ITUPublications

International Telecommunication Union

Standardization Sector

ITU Focus Group Technical Report

(06/2024)

ITU Focus Group on metaverse
(FG-MV)

FGMV-47

Economic Value Creation and Competition in metaverse

Working Group 7: Economic, regulatory & competition aspects

PREPUBLISHED

Version

Technical Report ITU FGMV-47

Economic Value Creation and Competition in metaverse

Summary

Metaverse is a nascent concept and potentially encompasses a broad set of technologies to create economic value. In this context, the identification of economic aspects is critical and imperative to capturing economic value. This Technical Report takes an economic perspective of metaverse to illustrate economic value creation and competition related aspects.

More specifically, it provides an approach to:

- Metaverse Value Chain
- Metaverse Economic Value Creation
- Competition Issues and Assessment for metaverse
- Metaverse Economy and Ecosystem Enhancement

Keywords

metaverse value chain; economic value; metaverse competition; metaverse markets definition; metaverse competition assessment; metaverse ecosystem.

Note

This is an informative ITU-T publication. Mandatory provisions, such as those found in ITU-T Recommendations, are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

Change Log

This document contains Version 1.0 of the ITU Technical Report on "*Economic Value Creation and Competition in metaverse*" approved at the 7th meeting of the ITU Focus Group on metaverse (FG-MV) held on 12-13 June 2024.

Acknowledgments

This Technical Report was researched and written by Okan Geray (Digital Dubai, United Arab Emirates) as a contribution to the ITU Focus Group on metaverse (FG-MV). The development of this document was coordinated by Andrey Perez (Anatel, Brazil) and Okan Geray (Digital Dubai, United Arab Emirates), as FG-MV Working Group 7 Co-Chairs.

Additional information and materials relating to this report can be found at: https://www.itu.int/go/fgmv. If you would like to provide any additional information, please contact Cristina Bueti at tsbfgmv@itu.int.

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Economic Value Creation and Competition in metaverse

1 Scope

The scope of this Technical Report is strictly limited to metaverse applications in an economic context. Specifically, it:

1. Develops a metaverse value chain in terms of primary and secondary activities.
2. Defines objectives of fair competition in metaverse and provides recommendations for jurisdictions to consider for instilling fair competition.
3. Provides a high-level competition assessment approach for regulators.

Several complementary activities are introduced in the document, as directly or indirectly impacting metaverse value chain activities and enhancing the general metaverse economy. The Technical Report recommends that jurisdictions consider capitalizing on these complementary activities to boost metaverse economy.

Finally, the potential evolution of business models from a telecommunication operator perspective is deliberated. This scope was assigned to Working Group 7 (WG7) of ITU's Focus Group on metaverse. WG7 covers economic, regulatory and competition aspects.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Technical Report are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Technical Report does not give it, as a stand-alone document, the status of a Recommendation.

[ITU FGMV-20] ITU Focus Group Technical Specification FGMV-20 (2023), Definition of metaverse

3 Definitions

3.1 Terms defined elsewhere

This Technical Report uses the following terms defined elsewhere:

3.1.1 metaverse [ITU FGMV-20]: An integrative ecosystem of virtual worlds offering immersive experiences to users that modify pre-existing value and create new value from economic, environmental, social and cultural perspectives.

NOTE – A metaverse can be virtual, augmented, representative of, or associated with, the physical world.

3.2 Terms defined in this Technical Report

None.

4 Abbreviations and acronyms

This Technical Report uses the following abbreviations and acronyms:

AI Artificial Intelligence

ICT Information and Communication Technology

IoT Internet of Things

SDO Standards Development Organization

VR Virtual Reality

XR Extended Reality

5 Conventions

None.

6 Metaverse Value Chain

Digital technologies have revolutionized economies and societies in the last three decades. Metaverse as an emerging digital technology poses significant surplus economic opportunity and potential (while also recognizing the fact that it brings regulatory and policy challenges).

