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Meta's Response to Chapter 4 of TRAI's Consultation Paper on Digital Transformation through 5G Ecosystem

Introduction

Meta appreciates the opportunity to respond to the Telecom Regulatory Authority of India's ('TRAI') on the Consultation Paper on Digital Transformation through 5G Ecosystem ('Consultation Paper'). Our inputs are specific to Chapter 4 (Metaverse : Opportunities And Challenges) of the Consultation Paper.

At Meta, we are enthusiastic about the opportunities the metaverse can bring to people, society, and the Indian economy. We welcome TRAI's decision to start a public conversation at a time where the metaverse is at a critical early stage in its development.

India will play a very important role in building for the global metaverse. India's vast talent pool of engineers, developers and creators and its vibrant startup ecosystem will be critical in building foundations of the global metaverse.

Ensuring nascent technologies reach their full potential aligned with India's principles and values will require an inclusive society-wide dialogue. Meta wants to engage with the TRAI and the other policymakers in India as a partner and contributor in this respect. By working together from this early stage across industry, the public sector, academia and civil society, India can foster a global dialogue on this next iteration of the internet, and ensure that the enthusiasm and support for its development is accompanied by a rigorous focus on ensuring it is done collaboratively, transparently and responsibly.

A. Key role that Indian stakeholders will play in shaping the global metaverse

Just as India became the hub for software development in the 1990s, as we move to the metaverse, India's developers, creators, entrepreneurs and startups will play a critical role in shaping its future and making India the producer of technologies relevant for the metaverse. India will thus play a significant role in building the foundations of the global metaverse.

India is uniquely positioned to lead on the development of augmented reality ('AR'), virtual reality ('VR') and other technologies shaping the future of the internet. Although nascent, the metaverse can be described as a single system of interconnected digital spaces, including immersive virtual worlds, that allow users to connect, interact and communicate with a feeling of presence. The metaverse experience will be achieved through a range of

technologies, including VR headsets immersing users in virtual spaces, AR glasses that promise to project computer-generated images onto the physical world, mixed reality ('MR') experiences that blend both physical and virtual environments, and mobile devices.

This continued evolution of the internet will require the participation of diverse stakeholders in the development and accessibility of the metaverse, which will not be built by any one company, but by a wide range of stakeholders including industry, policymakers, civil society, the public sector, experts and academics. By building a strategic approach to fostering growth of the metaverse across India, policy makers can play a crucial role in shaping immersive technologies at an early stage of its development.

Building an open metaverse can help ensure Indian startups, developers, creators, the backbone of India's economy are not constrained by "walled gardens" and that all stakeholders, from creators, developers, academics and companies of all sizes, have a shared presence and more equal economic opportunities.

It will be down to the ingenuity of the brightest creators, developers, entrepreneurs and individuals in India to shape the metaverse and determine how far it can go. The possibilities are significant in an ecosystem that is already beginning to stretch out across India - from research and development into the display technology that will make the development of VR/AR wearables possible, to the creation of the content users will enjoy in the metaverse. Following factors are strong indicators for India's potential in the metaverse:

- With over half of India's population under the age of 30, India produces the highest number of STEM graduates[1] globally. As per the IPSOS research[2] for the World Economic Forum, enthusiasm for metaverse exceeds the global average in India. 80% were familiar with the metaverse, above the global average, and 75% of respondents expressed positive feelings about engaging with extended reality ('XR'). The enthusiasm and familiarity with the metaverse will support the development and social acceptance of the metaverse in India. Corporations are keen to invest in the metaverse, and consumers are excited to use related products[3]. As per PwC India survey[4], close to 70% of business executives in India plan to integrate the metaverse into their organizational activities.
- India[5] has emerged as the third largest ecosystem for startups globally with over 112,718 startups recognised by the Department for Promotion of Industry and Internal Trade ('DPIIT') across 763 districts as of 3rd October 2023. India ranks second in innovation quality and is the leader in the quality of scientific publications and the quality of its universities among middle-income economies. As of 3rd October 2023, India is home to 111 unicorns with a total valuation of $ 349.67Bn. Out of the total number of unicorns, 45 unicorns with a total valuation of $ 102.30 Bn were born in 2021, and 22 unicorns with a total valuation of $ 29.20 Bn were born in 2022[6]. These startups are creating India specific tech-enabled solutions at scale across sectors such as education, commerce, financial services, etc. Specifically relevant for metaverse, more than 2000 startups registered with DPIIT are startups working on emerging technologies like AI, AR & VR[7].

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- The Progressive Policy Institute estimates India will have the largest app developer base in the world by 2024[8]. According to a recent study[9], the emergence of XR technologies will enable growth of access to a number of skills certifications, short-term training programs, and other accessible education opportunities instead of just four-year degrees to support economic advancement. Skill-based job opportunities at a mass level plays a critical role to enable economic growth of India.

