post-COVID world in which business travel and face-to-face training have become more challenging.

As one of the world's largest information technology training and talent development companies,

the National Institute of Information Technology (NIIT) in India has developed learning and teaching products in collaboration with many partners and gained extensive experience applying gamification, VR, and AR technologies in training. Here are a few examples:

Gamification has been applied in a leadership training program for corporate executives. The program was designed for a global energy and petrochemical group hoping to retool its existing training on business ethics and legal compliance. It was designed for senior executives of subsidiary companies and focused on complex real-life and everyday issues related to business ethics and legal compliance. In response to these needs, NIIT created a real-time 3D game to provide experiential learning content. Following a learning-by-doing approach, the training course aims to motivate executives to break through the slow pace of traditional courses and think quickly to foster business development.

A training program was created through a VR game to simulate safety drills in underground mining scenarios. The game adopted a first-person perspective to be deployed through HTC Vive headsets. It empowers learners to navigate complex mines to mark and fix safety problems as they move forward in the game. If learners fail to solve emerging problems quickly, they will "experience" the consequences of serious disasters such as personnel injuries, mine collapses, and massive hypoxia and asphyxia. In addition to making the game more engaging, these experiences have an important role in teaching: By triggering emotional responses in learners, the experiences result in more accurate retention of memories associated with the emotional reactions, which in turn ensure that better learning results transfer to work in the real world. This training solution is usually deployed at the client company's safety production drill laboratory outside its mining site.

A VR training game was created for home inspections in the real estate industry. Simulating real-life scenarios, the game also adopted a first-person perspective to be deployed through HTC Vive devices. The game helps new employees in the real estate industry learn how to inspect homes, identify possible defects that might affect the price, determine the cost impact of each defect, and observe the long-term impact of their decisions on negotiations with clients. Contrasting previous training programs that have had little success helping learners understand the consequence of a poor home inspection, this training solution has been more efficient by providing more timely and effective feedback.

A training application for electrical testing was designed for a manufacturing company. The mobile-based application helps electrical engineers in a global manufacturing company perform several basic tests in electrical operations and obtain relevant industry certifications.

A Python data analysis course has been developed combining a traditional online classroom and a metaverse learning community. NIIT China conducts many digital talent training sessions every year. The data analysis course launched by its subsidiary StackRoute in 2022 has adopted the form of a metaverse learning community in which students can create their own digital images and interact with the instructor and classmates in the metaverse for a better immersive learning experience.

According to a research published by Pricewaterhouse-Coopers, compared to classroom learners, VR-trained learners were 3.75 times more emotionally connected to the content, completed training an average of four times faster than classroom training, and were up to 275 percent more confident to act on what they learned after training.

A strong consensus has emerged that training solutions based on VR, AR, and other metaverse-related technologies such as gamified teaching programs have the potential to exponentially increase the opportunities for talent development in various industries.

The author is head of business development of corporate learning at NIIT China.

Into the Metaverse

Edited by **Bian Xiuhong**
Designed by **Liu Peiyao**

What is the metaverse? It is a gaming platform, a virtual retail destination, a training tool, an advertising channel, a digital classroom, and a new gateway to digital experiences. The metaverse seeks to be whatever your imagination makes it. Beyond the hype, the metaverse is real and potentially revolutionary, and has the makings of a significant opportunity.

The History of the Metaverse

1978 — MUD1, the first multiplayer real-time virtual world

1982 — *Tron*, one of the first movies to imagine a digital reality

1984 — *Neuromancer*, a novel popularizing the term "cyberspace" that imagined billions of "cyber-users"

1992 — Neal Stephenson coined the term "metaverse" in his 1992 sci-fi novel *Snow Crash*, which envisioned a virtual reality-based successor to the internet

1999 — *The Matrix*, a movie imagining humanity inside a virtual world

2003 — Second Life, the first platform allowing users to "live" in a virtual world, surpassing one million monthly active users in 2007

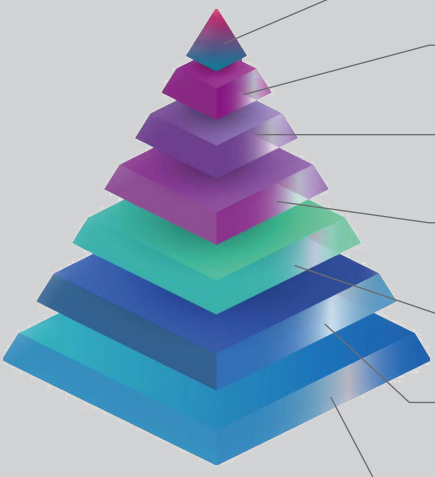
2006 — Roblox, a multiplayer game platform that surpassed 55 million daily active users in February 2022

2018 — *Ready Player One*, a film imagining a full-fledged virtual world called "the Oasis," based on a book from 2011

2021 — Facebook became Meta, aiming at a metaverse ecosystem; investments of more than US$10 billion in 2021