Value chain refers to the series of steps involved in bringing a product or service from idea to customer. It's like a chain reaction, where each step creates and adds economic value to the final product. For example, designing a product adds value, manufacturing it adds more value, marketing it adds even more, and so on. By analysing this chain, one can identify areas for improvement and maximize the economic value they create. Hence, value creation occurs at each stage (activity) of the value chain.

This section identifies, explains and structures value creation activities pertaining to metaverse. That is, it identifies various, potentially commercial, value adding activities related to metaverse which is referred to as metaverse value chain. Each identified activity in the metaverse value chain can potentially be monetized and hence create direct economic value.

The value chain is composed of two types of value creating activities, namely:

- primary activities; and
- support activities.

Primary activities deliver value to users of metaverse. Primary activities contribute directly to the creation of metaverse products and services in the economic sense.

Support (sometimes referred to as secondary) activities are complementary or auxiliary activities that help improve primary activities.

6.1 Identification of Metaverse Value Chain Activities

Figure 1, below, depicts the metaverse value chain in terms of primary and support activities.

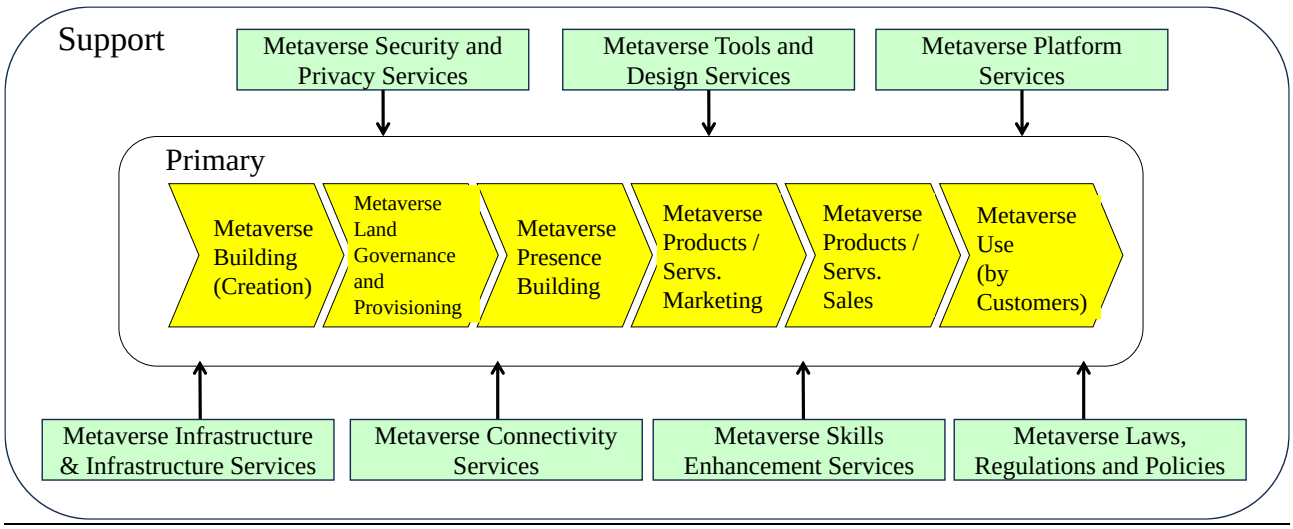

Figure 1 – Metaverse Value Chain

Figure 1 encompasses a broad range of activities that create value for metaverse. There is no implied order for support activities in Figure 1 since they are independent and non-sequential in nature and do not necessarily build on each other. For any given metaverse:

- not every activity in Figure 1 would apply;
- not every activity is commercial (i.e., involves money exchange), but can potentially be; and
- multiple entities or organizations can participate in a single activity in the metaverse value chain.

6.2 Explanation of Metaverse Value Chain Activities

This section briefly explains the activities included in the metaverse value chain in Figure 1.

Primary Activities:

Metaverse Building (Creation): This activity includes designing, developing, and implementing a metaverse and making it available for use.