- Real-time digital payments in India make up 40% of all such transactions globally, which is the highest in the world. The success of its fintech ecosystem in encouraging mass adoption can be attributed to a combination of low cost internet data, high smartphone penetration rate, and India's Unified Payment Interface (UPI)[10]. The successful pilot of digital e-rupee[11] led by RBI could create another revolution in India's digital payment ecosystem.

- Indian creators are gaining popularity and finding a global audience and they will be the mainstay of the new social experience for building the metaverse. Several Indian creators have leveraged Meta Spark to start their entrepreneurship journey in the field of creating AR assets for brands[12].

- Large Indian corporations including Infosys[13], TCS[14], Tech Mahindra[15], Mphasis, Wipro, and Pristine Systems[16] are building solutions and products powered by XR that will support in creating the metaverse foundations[17]. Various sectors ranging from education, commerce, retail, gaming, entertainment, skilling, healthcare, tourism, agriculture, etc are expected to benefit from the application of XR technologies in India, for instance -

  - **Education**: Indian Institute of Technology Madras (IIT Madras) is developing a training module for the Indian Spaceflight Programme using XR[18]. Researchers at IIT Madras are also developing AR/VR-based learning environments for students in rural communities[19]. Several Indian startups like Meynikara, KlipVR, FOTON VR and Edverse are working to build VR and AR based solutions for bringing a revolution in the Indian education system[20].

  - **Services, Retail and Commerce**: 81% of Indian consumers believe that AR can improve their buying experience and bridge the gap between offline and online[21]. The Censuswide survey finds that 86% of retail businesses in India think the metaverse is important[22]. Retailers and e-commerce players in India such as Myntra[23], Pepperfry[24] are offering AR-based services, which enables customers to make informed decisions without even visiting the stores. Tanishq unveiled its wedding jewellery collection at a virtual press conference, creating an immersive and personalized 3D experience for viewers. Similarly, tyre manufacturer CEAT is creating its own CEAT Shoppe in the metaverse. Buyers will be able to view the products in 3D and book orders simultaneously[25]. They will also be able to schedule a pickup from a physical store. Recently, Shoppers Stop used AR to launch their make-up collection with festive themed looks[26]. Aditya Birla Group, has unveiled OneVerse, a Virtual Lounge in the metaverse designed to provide customers with an immersive and interactive encounter with its comprehensive PIFA solutions: protection, investing, financing, and advising[27].

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- **Animation & Gaming:** As per recent estimates from NITI Aayog, it is expected that ~50% of Indian animation and VFX studios will adapt to real-time technology (core technologies for perceptual interaction through XR devices, demand for 3D modeling, etc.) by 2025[28].
- **Skilling**: Indian startups like Skillveri[29], Simulanis[30], Cusmat[31] are providing XR based simulation platforms to offer hands-on training on welding, spray painting, blasting, and other skills. AjnaLens, Mumbai-based XR hardware and software company, partnered with Tata Technologies to digitize 150 ITIs in Karnataka. The initiative equips ITIs with Ajna XR stations, the VR-based Phygital Training Simulator that provides immersive skill training to drive performance and reduce training cost[32]. Another startup, Autovrse, is building VR and AR solutions for industrial training, enhancing customer experience and, more recently, for VR games[33].
- **Healthcare:** Several Indian startups and companies are reshaping the future of healthcare with XR technologies. Chennai-based firm Medisim has developed VR technology to provide skill training to help medical students get hands-on experience in the virtual world before going near a patient[34]. Apollo Hospitals announced a collaboration to provide an immersive experience to increase patient engagement and skill mastery for hands-on training[35]. Indegene announced the launch of metaverse capabilities to support life sciences organizations[36].
- **Tourism:** In April 2022, the Hon'ble Prime Minister of India, Mr. Narendra Modi, inaugurated Pradhan Mantri Sangrahalay (PM Museum) in New Delhi. Indian startup, Tagbin, along with other technology partners, digitized the museum by leveraging technologies such as AR/VR[37]. WhoVR, a Bangalore-based startup is focused on creating the Indic Metaverse with heritage site tours, time-travel experiences, music concerts, heritage games as multi-sensory experiences involving sight, sound, touch and smell[38]. We're also seeing how immersive technologies can transform the future of cultural learning experiences at museums, galleries, and educational spaces. The Museum of Art & Photography (MAP) in Bangalore uses Meta's AR platform to make some of the displayed art pieces come alive through engaging AR experiences.
- **Public services and government application**: To give impetus to the uptake of digital services in the country and raise awareness about various initiatives under the Digital India Programme, as part of G-20 DEWG, MeitY has launched Digital India mobile van to display Digital India's iconic journey through use of immersive technologies like VR[39]. Telangana launched its Space Tech Framework by hosting the event in VR[40]. Kerala Police Academy is using VR to help trainees and new recruits simulate life like representations of crime scenes[41].

As evident from above, building for the metaverse aims to provide economic opportunities and help grow significant sectors in India; benefiting a huge number of developers, creators and the flourishing startup ecosystem in the country. According to the study from Analysis Group[42], the metaverse is estimated to add $240 billion or 4.6% to India's GDP by 2031, potentially impacting existing economic influences like employment opportunities, specialized

industries, infrastructure and more, if the metaverse were to be adopted and grow in a manner similar to how mobile technology grew in India.