Future metaverse to come with more and more developments happening daily

Seven Layers of the Metaverse



Experience	Games, Social Networking, Esports, Theater, Shopping
Discovery	Ad Networks, Social Curation, Ratings, Stores, Agents
Creator Economy	Design Tools, Asset Markets, Workflow, Commerce
Spatial Computing	3D Engines, VR/AR/XR, Multitasking UI, Geospatial Mapping
Decentralization	Edge Computing, AI Agents. Microservices, Blockchain
Human Interface	Mobile, Smart Glasses, Wearables, Haptic, Gestures, Voice, Neural
Infrastructure	5G, Wi-Fi 6, 6G, Cloud, 7nm to 1.4nm, MEMS, GPUs, New Materials

Value Creation in the Metaverse

Money Generated by the Metaverse across Consumer and Enterprise Use Cases (estimate)

Relative Potential of Consumer and Enterprise Use Cases in 2030

Low | Medium | High

Consumer use cases

- Virtual assets
- Digital media
- VR/AR hardware
- Health and fitness
- Education
- Ads
- Gaming
- Live entertainment
- E-commerce

Enterprise use cases

- Construction
- Local government
- Education
- Central government
- Investment
- Utilities
- Consumer services
- Resource industries
- Insurance
- Healthcare provider
- Transportation
- Wholesale
- Professional services
- Telecommunications
- Media
- Process manufacturing
- Retail
- Banking
- Discrete manufacturing

Top 10 Corporate Capabilities Needed to Deliver Metaverse Strategy Considered by Senior Executives

Business (model) building	Legal, risk, and compliance
Product development/coding	Cybersecurity
Infrastructure/back-end engineering	Analytics
Blockchain/commerce/payments	Content creation
Product design	Marketing/go to market

n = 448 *Source: McKinsey & Company Senior Executive Survey*

Top 10 Metaverse Technologies Considered by Senior Executives

Cryptocurrency	Virtual worlds (spatial computing)
Artificial intelligence	Cloud computing
AR/VR (new interfaces)	NFTs
Web 3.0	Creator economy
Blockchain	Edge computing

n = 448 *Source: McKinsey & Company Senior Executive Survey*

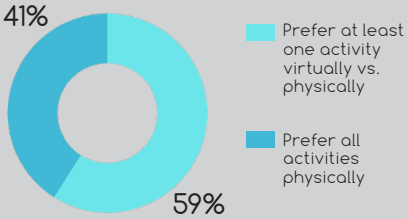
Metaverse Features or Capabilities Implemented in Industries as of April 2022 (% of senior executives in each industry)

Adoption level: High (>70%) Medium (40-70%) Low (<40%)

Industry	Marketing campaign or initiatives	Learning and development for employees	Meetings in the metaverse	Events or conferences	Product design or digital twinning	Recruiting or onboarding new employees	Customers can pay with crypto currency
Technology	68	64	54	64	54	39	23
Media and telecommunications	82	36	36	43	54	18	25
Advanced industries	64	55	36	64	64	36	9
Financial sector and insurance	67	63	56	49	56	25	31
Consumer, AF&L (Apparel, footwear, and luxury), and retail	95	56	59	41	50	41	14
Energy and materials	54	85	69	46	69	31	8
Healthcare and public sector	10	59	79	72	59	38	34
Tourism, transport, and logistics	56	78	56	78	56	44	22

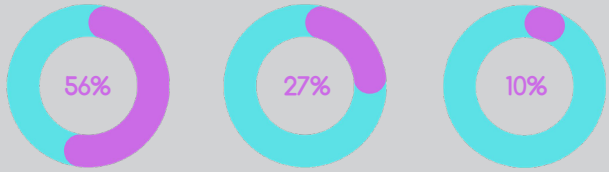
n = 258 *Source: McKinsey & Company Senior Executive Survey*

Preference for at Least One Activity in an Immersive Virtual World Compared to Physical Alternative (% of respondents)



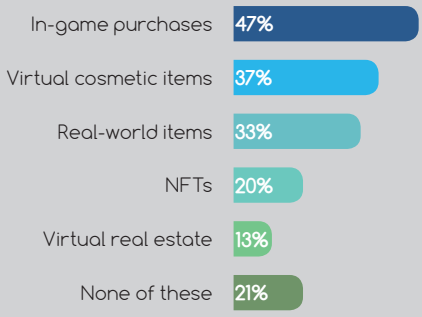
n = 2,939
Source: Intelli Metaverse Consumer Survey in Europe, the Middle East, and Asia (EMEA) and Asia–Pacific (APAC)

Top 3 Reasons for Purchases in the Metaverse (% of respondents)



n = 1,543 *Source: Intelli Metaverse Consumer Survey in Europe, the Middle East, and Asia (EMEA) and Asia–Pacific (APAC)*

Purchases Made by Consumers in the Metaverse (% of respondents)