Metaverse Land Governance and Provisioning: This activity includes governing metaverse land (and in general metaverse space) including zoning, parcelling, allocation, distribution, and provisioning for use (free or commercial).

Metaverse Presence Building: This activity includes building additional presence in metaverse after the metaverse is created and related land is provisioned (where applicable). It aims to create immersive experiences and can include commercial and non-commercial assets, products and services (includes and reflects existing physical counterparts and/or includes physically non-existing virtual ones).

Metaverse Products / Servs. Marketing: This activity includes marketing of metaverse and related products and services. It can include, for example, marketing activities in social media, physical media, and other digital media; and can include advertising activities conducted through ad networks, ad exchanges, ad agencies and advertisers, and so on, pertaining to metaverse.

Metaverse Products / Servs. Sales: This activity includes sales and distribution of assets, products and services in metaverse. The assets, products and services can be real (with real counterparts) or virtual, i.e., existing only in metaverse.

Metaverse Use (by Customers): This activity includes usage of metaverse by users (e.g., individuals, organizations and entities). It may entail commercial fees such as per usage fee and subscription fee, or may be provided free of charge.

Support Activities:

Metaverse Security and Privacy Services: This activity includes provisioning of metaverse- related security and privacy enhancing services for implementing and enforcing applicable laws, regulations and policies in a jurisdiction or metaverse security and/or privacy requirements and policies of an organization.

Metaverse Tools and Design Services: This activity includes provisioning of metaverse-related tools and design and development services to enable metaverse creation and presence building.

Metaverse Platform Services: This activity includes provisioning metaverse platform services for metaverse computing and data processing and management facilities (e.g., blockchain platform services, AI platform services, digital twin platform services, XR for metaverse platform services).

Metaverse Infrastructure and Infrastructure Services: This activity includes provisioning metaverse infrastructure including equipment, hardware, software, and infrastructure services (e.g., platform as a service, infrastructure as a service). This activity excludes connectivity services, which are included in the next activity.

Metaverse Connectivity Services: This activity includes provisioning of ICT connectivity services to enable access to metaverse by users. It may entail next generation network features with low latency, high bandwidth, and quality of service guarantees, among others.

Metaverse Skills Enhancement Services: This activity includes provisioning of metaverse skills boosting activities and related services. It includes, among others, metaverse-related programmes, degrees, certificates, courses of professional training organizations, academia, and educational institutions.

Metaverse Laws, Regulations, and Policies: This activity includes development and enforcement of metaverse-related laws, regulations and policies in a jurisdiction (in some cases, policies might be applicable to one or more organizations rather than an entire jurisdiction). Standards developed by SDOs are also included in this activity.

It is important to note that the metaverse value chain includes activities related to economic value creation through metaverse.

It is also important to note that the measurement of economic value created through metaverse will pose challenges as the economic value-added calculations today (e.g., utilizing national accounts, International Standard Industrial Classification (ISIC) of all economic activities) do not classify economic activities by technology type (e.g., metaverse, AI). Hence, additional data collection and analyses might be required with appropriate breakdowns to target metaverse specifically.

7 Competition in metaverse

Metaverse presents opportunities and challenges for competition. It is important to promote and maintain fair competition and to ensure a robust and healthy competitive landscape within metaverse. Creating a business environment that fosters economic growth, innovation, consumer welfare, and efficient allocation of resources is critical in sustaining metaverse.

7.1 Objectives of fair competition in metaverse

Competition is the cornerstone of a healthy and vibrant market economy for metaverse. It serves as a powerful engine for innovation, efficiency, and ultimately, economic value creation. However, to reap the full benefits of competition in metaverse, it is important to establish a level playing field. This is where the concept of fair competition comes into play.