Immersive technologies are also creating [new experiences](#) for education and lifelong learning. Studies[43] have found that VR can positively improve a variety of learning outcomes — such as comprehension, knowledge retention, student engagement, attention span and motivation. VR and AR technologies can be used to upskill technical staff, such as maintenance engineers, and provide virtual space for them to practice, as well as delivering real-time guidance on the job. Research[44] found that businesses can train employees up to four times faster in virtual environments than through other methods.

We believe India should harness the potential of development of the next generation of computing platforms. Among the many developments happening in immersive computing, the development of AR devices represents one the most exciting and promising breakthroughs. True AR glasses will require years of research in making devices slimmer, lighter, faster, and more powerful, all while consuming less battery power and generating less heat. This will require a massive set of breakthroughs and inventions across all sorts of areas, from lenses and miniature displays to lightweight materials and AI-powered interfaces. Several universities and research centers in India (e.g. CAVE at IIT Madras, iHub Drishti at IIT Jodhpur, VARCOE at IIT Bhubaneswar, IIT Patna Vishlesan I-hub Foundation, STPI-IMAGE) are leading critical work to advance XR technologies.

India should therefore seize the opportunity to position Indian startups and developers and other stakeholders as protagonists in the transition from mobile to AR wearables, and explore how the collaboration between tech companies and the Indian ecosystem can foster deep industrial transformation that can contribute to making the metaverse led by India's innovation and creativity.

We believe this is just the start of the journey in India, and Indian startups, developers, companies, and creators should set ambitious goals for themselves, and work to become a global leader in the development of these next generation computing platforms. Our role is to support this journey and responsibly develop the fundamental technologies, social platforms and creative tools that stakeholders in India can use to bring the metaverse to life.

B. Our work to support India's ecosystem

There are millions of creators and developers who are using our apps to build community in India, gaining popularity and finding new audiences abroad, and monetizing their presence.

We want to do our part to help foster XR technologies in India and help build the foundation for the global metaverse.

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- Bringing together our work across education and skilling, mapping the journey of India's students from the classroom to the workforce, we recently announced a **three-year partnership with the [Ministry of Education, and the Ministry of Skill Development and Entrepreneurship](#)** to empower students, educators, and entrepreneurs across India.
  - Under the partnership, we have signed three Letters of Intent ('LoI') – with the National Institute for Entrepreneurship and Small Business Development ('NIESBUD') which is engaged in training, consultancy and research to promote entrepreneurship and skill development in India, the All India Council for Technical Education ('AICTE'), a statutory body, and a national-level council for technical education, under the Department of Higher Education and the Central Board of Secondary Education ('CBSE'), the national level board of education in India for public and private schools.
  - Earlier in July this year, we launched the **Creators of Metaverse program** with AICTE, whereby 100,000 students and 20,000 educators will be enabled in AR,VR, AI and XR technologies. Further, we are working to introduce a 2-year AVGC-XR-AI diploma course for students across AICTE affiliated colleges.
  - To make emerging technologies like AR more mainstream, we have an ongoing partnership with the **[CBSE](#)** that commenced in December 2021, to train 10 million students and 1 million educators in AR, VR, AI, and Digital Citizenship. The partnership with CBSE underscores Meta's commitment to India, and reflects the joint ambition to universalize STEM education by ensuring that students across India have equitable access to quality educational content which aims to prepare them for the Future of Work in a digitally powered economy. We will continue providing end-to-end training and upskilling support for students and teachers until 2026.
- In June 2022, we launched the **[LeARn Program](#)** to train 40,000 students in AR, and developed the School of AR, a flagship program that up-skilled 1,000 developers to work on advanced capabilities in MetaSpark.
- Through the **[XR Programs and Research Fund](#),** we have invested **$3 Million** for nurturing and supporting XR developers & startups in India.
  - We launched **[XR Startup Program](#)**, our collaboration with the **MeitY Startup Hub** to discover, nurture, and accelerate XR technology startups and innovators across India. Out of the startups selected in the Accelerator Program, over 30% are from smaller cities across India. Also, 40% of the selected innovators and startups in the grand challenge are from tier smaller cities. Further, more than 20% of the cohort has women innovators and startups with women founders/ co-founders. Through the Accelerator Program we have supported 40 early-stage start-ups building XR technologies with a grant of Rs 20 lakhs each. And with the Grand Challenge, we shortlisted 80 innovators to attend a bootcamp and provided 16 of them with grants to develop their prototypes. These innovators come from sectors such as Education, Learning and Skills, Healthcare, Gaming and Entertainment, Agritech & Climate Action and Tourism & Sustainability. Details of startups can be found [here](#).