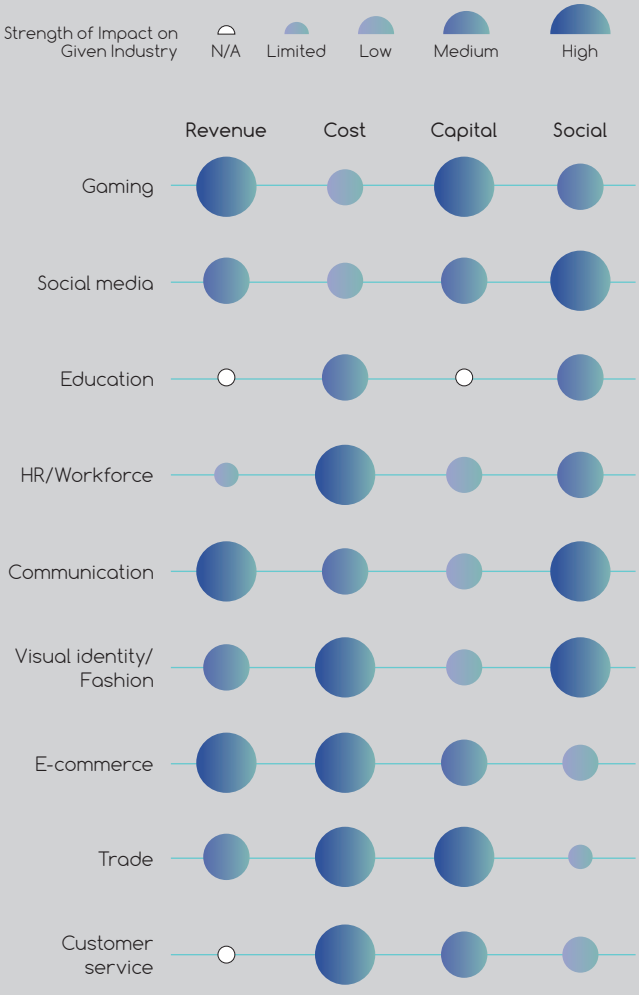


n = 2,093 *Source: Intelli Metaverse Consumer Survey in Europe, the Middle East, and Asia (EMEA) and Asia–Pacific (APAC)*

Top 5 Activities Most Preferred in an Immersive Virtual World Compared to Traditional Alternatives (% of respondents)

n = 1,210 *Source: Intelli Metaverse Consumer Survey in Europe, the Middle East, and Asia (EMEA) and Asia–Pacific (APAC)*

Value Proposition of the Metaverse in Industries



Drivers of Excitement for Consumers Who Prefer Immersive Virtual Experience over Similar Activities in the Physical World (% of respondents)

n = 1,210
Source: Intelli Metaverse Consumer Survey in Europe, the Middle East, and Asia (EMEA) and Asia–Pacific (APAC)

Sources: Value Creation in the Metaverse: The Real Business of the Virtual World by McKinsey & Company, and The State of the Metaverse in 2022: Building an Open World by Nextrope

How the Metaverse Reshapes Young People's Social Life

Concept by ***China-India Dialogue***

Gen Z and the Metaverse

Siddhi Kabra

Occupation: Research & investment analyst
Birth place: Hyderabad, India
Current residence: Bangalore, India

"Metaverse" is a loose term that refers to virtual worlds where people have avatars that interact to play games, work, build things, and watch performances. With huge hype around the metaverse after Facebook rebranded itself as Meta and announced a shift in focus to virtual worlds, and with Nike and Adidas among the corporate giants preparing projects for the metaverse, the opinion of Gen Z that will shape the metaverse is of prime importance.

Gen Z has been raised on social media, with the whole world constantly at their fingertips. Is Gen Z really going to be the population that drives significant early adoption of the metaverse? An online study conducted in the United States in June 2022 found that Gen Z respondents had heard more about the metaverse than any other generation. What kind of experience does Gen Z, fluent in virtual language, expect from the metaverse? According to research by Nokia, the metaverse is an extension of the world in which Gen Z lives. Gen Z gamers spend twice as much time hanging out with friends in the metaverse as they do in real life. Some even view the time they spend in the metaverse as an actual part of their daily reality. Furthermore, Gen Z makes up approximately 60 percent of users in the metaverse. As a matter of fact, Gen Z already lives in the metaverse. However, for some young people, this may translate to the metaverse becoming a magnifier of a digital world they already know. It may lead to a metaverse world filled with disinformation campaigns, addictive behavior, and tendencies towards violence. Whether the metaverse is simply an extension of the current world we live in or a transformative experience remains up for debate.

The metaverse accelerates socialization in a world where

shared interests already exist. Whether it's connecting with a cycling team trekking across Africa or connecting with swimmers from Croatia, Gen Zers use their current interests to relay friendships and connections. Since the COVID-19 pandemic, however, this generation has shifted its attitudes about physical interactions for the positive. Meeting and greeting people face to face has become more meaningful. So, the key question is: Can the metaverse duplicate human experience?