Fair competition ensures that all metaverse businesses have the opportunity to compete on their merits, fostering a dynamic environment that benefits both businesses and consumers in metaverse. In this context, the following non-exhaustive objectives can facilitate fair competition in metaverse:

- Promote Consumer Welfare: Ensure consumers have a wide choice of high-quality goods and services in metaverse at competitive prices, where applicable. When metaverse businesses can compete fairly, consumers are empowered to make informed choices based on price, quality and innovation. Hence, metaverse businesses are encouraged to be responsive to consumer needs and preferences, leading to a wider variety of metaverse products and services at competitive prices. This fosters a sense of trust and transparency within metaverse economy, ultimately benefiting consumers.
- Encourage Innovation and Efficiency: Stimulate metaverse businesses to innovate and improve efficiency to gain a competitive edge. Innovation and efficiency create a level playing field and foster a dynamic market environment. When metaverse businesses compete based on efficiency and innovation, the playing field becomes less reliant on factors like size or established brand recognition. This allows metaverse start-ups, smaller, and agile companies with innovative solutions to compete effectively against larger players in metaverse. The pursuit of efficiency incentivizes metaverse businesses to improve their operations, reduce costs, and streamline processes. This pressure to innovate creates a dynamic market where metaverse businesses push the boundaries and raise the overall quality of metaverse products and services.
- Promote Fair Market Practices: Prevent anti-competitive agreements and dominant undertakings from stifling competition in metaverse. Fair market practices ensure that all metaverse businesses compete by the same set of rules. This eliminates advantages gained through unethical practices like price-fixing, or metaverse market(s) dominance exploitation. With a level playing field, metaverse start-ups, smaller, and innovative companies can compete effectively against established metaverse players based on merit. Fair metaverse market practices promote transparency in business dealings. This includes clear pricing, accurate advertising, and trustworthy metaverse product information. Metaverse consumers gain trust when they know that they are making informed decisions based on factual information about metaverse. Fair metaverse market practices actively discourage (and in some cases penalize) anti-competitive behaviour (e.g., cartels, mergers that stifle competition, or predatory pricing aimed at driving out metaverse competitors). This protects the metaverse economy from being dominated by a few powerful players, ensuring a diverse range of metaverse businesses can participate and innovate.
- Facilitate Market Entry and Exit: Ensure a level playing field for new metaverse businesses to enter the metaverse market and for inefficient ones to exit without undue barriers. Simplifying regulations, metaverse licensing procedures, and access to resources can make it easier for new metaverse businesses to enter the metaverse market. This injects fresh ideas, diverse perspectives, and potentially disruptive technologies into the competitive metaverse landscape. Existing metaverse players are encouraged to innovate and improve their offerings to stay ahead of the curve. Lower exit barriers allow recycling of inefficient metaverse businesses, which in turn, enhances productivity in economy. This frees up resources like capital, labour, and talent for more efficient and innovative metaverse businesses, allowing them to expand and contribute more significantly to metaverse economy. Facilitating market exit allows the market to adapt to changing metaverse consumer preferences and technological advancements. Metaverse businesses that fail to adapt to these changes can exit gracefully, making way for new metaverse businesses that cater to the evolving needs of the metaverse market.

7.2 Regulating for a competitive metaverse economy

To achieve a robust and healthy competitive metaverse landscape, jurisdictions can consider utilizing an appropriate mix of regulations and policies. In this context, jurisdictions are recommended to:

- encourage open standards and interoperability between platforms to foster competition and discourage practices that lock users into specific metaverse platforms;

- ensure users have the right to transfer their data (e.g., avatars, assets) between metaverse platforms, promoting competition and user choice;
- prevent platform operators from unfairly discriminating against competitors or content creators within metaverse;
- establish a regulatory sandbox to facilitate innovation and allow new entrants to test their business models in a controlled environment;
- educate users about their rights and choices within metaverse, including security, data privacy and portability options;
- implement anti-trust measures to prevent anti-competitive practices like mergers, acquisitions, or self-preferencing by dominant metaverse platforms;
- encourage transparency in algorithms used for content moderation, matchmaking, and search results within metaverse to prevent bias and manipulation;
- take appropriate measures for in-metaverse marketplaces to prevent unfair pricing practices and ensure a level playing field for metaverse businesses;
- establish regulations for virtual currencies used within metaverse to prevent adverse financial practices such as fraud, money laundering, and market manipulation;
- mandate clear and transparent disclosures about in-metaverse purchases, including potential risks and hidden fees;
- enforce robust data privacy and security standards for user data collected within the metaverse;
- establish a new or designate an existing regulatory body to oversee competition within metaverse;
- adopt a dynamic and anticipatory regulatory approach as metaverse is a fast-evolving technology;
- collaborate with other local, regional, and international regulatory bodies to establish consistent standards for healthy competition in metaverse; and
- develop effective enforcement mechanisms to mitigate violations of competition regulations within metaverse.