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- We [recently](#) also launched a **new mixed reality (MR) programme** in India that offers financial support of $250,000 as well as mentorship opportunities for startups and developers to build apps and experiences using Meta's presence platform.
- We are supporting the **[Federation of Indian Chamber of Commerce & Industry](#)** (FICCI) for the **[XR Open Source (XROS) fellowship program](#)**. Run by FICCI, XROS is supporting 100 Indian developers working on XR technologies by providing them with fellowships which includes stipend and mentoring. [Over 65% of the selected fellows are from smaller cities and regions and about 20% of them are women developers](#). The National e-Governance Division, an initiative of the Ministry of Electronics & Information Technology (MeitY) and the Office of Principal Scientific Adviser to the Government are partners to the program. The program is supporting developers to make contributions to open source projects related to the XR technology and will further lay the foundation for India-specific solutions that are affordable, appropriate and localized to Indic languages.
- Earlier this year, we also partnered with the **National Skill Development Corporation (NSDC) and the Ministry of Skill Development and Entrepreneurship** at **G20 the Future of Work Summit**, showcasing innovations in skilling and the role of advanced technologies (VR & AR) for skill enablement.
- We are also supporting researchers at [IIT Madras](#) on a study to examine techniques for enhancing learning in the metaverse.
- Building for the metaverse will require major breakthroughs in artificial intelligence ('AI'). Our AI labs are already [making advancements](#) in research and development as part of a long-term effort to enable the next era of computing. Our AI research can [help break down language](#) barriers in both the physical world and the metaverse.
- From the very beginning, we have supported and launched various **open source initiatives which are aligned with India's ethos of openness.** We applaud the government for driving India's AI-based language platform, Bhashini. We believe open source is not only good for developers, [it brings the best out in people](#). By sharing our research, code and designs with others, we're moving the entire ecosystem forward while helping other companies and individuals scale more quickly and build great products.
- Through our research in AI, we are committed to supporting language diversity. We want to make it easier for people to access information and use devices in their preferred language, and have launched a series of AI models and open data sets to build the foundation blocks for the translation of low-resource languages. These projects could transform translation for all Indic languages and open up the digital and physical worlds in new ways. To build the foundation blocks for translation of [low-resource languages](#), Meta has open sourced several data sets and AI models .
  - [Massively Multilingual Speech (MMS) AI research model](#) from Meta can identify more than 4,000 spoken languages, 40 times more than any known previous technology. These models expand text-to-speech and speech-to-text technology from around 100 languages to more than 1,100 languages (including around 60 Indian languages).

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- ○ We also open sourced [No Language Left Behind (NLLB)](#), a single multilingual AI model which supports 200 low resource languages, including 25 Indian languages. For some Indian languages, NLLB's translations were more than 70% more accurate, proving to be a game changer for a country as diverse as India.
  - ○ Recently we also open sourced [SeamlessM4T,](#) the first all-in-one multimodal and multilingual AI translation model that allows people to communicate effortlessly through speech and text across different languages. SeamlessM4T supports
    - ■ Speech recognition for nearly 100 languages
    - ■ Speech-to-text translation for nearly 100 input and output languages
    - ■ Speech-to-speech translation, supporting nearly 100 input languages and 36 (including English) output languages
    - ■ Text-to-text translation for nearly 100 languages
    - ■ Text-to-speech translation, supporting nearly 100 input languages and 35 (including English) output languages

- ● Many Indian researchers and developers have used Meta's open source models to develop indigenous models:
  - ○ Yubi[45], a unified credit platform for corporations and lenders, launched an indigenous [open source](#) fintech language model called YubiBERT. The model understands 13 Indian languages and the code uses the NLP architecture RoBERTa, which was trained by Meta.
  - ○ Vakyansh[46], a speech recognition framework for Indic languages developed by Ekstep Foundation in India leverages Meta's AI model Wav2vec2.0.
  - ○ IndicTrans[47], a neural machine translation model developed by Indian researchers used Meta's semantic search infrastructure, [FAISS](#).
  - ○ Researchers from the IIT Madras[48] are also experimenting with NLLB to enable speech to text translations in regional Indian languages.

- ● Recently, we also signed a [Memorandum of Understanding](#) with the 'India AI', an independent business unit (IBD) under Digital India Corporation (DIC), Ministry of Electronics and Information Technology (MeitY) to foster collaboration in the field of Artificial Intelligence (AI). This collaboration will establish a framework of cooperation between 'India AI' and Meta in the field of AI & emerging technologies including to make Meta's open-source AI models available for use by the Indian AI ecosystem. Amongst various initiatives, the collaboration will focus on building datasets in Indian languages to enable translation and large language models, with priority given to low-resource language.

As we continue to explore partnerships that can help in building an ecosystem to foster future technologies in India, we hope to develop programs and initiatives that can advance innovation, providing economic and social benefits

to everyone in India. Our hope is that these investments can also help in supporting a future ready workforce and accelerate India's contribution in building the foundation of the global metaverse.