The metaverse is a floor for experimentation on becoming whom Gen Zers cannot be in real life. It is a space for growing and learning. In a Razorfish study, 45 percent of Gen Z gamers said that they felt more like themselves when playing in the metaverse than in real life. And 40 percent attributed gaming and metaverse tech to a positive impact on their self-confidence. Investors and big companies are betting that Gen Z will flock to the metaverse.

Are they too optimistic? What factors are hampering Gen Z's engagement with the metaverse? Most young people use these digital experiences only part-time, and this factor is unlikely to change. Accessibility remains a major issue. To paraphrase Microsoft co-founder Bill Gates, most people, especially in a generation that identifies itself with its uniqueness, do not have the specific technologies and devices (such as VR goggles and motion capture gloves) that accurately reflect their expressions, body language, and the quality of their voice. According to Nokia research, development of improved extended reality (XR) devices, especially those at a lower price point, will drive the future of the metaverse. It would require an entire supply chain, mega scans of the real-world environment, and 3D human-like avatars for the metaverse to reach maximum accessibility and acceptance. Gen Z will make up 27 percent of the workforce by 2025. By then, a significant convergence between 5G and edge computing solutions will likely normalize more sophisticated, lightweight, and stylish wearables. We can expect the shift to the metaverse for Gen Z to be gradual.

However, some Gen Zers are even unsure of what the metaverse means. They don't fully understand what the metaverse is or how it works. The confusion is natural considering that it remains unclear what the metaverse will look like. The internet was largely developed by public institutions, labs, and independent academics to share research and communicate with other professionals from around the world. Its commercial potential was an afterthought. This is not the case with the metaverse, which is being developed independent of government oversight by big tech companies with commercial intentions at their core. Over the next few decades, the metaverse will slowly, continuously emerge and inevitably take on many different forms along the way.

It is difficult to foresee what the metaverse of tomorrow will look like today. The metaverse is a distant and enormous challenge and only the most digitally savvy can appreciate its potential for the future. At least we can be sure that Gen Z will shape the possibilities of the metaverse and that their outlook is here to stay.

Can the Metaverse Pave a Way Forward for China-India Exchange?

Zhang Yifan

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The term "Meta" originates from the Greek word for "beyond." U.S. social media giant Facebook was rebranded as Meta in October 2021, reflecting its ambition to build a metaverse platform. Quickly, the metaverse became a hot

topic. It seemed that many things in the metaverse discourse system would be redefined, although it remains unknown whether such limelight represents a future trend.

In China, metaverse-related industries and markets are growing. And the country's tech giants definitely won't miss this great opportunity to foster industrial changes. Tecent, Alibaba, ByteDance, and other Chinese high-tech companies are making big efforts to improve the production capacity of the metaverse in the race with their U.S. counterparts in Silicon Valley.

With its advantages in network infrastructure and vast market size, China's metaverse development prospects are particularly promising. According to a survey conducted by online news portal Decrypt, more than 7,000 new trademarks containing the word "metaverse" were filed, and more than 1,000 companies registered trademarks related to the metaverse in China from the end of 2021 to the middle of 2022.

As one of the countries investing the most in metaverse construction, India has also emerged as a dazzling star in the metaverse race. Since 2020, India's annual investment in augmented reality (AR) and virtual reality (VR) has increased by an unprecedented rate of 38 percent, and its total investment in metaverse-related industries has reached hundreds of billions of rupees. Telecom company Jio, a subsidiary of India's diversified conglomerate Reliance Industries, has become a leading force in metaverse development in India, with strong momentum in smart classrooms, blockchain, and other related fields.

The concept of the metaverse is also exerting strong influence on social exchange and living styles of the youth in both China and India.

The social exchange mode of the metaverse creates many multi-dimensional and inter-embedded digital communities. Diversified presentations are enriching the immersive and interactive experience of social exchange in the metaverse, forming a digital world parallel to the physical world.

And the COVID-19 pandemic helped normalize online communication between people worldwide. The surge in netizen population and their average internet usage duration has pushed the metaverse into a popular trend because traditional social media platforms are increasingly unable to meet people's strong desire for learning new things.

The multi-dimensional online social exchange of young people of China and India is mostly seen on social media platforms such as Facebook, Twitter, WeChat, and Sina Weibo. The irregular structure of the internet is mirrored in the usage of social media. Schools, families, communities, and other circles are the basis for the explosive increase of social media users.

Although the youth of China and India tend to be heavy social media users, their exchanges on social media remain far from the standards of the metaverse. The shortcomings of today's internet have left unimpeded channels of virtual social interaction between the two countries a hope for the future.

David Baszuki, founder and CEO of Roblox, a world-renowned online game platform, suggested that the eight basic characteristics of metaverse-based social exchange are identity, friending, low latency, immersion, diversity, ubiquity, low cost, and civility.