7.3 Assessing competition in metaverse

To ensure the fulfilment of the fair competition objectives outlined in section 7.1, regulatory bodies can assess the competitive landscape within metaverse. This helps them identify and address practices that hinder these objectives. They can then implement policies and regulations that promote a fair, efficient and innovative metaverse economy.

Metaverse market definition: An initial step in assessing competition in metaverse is the market definition (or identification) whereby the regulatory body should define the relevant metaverse market based on:

- Product substitutability: How easily can users switch to alternative metaverse products and services offered by different metaverse businesses?
- Geographic substitutability: Can metaverse users readily access similar products or services from metaverse businesses located elsewhere?
- Demand-side substitutability: Do metaverse users consider a group of products or services as close substitutes for each other?
- Supply-side substitutability: Can metaverse businesses easily switch development to meet demand for substitute metaverse products and services?

In some cases, a regulatory body can use the metaverse value chain as a tool to define metaverse markets for competition purposes, but it may not be the sole factor.

Benefits of the Value Chain Approach:

- Identifies Distinct Activities for Competition: The metaverse value chain breaks down metaverse into distinct activities referred to as primary and support activities. This can help identify potential areas where competition might be concentrated or limited.
- Highlights Bottlenecks: By analysing the metaverse value chain, the regulatory body can pinpoint activities where a single metaverse business or a few businesses exert significant control, potentially hindering competition.

Limitations of the Value Chain Approach:

- Focuses on Activities: The metaverse value chain primarily focuses on the activities. While valuable, it does not fully capture the competitive landscape, which is influenced by factors like substitutes and the broader metaverse market environment.
- Potential Oversimplification: The metaverse value chain might not reflect the complex reality of some metaverse industries. There could be overlap or interdependence between activities, and competition may not be neatly confined to specific activities.

Hence, the metaverse value chain is a valuable tool for regulatory bodies to understand the dynamics of competition within metaverse economy, but it should be used in conjunction with other frameworks for defining the metaverse market for competition assessment.

Metaverse competition assessment: The regulatory body should assess the level of metaverse competition in the defined metaverse market by considering the following factors, among others:

- Market concentration: The number and size distribution of metaverse businesses in the metaverse market. A high concentration indicates potential dominant undertaking by a few large players.
- Barriers to entry: Factors that make it difficult for new metaverse businesses to enter the metaverse market, such as high capital requirements, regulatory restrictions, or established brand loyalty. Metaverse market contestability aims at minimal barriers for new firms to start operations and leave if they're not profitable (if an existing metaverse business raises prices excessively, new metaverse businesses can enter, capture those high profits, and then potentially leave again if prices fall. This keeps prices in check and incentivizes existing metaverse businesses to be efficient).
- Market power of buyers and suppliers: The bargaining power of metaverse users and suppliers can influence competition. A small number of powerful metaverse users or suppliers can put pressure on metaverse businesses to raise prices or lower quality.
- Product differentiation: The extent to which metaverse products and services offered by different metaverse businesses are distinct. High differentiation can limit substitutability and reduce metaverse competition.
- Availability of substitutes: The presence of close substitutes can increase metaverse competition by limiting the ability of metaverse businesses to raise prices.

Metaverse market conduct: The regulatory body should assess the conduct of metaverse businesses in the defined metaverse market. Competitive metaverse markets rely on fairness to function effectively.