C. Developing the metaverse collaboratively and responsibly

While we are enthusiastic about the opportunities of the metaverse, we also fully appreciate that rapid technological advancements also raise potential challenges. The metaverse will transform the way people connect and how businesses grow, and lead to closer social experiences compared to the ones they have online today. As we approach this next evolution of the internet, we collectively need to ensure the experiences enjoyed in the metaverse are inclusive and provided in a way that keeps people safe. Like the internet, the metaverse is not a single product that one company can build alone. It will require collaboration between several companies and stakeholders coming together

In this respect, it is important to remember that the metaverse is not being built in a regulatory vacuum: in fact, as the next evolution of the internet, it is already subjected to the wide range of laws, norms, principles and standards that already regulate today's internet and the technologies that power it. For example, the Digital Personal Data Protection Act, 2023 (DPDP) that will govern how data is collected, processed and shared, already offers an exhaustive and adaptable framework, independently of the technology used, for the collection and processing of personal data that will happen in the metaverse.

As the technologies that make the metaverse continue to be developed, novel and unique issues may arise, just as in any other field. This underlines the importance of a robust and inclusive framework for dialogue, so that emerging issues can be discussed, existing regulatory principles applied, and gaps identified. Whether new regulation is necessary to address these potential new questions will need to be ascertained on a case-by-case basis, collaboratively and iteratively, and on an evidence-basis.

The multi-stakeholder approach to the development of metaverse policy should not be limited to discussions on regulation. Stakeholders must also come together around other policy tools. The metaverse will reach its full potential only if built on a foundation of common technical standards and protocols empowering both businesses and people to seamlessly navigate and travel between multiple destinations and experiences, just like we can browse the internet today freely. Not every element of the metaverse needs to be, or will be, interoperable with others, but without agreement that interoperability matters to connect the metaverse together where it makes sense to do, the metaverse may become fragmented and broken into silos, each impenetrable from the other. The development of technical standards in specific areas is therefore crucial to a baseline level of interoperability that mirrors the kind of open internet protocols we see in place today, lowering barriers to entry and facilitating market access by small firms and developers.

We are already working with several international organisations including the World Economic Forum, the OECD, the XR Association and the Metaverse Standards Forum on their efforts to ensure the metaverse is built on a foundation of open standards – more like the internet of today. These multi-stakeholder initiatives can ensure the metaverse will be accessible to both developers and other participants. In India we are actively participating in various industry forums including the Metaverse Panel set up by the Electronics and Information Technology Division Council (LITDC) at BIS to share updates about the developments happening at various global forums & standard setting bodies.

Second, and significantly more difficult, is determining how to foster shared rules of behaviour for people across the metaverse. Given that a sense of presence may make interactions feel similar to how they feel in the physical world, how should we think about where the line is drawn in terms of formal rules for what behaviour is and isn't allowed? How should rules adapt to spaces where real-time conduct is more common? How do we ensure that rules are equitable for all communities? And given the technical challenges, what level of standards is realistically achievable? We are committed to working with policymakers, civil society, platforms, developers, and individual communities to continue making progress on these questions.

Facing these hard questions, we have been thinking thoroughly about how to ensure the metaverse and its enabling tools are developed in the right way since the very beginning. We have set out a number of priorities in areas that raise questions without easy answers:

- **Economic opportunity:** How can we give people more choice, encourage competition and maintain a thriving digital economy?
- **Privacy:** As we do today under global data regulatory norms, how can we continue to ensure the minimisation of data collected and used, keep building technology to enable privacy-protective data uses, and adapt tools to give people transparency and control over their data in the metaverse?
- **Safety and integrity:** How can we continue to keep people safe online and give them tools to take action or get help if they see something they're not comfortable with?
- **Equity and inclusion:** How can we make sure these technologies are designed inclusively and in a way that's accessible?

These priorities build on a set of Responsible Innovation Principles that Meta's Reality Labs first set out in 2020 to underpin our product development work.
- **Never surprise people:** We strive to be explicit and transparent about how our products work and the data they collect and share. We take user experience and expectations into account when building products. We also articulate best practices for responsible use and behaviour when using our products through services like the Meta Quest Safety Center.

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- **Provide controls that matter:** Building technologies that blend the virtual and physical worlds presents opportunities to establish new ways of approaching digital and physical norms while also setting appropriate boundaries. We provide people with the controls that enable them to choose how their personal data is used, personalise their experience and how they use our products. These controls are based on applicable regulation, and research, not assumptions, and consider context and sensitivity.
- **Consider everyone:** In a world where AR and VR technology is ubiquitous, we'll work to ensure our products are inclusive of the world's diverse populations, including people in both vulnerable and under-represented communities.
- **Put people first:** Creating business value gives our products the opportunity to deliver value back to people. But on balance, we believe that over the long term business value stems from putting people first.