Currently, metaverse development can't meet the growing needs of the internet users of China and India. Many things need to be improved to build multi-dimensional social media scenarios, including clarity of concepts, hardware, technology, functionality of existing metaverse products, and user experience.

The concept of the metaverse is exciting, but the traditional social exchange model connecting Chinese and Indian young people still needs to be continuously promoted. In multi-dimensional social exchange—not only in the metaverse but also in the real world, positive energy generated by interaction involving eyes, words, and opinions may still be greater than social practice based on virtual space.

We hope that young people from both countries will make great efforts to create their own unique cultures on domestic and international real and virtual platforms and harness Asian commonality based on history and cultural genes to pave a path forward for in-depth social exchange between China and India.

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Indian Folktales in Chinese

By **Shikha Pandey**

Language learning demands a connection with the local culture and customs, which is also the core of intercultural communication in foreign language education. Indian folktales could help expand the horizons of learning Chinese in India.

My journey to China was never planned when I first jumped on a plane in 2013 to discover my potential. Moreover, doing my master's degree in the Chinese language and then taking up the teaching profession in India was never a career choice I had considered even after completing my bachelor's degree in computer science in Mumbai. More than five years have passed since I embarked on my journey to teach the Chinese language in India, and I have seen many ups and downs since.

My experience teaching Chinese to Indians has always been a learning process, and I have realized that teaching Chinese is more complicated than learning Chinese for any local teacher. One of the biggest challenges local Chinese teachers face in India is the need for teaching materials tailored to the learners to make learning more fun and interactive. The teaching materials used in Indian universities are usually from China, but most are outdated. The teaching content also lacks a focus on intercultural communication that meets the language teaching requirements in India.

I was always keen to contribute in this area and work on Chinese language materials that meet both teachers' and learners' requirements. It gave rise to the idea of working on translating the folktales of Akbar and Birbal into the Chinese language in 2020 as the entire world paused due to the COVID-19 pandemic and people changed their work and study modes from offline to online. As part of the three-year B.A. in Chinese Studies program, every student had to do internship work in the last semester. Since the entire world was under lockdown at that time, students had no internship options from any local or Chinese firm in Mumbai. Therefore, we decided to do something that would not require stepping out of homes but could fulfill the academic requirement for graduation.

That is how I got an opportunity to work on Chinese learning materials tailored to India. My idea was to produce materials to help Chinese language learners in India connect with the language smoothly and generate interest in learning by reading childhood folktales in Chinese. I have always believed that language learning demands a connection with the local culture and customs, which is also the core of

intercultural communication in foreign language education. Without any link with the native cultural context, language learners often find it challenging to connect with the language. Especially for speakers of Indo-European languages, learning Mandarin Chinese from the Sino-Tibetan language system demands more time and practice. European languages like English, German, and French are much easier for Indians to learn.

Since the folktales of Akbar and Birbal contain many short stories, our initial task was to select the 10 stories most popular among Indians. That is how we compiled our final list of stories, which kick-started our work. Two of the third-year students of our B.A. in Chinese Studies program joined this translation project for their internship. Along with Professor Shang Quanyu from South China Normal University in Guangdong Province, I was responsible for proofreading and editing as well as the book template and design.

We sought a picture book, so illustrations posed another challenge alongside translation. The illustrations are the main attraction of any picture book and convey the ideas behind the text. Our students found a professional illustrator who did a brilliant job. The work started in late 2020 and was completed by April 2022. It took more than a year to produce the 56-page picture storybook of Akbar and Birbal in Chinese.

At first, the work was not as easy as we had thought it would be. After every story was translated, I looked it over carefully and forwarded it to Professor Shang, who was then in Europe, to check it again. He helped our students work on quality translation and enhance their language skills. It became more than just a storybook with text and pictures. Every story has a list of vocabulary and exercises at the end. I was also keen to release the book in China so that university students as well as school kids across China can learn about Indian folktales and have a better medium to get in touch with Indian culture and society.

Moreover, the folktales of Akbar and Birbal come with universal moral lessons for everyone regardless of nationality and community. One of our goals has always been to strengthen academic exchange and communication between India and China and help students from both sides acquire positive exposure to our culture and society. Healthy communication would benefit the youth of both India and China in this era of globalization and technology, and it will help them create a better world for themselves and future generations through peace, love, and mutual respect for one another. I hope this book will play a vital role in generating mutual interest in learning the Chinese language among Indians and understanding Indian culture and society among the Chinese.

Students of the B.A. in Chinese Studies program have a group study session on the campus of the University of Mumbai. (Photo courtesy of the author)

The author has been working as visiting faculty in the B.A. in Chinese Studies program and the Confucius Institute at the University of Mumbai since obtaining her master's degree from Tianjin Normal University in China in 2017. She was also an assistant professor at the University of Mumbai before her Ph.D. studies at Beijing Language and Culture University started in 2020.

Prospects of China-India Film Cooperation

By **Xu Hui**

If the two countries can take advantage of these favorable conditions for long-term development, it will inspire confidence in investors, industry insiders, and viewers about the bright future of China-India film cooperation.