Project Aria is a research device from Meta. The research glasses utilize ground breaking technology to help researchers contribute to the advancement of egocentric research in machine perception, and what will eventually be AR glasses. In 2021, we announced Ego4D, an ambitious long-term project aimed at solving research challenges in egocentric perception. We brought together a consortium of 15 universities and labs across nine countries including India. Recently, as part of two-year effort by Meta's FAIR (Fundamental Artificial Intelligence Research), Meta's Project Aria, and 15 university partners from Ego4D consortium, we released a foundational dataset and benchmark suite ("Ego-Exo4D") to support research on video learning and multimodal perception. It constitutes the largest public dataset of time-synchronized first and third person videos.

We are also taking a layered approach to ensure people feel safe when using our tools. In the metaverse we want everyone to feel both in control of their experiences and safe in line with their expectations. That is why we have put in place measures, tools and policies to protect people as we develop our technologies and help developers to be responsible for addressing these issues. For example, our Code of Conduct for Virtual Experiences outlines what is and what is not allowed on our technologies, and these apply to both content and conduct in VR. Behaviours that constitute abuse and harassment are not allowed on the Meta Quest platform. Developers can add additional policies to supplement the Code of Conduct. Additionally, we empower developers and users with safety tools to be in control of their experience. For example, in Meta Horizon Worlds, in addition to mute, block and report functions, we built bespoke safety solutions such as Personal Boundary, which allows people to prevent others from getting too close, and Pause, which gives people the ability to take a break and quickly access safety tools. Developers who integrate with our block API can ensure that when one user blocks another user in a different app, they area also blocked in the developer's app.

When it comes to personal data collection, the development of new technologies like VR and AR devices also comes with the development of new sensors and novel data inputs. An example of a feature powered by a novel data input would be eye tracking as seen in the Meta Quest Pro. Eye tracking has the potential to increase the feeling of

presence for users in VR by making a user's avatar's eye contact and facial expressions look more natural, like being able to blink or make eye contact with other people. We are cognizant that this feature and others like it raise heightened sensitivities and concerns, so we have built privacy-protecting measures in the product. Eye tracking is off by default, and opt-in only. We also use on-device processing to limit what eye tracking data leaves the device, meaning raw image data is processed on device and not stored or shared to Meta or third parties. But users have the choice to share abstracted eye gaze data with an app in order to use the eye tracking feature in the app. Additionally, developers of 3rd party apps on the Meta Quest platform must comply with our Developer Data Use Policy, which outlines permitted and prohibited use cases of data. We also want to be transparent with users and our community, and have released a white paper detailing how we have built Meta built eye tracking on the Meta Quest Pro with privacy in mind. We also have a help center article for users to understand how to turn the feature on or off, and an Eye Tracking Privacy Notice to explain how eye tracking works and how data is processed.

To maintain consistency with industry practice, our eye tracking API designs for Meta Quest Pro are anchored on Android NDK from the Android Open Source Project framework that our headset is built upon and the industry-wide OpenXR standard for inputs. We collaborated with industry partners to develop the OpenXR standard for eye tracking APIs to help facilitate an interoperable and consistent approach to eye tracking software development across the VR developer ecosystem. The standard specification is available here.

Similarly, designers of smart glasses face the challenge of how to inform people when smart glasses wearers are taking photos or videos ("bystander signaling"). To address this concern our smart glasses have a "capture LED light" feature that lets people know when someone is using the camera to capture content or going live.

With Ray-Ban Meta smart glasses, we've introduced the next generation of smart glasses from Meta and EssilorLuxottica, upholding our commitment to our Responsible Innovation Principles with clear proof points of privacy by design in building the capture LED light that exists today. We engaged with experts early to test ideas and receive feedback on our approach throughout the product development process, and based on feedback we heard, we made meaningful and tangible improvements to bystander signaling, such as increasing the size of the LED light and its visibility. The LED light also has a differentiated blinking pattern during recording, and if the LED is fully covered, the wearer will not be able to start recording, and will be notified to clear it. We recently released a white paper "Designing for Everyone: Bystander Signaling for Smart Glasses" which outlines our framework for tackling the complex and nuanced problem of bystander signaling.

Making our products safe for any audience is a priority, for this reason we apply a holistic lens to examine privacy, safety and wellbeing, and integrate into our products a wide range of controls and safeguards for those purposes. Supporting families and young users is a top priority for Meta. We empower parents and youth with tools and resources to support young people in developing safe habits in virtual spaces, and ensure that younger users will

have additional safety, privacy and age appropriate protections by default. For example, our VR product (Meta Quest) has parental supervision tools that allow parents to help their child use VR in a way that is safe, comfortable, and age appropriate – parents of teens can view time spent in VR, view the teen's app library, block use of individual apps, block platform social features, view who the teen is following and followed by, and approve purchases. Privacy settings for young people are also set to more private options by default. Additionally, we have educational resources available on our website, like the [Meta Quest Safety Center](#) and [Parent Education Hub](#), where people can learn more about the VR product, parental supervision tools, and the Code of Conduct for Virtual Experiences.

Another area that is crucial to our strategy is addressing the need to build these new tools inclusively and with accessibility in mind from early on in their development. To do so, we're collaborating with diverse companies, developers, experts and policymakers. Some examples of our initiatives in this area are:

- **Product representation:** We offer more than one quintillion different attribute combinations for Meta Avatars, from skin tones to facial shapes and representation assets such as religious headwear so that everyone can feel represented and included.
- **Cost accessibility:** We know XR devices can be cost-prohibitive for many, but immersive experiences like Horizon Workrooms can be accessed from other devices, like smartphones and desktops; and we are working to make more experiences available across platforms.
- **Skill development:** We're working with partners to help develop skills in AR, VR and immersive media. This is part of our greater effort to help creators, developers, startups with a wide range of backgrounds and perspectives make a living in the metaverse.

The metaverse has the potential to be a great technological equaliser, but that can only happen if a wide range of stakeholders get involved during these early stages to help steer the direction of what we want the future to look like. We've got a long road ahead of us. Our success in realizing this vision depends on our investments, our commitment and who is at the table making decisions. Meta is committed to involving people from all backgrounds from the very beginning to create a future where everyone can prosper on the same playing field.

Our work on our Responsible Innovation Principles and focus areas is just the start of the journey. By working together from this early stage across industry, the public sector, academia and civil society can begin to answer these questions as these new technologies are built, and ensure that the enthusiasm for the potential of these technologies is accompanied by a focus on developing it responsibly.

D. Policy Recommendations

The TRAI's call for comments tackles a set of questions that we believe are fundamental to the future of metaverse technologies and the internet itself. In developing virtual, augmented and mixed reality products and services, we

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have gained early experience that we would like to share with Indian policymakers to contribute to India's innovation while ensuring they are developed responsibly. While the metaverse is still nascent and not yet built, we would like to share the following set of policy recommendations in the hope that it can help guide both the uptake and the development of the metaverse in line with Indian values and perspective.

1. **Partnering with industry can help Indian policymakers spur investment, innovation and growth in the Indian economy.** The metaverse is a significant opportunity for innovation which while built on existing legal and technical frameworks may bolster the development of metaverse technologies in India. TRAI's consultation paper represents an opportunity to assess the potential of the metaverse for India and lay out a strategy to position Indian stakeholders as protagonists in the internet of tomorrow. We believe partnering with industry could help Indian policymakers make this vision possible. We are grateful to the Government of India for giving us the opportunity to partner on various initiatives.

   Policymakers should encourage a forward-looking, collaborative relationship with industry participants as well as civic engagement to foster the uptake of these technologies and ensure their development abide by Indian values. Examples of these potential partnerships include startup developer accelerators, funded research programs, offering regional incentives and setting up connection hubs between industry, civil society, academics, the public sector and other stakeholders. Public private partnerships on regulatory sandbox for XR can help ascertain if existing regulations, standards, and policies are robust enough for new products based on XR technologies.

   Meta is already partnering with a wide range of private and public stakeholders in India, and we want to continue acting as a partner and contributor to help bolster innovation in India.

2. **Indian policymakers should establish national and state level strategies to make India ready to make the most of the metaverse opportunity.** We believe making Indian developers, startups, companies lead in the internet of tomorrow is possible. This will require creating attractive, innovation-oriented environments for entrepreneurs and businesses willing to experiment and create value through the use of these technologies. This should include the incubation of XR startups in collaboration with national universities in India, or the launch of startup accelerators, such as the one [Meta](#) has launched in collaboration with MeitY Startup Hub. We believe these are the right initiatives to make Indian startups and developers experiment early on with these technologies, and gain early experience that can become a competitive advantage once immersive technologies become more widely distributed across the world. We are proud to support Indian startups and businesses through our initiatives and we welcome a strong partnership with the government to leverage the digital economy for social good and economic value in India.

3. **Indian policymakers should support international, multi-stakeholder efforts to develop baseline**

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technical standards in specific areas on an evolving basis and encourage India's industry to participate in these efforts so that they are built with Indian values and priorities. To achieve its full potential, the metaverse should be developed collaboratively, and with interoperability in mind, mirroring the kind of open internet protocols we see in place today that empower people to seamlessly navigate and travel between multiple online experiences. Where industry participants come together to collaborate in open forums on standards development for new technologies and the future of the internet, we encourage policymakers to consider ways to support and embrace such standards. One example is the work of the Metaverse Standards Forum which provides a venue for cooperation between standards setting organisations and companies to foster the development of certain core technical interoperability standards for a more inclusive metaverse, and accelerate their development and deployment through pragmatic, action-based projects. Aligning any future initiative with the work of such international, multi-stakeholder efforts around technical standards development is vital to ensure policies and regulations align with industry best practices and support responsible innovation globally. Similarly, the World Economic Forum has announced a Defining and Building the Metaverse initiative that brings together key stakeholders to develop a more interoperable and inclusive metaverse. Given the potential of the metaverse, Indian stakeholders including developers, experts, companies, startups, academia should look to actively participate and contribute to the global standard setting process. Various divisions within the government of India, like MeitY, Department of Science and Technology, Department of Telecom can consider supporting and incentivizing the development of open source technologies relevant for XR, participation and contribution of Indian companies and developers in global industry led standard setting bodies to ensure Indian values and priorities are factored in.