The 12th Beijing International Film Festival (BJIFF), themed "United We Advance," kicked off in the Chinese capital on August 13, 2022, aiming to screen global masterpieces and promote film exchange and cooperation. Two Indian films, *Jai Bhim* and *Sardar Udham,* and 14 other shortlisted films stood out above 1,450 submitted works from 89 countries and regions around the world to become finalists for the Tiantan Award.

Based on a famous habeas corpus case in Tamil Nadu in 1993, *Jai Bhim* boldly addresses caste-based discrimination without sugarcoating any cruel reality. The film, also remarkable for its narrative and audio-visual devices, is entertaining and has artistic merit. It has been rated 8.9 on IMDB and 8.7 on the Chinese media review platform Douban. The other film, *Sardar Udham*, is an epic revolving around the story of the Jallianwala Bagh Massacre of 1919 and the subsequent assassination of Michael O'Dwyer by Sardar Udham Singh in London in March 1940. These two films provide food for thought for the Chinese film industry on how to weave reality into artistic expression in a commercial film.

In fact, the connection between BJIFF and Indian films emerged several years ago. In 2019, "Indian Film Week" was held as a special section during the 9th BJIFF. About 10 excellent old and new films in different cinematic styles such as *Sir, Ittefaq*, *Love Per Square Foot*, *Pather Panchali*, *Aparajito*, and *Apur Sansar* were screened.

During the 9th BJIFF, Chinese and Indian filmmakers including Prasad Shetty, co-producer of *Secret Superstar*, and Kabir Khan, director of *Bajrangi Bhaijaan*, attended a press conference on China-India film cooperation on April 19, 2019. They discussed China-India film exchange and co-production throughout the industry chain including investment, filming, production, marketing, and releases based on the spirit of mutual complementarity and win-win cooperation, seeking to join hands to reshape the landscape of the global film

industry. To celebrate the brilliant future of Chinese and Indian films, the Indian film *Zero* was screened at the closing ceremony of the festival, during which its lead actor Shahrukh Khan showed up to interact with Chinese fans. It is noteworthy that Indian film *Fear* won the Tiantan Award for best cinematography at the festival.

Many Indian films have been screened in Chinese cinemas in recent years. Chinese viewers have embraced Indian films with astute social commentary and sophisticated production. Reality-based and entertaining films such as *Dangal, Secret Superstar, Hindi Medium*, and *Padman* were well-received in China and successful in box office revenues. This popularity has led China to overtake North America as India's largest overseas box office market.

The frequent visits to China by well-known Indian filmmakers and movie stars have also created bonds with Chinese moviegoers. Aamir Khan, dubbed "Uncle Mi" by Chinese fans, is one of the most popular Indian movie stars. His movies often boldly criticize backward educational systems, blind religious worship, rotten caste system, and fixed social hierarchy, through which Chinese viewers discover and learn more about the South Asian country. Aamir Khan and other Bollywood stars like Shahrukh Khan, Hrithik Roshan, Yami Gautam, and Rani Mukherjee have all ever visited China to meet their Chinese fans and attend film events with their Chinese counterparts like Andy Lau, Huang Bo, Wang Baoqiang, and Deng Chao. Chinese kungfu star Jackie Chan also attended India's Chinese Film Festival and exchanged ideas with Indian filmmakers. Such exchanges and interactions have enhanced mutual understanding and provided support for film cooperation between Chinese and Indian motion picture entities.

A poster of the Indian movie *Jai Bhim*. Inspired by a real-life incident that happened in Tamil Nadu in 1993, it revolves around a human rights lawyer named Chandru fighting to render justice to a tribal couple. (Photo courtesy of Douban)

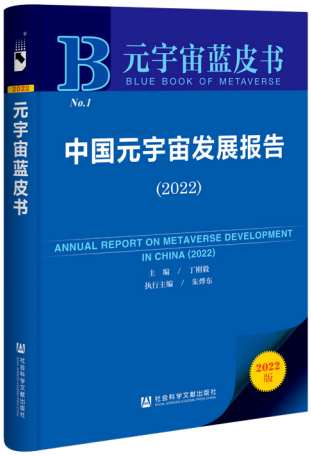
The year 2019 was a milestone for the two countries' film sectors when film cooperation peaked. Unfortunately, the COVID-19 pandemic attacked and shattered the path to further film cooperation. The global film industry also suffered a great loss. Instead of being discouraged by the heavy blow, Chinese and Indian filmmakers picked themselves up and resumed film production and screening as soon as possible.

China and India are home to a third of the world's total population, creating a huge audience base. The Chinese film sector has a solid foundation with the world's largest number of film screens and highest box office revenue, and ranks among the global top three in film production. India ranks first in the world in terms of annual film output, and its multilingual film industry is in full bloom. Indian films are well-received in overseas markets. If the two countries can take advantage of these favorable conditions for long-term development, it will inspire confidence in investors, industry insiders, and viewers about the bright future of China-India film cooperation.