4. **To the extent that any novel or unique issues arise over time as the metaverse continues to evolve, we call upon the Indian policymakers to address any emerging legislative gaps on a case-by-case basis, using evidence-based policy development.** We support the development of common standards and best practices for the metaverse, and are working with others through forums like the Metaverse Standards Forum to that end. However, policymakers must recognise that these technologies are nascent, and that many of the benefits and potential risks that experts predict will be raised by advances that are still to come. Further, India already benefits from solid legal frameworks that apply to the internet and its technologies and, therefore, may continue to apply to the metaverse. To address any potential legislative gaps, the Indian policy makers should establish mechanisms to promote long-term dialogue and cooperation with industry stakeholders, to share knowledge and ensure a shared understanding of these technologies as they keep getting developed. This could take the form of regulatory sandboxes with clear exit criteria that allow industry participants to offer products to limited numbers of consumers in a more controlled environment, or other experimental governance programs. For example, Meta has experience with similar solutions via the [Open Loop](#) program, which leverages policy prototyping to improve rulemaking processes in tech policy. The [Open Loop initiative in India](#) is intended to guide and enable

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companies in India to implement the AI principle of human centricity, as enshrined in the national AI principles of India, and in a way that accounts for local and regional cultural factors with an emphasis on stakeholder engagement. The policy prototype project engages 12 startups providing B2C services from different sectors in India, including Agriculture, Health, Finance and Education.

5. **Indian policy makers should enable Wi-Fi in the 6 GHz spectrum band. AR/VR head mounted displays rely on the latest Wi-Fi technology to enable the most innovative AR/VR experience.** The 6 GHz band is important for next generation Wi-Fi operations. The 1,200 MHz of spectrum between 5 925 and 7 125 MHz provides more and wider channels than the 2.4 GHz and 5 GHz bands and will enable low latency, high throughput communication. The seven 160 MHz and three 320 MHz channels are critical for the metaverse which often involve multiple users and densely populated networks. Wider channels enable a better user experience and longer battery life for AR/VR head mounted displays. Globally, over 35 countries have chosen to delicense the 6 GHz band. They include the United States, Canada, Mexico, Brazil, Chile, Argentina, Colombia, Peru, Japan, Korea, Singapore, Malaysia, Australia, New Zealand, Thailand, Taiwan, UAE, Saudi Arabia, Jordan, Bahrain, Qatar, Kuwait, Kenya, South Africa, Togo, Israel, Russia and the countries in the EU. The limitation on usage of the 6 GHz band in India would restrict the performance of these devices and the innovation potential for India startups, developers, creators and users in the metaverse. The 6GHz band should be open to Wi-Fi, so that India's ecosystem can compete with their counterparts from other regions in reaping the benefits of the metaverse.

6. **Just like today's internet, since the metaverse will transcend national borders, it will need the same public and private standards, norms and rules to be able to operate across jurisdictions.** Like the internet, the metaverse will not be limited to use from within defined, geographic parameters. The siloed nature of bordered approaches to regulation might impede interoperability and portability in the metaverse. Onerous requirements for local storage of data are already particularly challenging for smaller businesses and their cross-border activities and in a burgeoning sector such as metaverse technologies this situation may amplify. In addition, given that it is foreseen that people will want to experience the ability to travel between and portability of assets across experiences, data localization restrictions risk stifling human opportunity. We welcome the Indian government's approach on cross border data flows under the DPDP Act.

7. **Bridge the metaverse skills gap: attracting and training talents are key assets of digital competitiveness.** The emergence of the metaverse has created new needs in a job market already in high demand for engineering and technical roles. Anticipating the evolution of skills and industry breakthroughs has become critical. We believe universities, engineering schools, and industry players should partner to assess the skills gaps, co-design roadmaps to adapt curriculums and strengthen industry/university cooperation. Indian policy makers have a role to play to facilitate industry-university collaboration to meet the evolving skills

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requirements. We are heartened to have partnered with the Ministry of Education to make emerging technologies (AR, VR, AI and XR) mainstream in India and empower students and educators via programs with CBSE and AICTE.

Conclusion

We welcome TRAI's initiative to kick-off a public conversation on the metaverse. Immersive technologies are a significant opportunity for social and economic progress in India and have the potential to spur innovation in India in a way we have not seen in today's internet. While these technologies are nascent, they may also raise challenges that must be addressed early in their development processes.

Kicking-off this early debate can position Indian stakeholders to play a central role in their development, grasp their benefits while ensuring they are developed responsibly and collaboratively. Our hope is that as the metaverse develops and evolves, Indian policymakers will demonstrate leadership by addressing any new policy challenges in an agile manner, ensuring that innovation and technological development around immersive technologies happen in a collaborative and responsible manner, and in conjunction with a global multi-stakeholder dialogue.

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