The author is a lecturer at Dalian Polytechnic University and a Ph.D. candidate at Beijing Normal University.

Present Situation and Measures on Metaverse Development in China

By **Zhu Yedong**



Annual Report on Metaverse Development in China (2022)
Chief Editor: Ding Gangyi
Managing Editor: Zhu Yedong
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Since the online gaming platform Roblox went public as the first metaverse stock in March 2021, investors and technology companies have poured money and effort to capture the emerging market. In July 2021, Facebook founder Mark Zuckerberg announced that the company would likely transition from a social media company to a metaverse company within five years. Metaverse gaming started a couple of years ago when the sandbox game Minecraft was available on Microsoft's HoloLens virtual reality (VR) headset. In February 2020, Tencent invested in Roblox and became the company's product publishing agent in China. At the end of 2020, Tencent proposed "Holographic Internet," a concept describing the same technological vision as the metaverse. Another Chinese technology company, Baidu, also invested greatly in the research and development (R&D) of metaverse products by establishing artificial intelligence (AI)-driven augmented reality (AR) labs, VR labs, and VR interactive platforms.

With the meteoric rise in the popularity of the metaverse, technology companies and other players have showed great interest and become involved in the new industry. The metaverse's origins and development status, as well as the potential impact, changes, and challenges it will bring to life, are all topics worthy of discussion alongside how to better develop it.

PROBLEMS

Overhyping. Originating in Neal Stephenson's 1992 sci-fi novel *Snow Crash*, at first "metaverse" was just a technological concept. A new concept is often followed by market hype that drives the industry bubble, and when the bubble bursts, the market will cool down and enter steady development. Capital has been pouring into the metaverse industry, and the hype about the metaverse has become inflated. Some companies are trying to attract funds through hype or

leverage the herd mentality to get the consumers to take the bait. Mature technical systems and sufficient application scenarios and product verifications are not yet in place to support the metaverse industry. Whether the metaverse is a bubble or development opportunity remains uncertain.

Social governance. The metaverse represents an integration and innovation in humanities, economics, society, and culture in the virtual and real worlds. It is a highly realistic simulated space. No one can predict the future, but everyone can create the future. They can create their own digital content and digital assets to influence the future metaverse. In the virtual world, more users participate in the building of the metaverse. Different roles and activities constitute a new virtual society, posing unprecedented regulatory challenges. Governments and regulators need to deal with issues concerning major public interests and public safety in the virtual world. They also need to guard against unsafe situations in which users hiding behind virtual identities commit illegal or criminal acts or vent their dissatisfaction and negative feelings by retaliating in the metaverse.

Data privacy. The metaverse is an intelligently enhanced world supported by data and information, and data is one of the key factors driving the development of the metaverse. Thanks to multiple technologies, the highly sought-after metaverse provides an immersive, real-time interactive, and chronologically compatible virtual world that can enhance various experiences, enrich perceptions, and cultivate creativity. It is a supplement and extension of the real world in which we live. However, it's also accompanied with the risk of privacy leakage after huge numbers of users store massive amounts of sensitive data such as identity attributes, social relationships, asset status, and emotional relationships. Data privacy and security in the metaverse have always required vigilance. Before the emergence of the metaverse, the latest generation of information technologies represented by AI and blockchain already struggled with private data disclosure in realms such as virtual currency theft, AI fraud, wearable devices and cloud data hacking, and sensitive information obtained through Ethereum.

Transition cost. The metaverse is a digital world that follows the general rules of the physical world while integrating technologies such as blockchain, VR, AR, AI, 5G, and big data. Its development will be highly dependent on high-performance hardware and efficient software. After Facebook renamed itself Meta and announced a new focus on the metaverse, Chinese companies including Tencent, Baidu, and ByteDance all followed and joined the race to win the metaverse market. However, preliminary construction requires massive amounts of technology and capital, and product R&D involves long-term verification and trial-and-error process. The high threshold and big investment required to make the metaverse operate has dampened enthusiasm from small and medium-sized enterprises (SMEs).

COUNTERMEASURES

Metaverse companies should be encouraged to explore the industry under the principles of technological development, risks prevention and control, and speculation reduction. Development of the metaverse should be coordinated with industrial policies, employment opportunities, and regulations to prevent the collapse of real-world industries due to excessive indulgence into the virtual.

First, industrial policies should be introduced to support SMEs in metaverse development. Governments at all levels can learn from the policies and measures of leading metaverse countries and regions including the United States, Europe, Japan, and South Korea, and release supporting policies with local characteristics to serve the metaverse industry and the needs of enterprises and the market. They should build an empowering metaverse environment by focusing on key technological breakthroughs, rapid implementation of typical

applications, content creation platform construction, and R&D solutions.

Second, metaverse players should curb the hype. The public should be educated to rationally understand and cautiously get involved in the metaverse to encourage healthy R&D and innovation, curb the hype, and prevent bubbles. Users should be warned about potential metaverse scams to avoid losses. Universal metaverse standards should be formulated to foster unified understanding and healthy and orderly development.

Third, supervision should be strengthened to avoid privacy leakage. Regulators should consider the big picture in economics, security, and privacy issues, summarize experience in network platform governance, and plan forwardly for platform monopolies, tax collection and management, regulation and review, data security, and social norms as well as refining and improving governance methods such as legislation, law enforcement, and supervision.

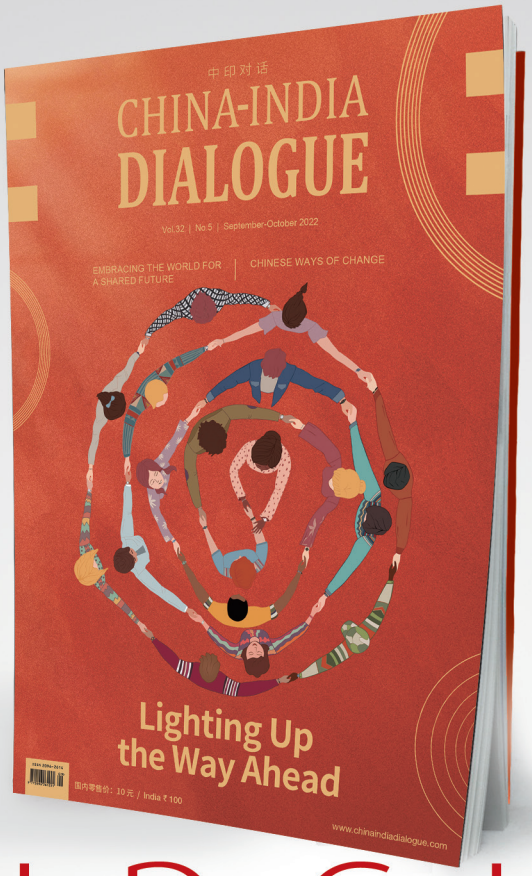
TRENDS

The COVID-19 pandemic has accelerated the digital transformation of the economy and society, heralding a comprehensive digital convergence with deepening innovation and reform in office, education, shopping, and medical care. The virtual world provides a new space for digital avatars to interact and network. The metaverse industry is in its infancy, and the discussion is now focused on concepts, technical systems, and business logic. The metaverse is expected to create a safer, more ideal, and more integrated immersive experience as its key technologies mature and are applied and verified in more scenarios.

The development of the metaverse drives information technologies, which also causes uncertainties. Built on the internet, the metaverse is a constantly colliding and expanding "universe" composed of countless virtual worlds and digital content. In the initial stage, blockchain could help establish a reliable and credible digital interaction network, VR and AR enable users to get completely immersed in a simulated environment, and AI supports innovating and iterating in the metaverse. The numerous metaverse application scenarios, huge user base, and diverse user demands will accelerate improvement and integration of key technologies and drive the development of related information technologies. But the metaverse is built on information technologies driven by human imagination. To obtain a richer experience in the virtual world, users will create more digital avatars just like the non-playable characters (NPCs) in the 2021 movie *Free Guy*. Such avatars could possibly have similar intelligence and behavioral capabilities as humans thanks to technology self-learning, updating, and iteration. The paths the metaverse will eventually take remain unpredictable.

The metaverse can transform and upgrade society and reform the real economy and employment. It can be regarded as a digital world built on underlying technologies such as mixed reality and digital modeling. Blockchain-based decentralized value transfer will probably build new social networks and collaboration in the metaverse and reshape social forms in different dimensions like identity, economy, and governance. To ensure that the virtual world is not disconnected from the real one, it is necessary to improve and integrate information technologies during new infrastructure construction in the real world and make the metaverse a propeller for it. However, gradual implementation of the metaverse in social networking, business travel, art, education, and medical care will generate more immersive and real-time interactive applications such as cloud shopping, cloud classrooms, cloud meetings, and cloud tourisms, bringing changes to e-commerce and online education sectors and inevitably impacting employment in physical industries.

The author is chairman and founder of Sinodata Co., Ltd. This article is an excerpt from *Annual Report on Metaverse Development in China (2022)*.



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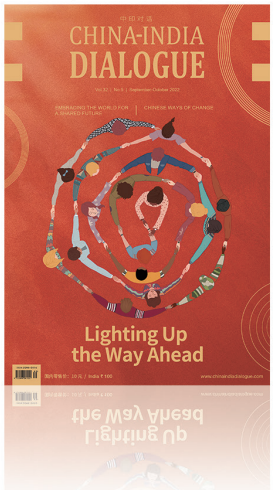

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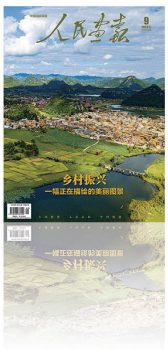

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