Regulatory bodies should assess prohibited conducts that stifle competition, including:

Collusion with Competitors (Horizontal Restraints): This involves agreements between competitors of metaverse businesses to limit competition (cartels). Examples include:

- Price fixing: metaverse businesses agreeing to set prices at a certain level, artificially inflating them for metaverse users.
- Market allocation: Dividing up a market amongst metaverse businesses, limiting their reach and metaverse user choice.
- Collusive bidding: Metaverse businesses coordinating a pre-determined outcome for a metaverse bid (e.g., agreeing on who will win a bid, preventing a fair competition for contracts).

Abuse of Dominant Market Position: When a metaverse business has a significant market share and power, it can unfairly leverage its position to adversely impact competition. Examples include:

- Predatory pricing: Selling metaverse products and services below cost to drive competitors out of business, then raising prices later.
- Exclusive dealing: Forcing suppliers or distributors of metaverse products and services to only conduct business with them, stifling competition.
- Tying arrangements: Requiring metaverse users to buy one product or service to get another, limiting their choices.

Anti-Competitive Agreements between Suppliers and Metaverse Businesses (Vertical Restraints): These agreements restrict competition in metaverse economy. Some examples include:

- Price constraints: Metaverse suppliers dictating the minimum price at which metaverse providers can sell their products.
- Exclusive territories: Limiting where metaverse providers can sell a product or service, reducing metaverse users' access.

Metaverse market competition enforcement: The regulatory body should consider one or more of the following enforcement alternatives if it deems violations as a result of its competition assessment in the defined metaverse market:

Prohibition of Agreements with Anti-Competitive Effects:

- Cartel-like behavior: If the cartel involves metaverse-related price fixing, market allocation or bid rigging, the regulatory body can completely prohibit it.
- Exclusionary agreements: The regulatory body might ban agreements that unfairly exclude new entrants or disadvantage existing competitors in the defined metaverse market.
- Excessive information sharing: Sharing sensitive information like pricing strategies or customer data could raise competition concerns. The regulatory body could limit the scope of information sharing allowed among metaverse businesses.

Conditional Approvals with Safeguards:

- Structural remedies: The regulatory body might require changes in the metaverse businesses' structures, such as divesting certain assets or creating firewalls to prevent sensitive information exchange.
- Behavioral remedies: The regulatory body can impose specific conduct limitations on the metaverse businesses. These could involve restrictions on pricing, service levels, or user interactions to maintain fair metaverse competition.

- Monitoring and reporting requirements: The metaverse businesses might be required to submit regular reports or undergo audits to ensure they comply with the set conditions for fair metaverse competition.

Clearance without Restrictions:

- Efficiency justifications: In some cases, the agreements demonstrably lead to efficiencies that outweigh any anti-competitive effects, the regulatory body might approve them without restrictions. For example, joint metaverse related research and development ventures can be beneficial if they lead to innovation without unfairly restricting the metaverse market.
- De minimis agreements: Agreements with a negligible impact on metaverse competition may be allowed without formal approval by the regulatory body.

Additionally:

- Fines and penalties: For certain violations, the regulatory body can impose fines on metaverse businesses involved in anti-competitive practices.
- Divestment orders: In extreme cases, the regulatory body could order metaverse businesses to divest certain assets or lines of businesses if their conduct creates an unmanageable risk to metaverse competition.

The specific enforcement decisions depend on the nature and the severity of violation, the relevant metaverse market dynamics, and the competition laws of the jurisdiction. The regulatory body should strive to balance the potential benefits of anti-competitive behaviour, such as increased efficiency or innovation, with the need to maintain a fair and competitive metaverse market environment.

In some cases, the regulatory body should cooperate with competition authorities (regulatory bodies) in other countries to enforce metaverse competition laws and address international anti-competitive practices. Those cases would require international cooperation and collaboration arrangements between regulatory bodies related to metaverse.

8 Metaverse economy enhancement

Metaverse economy exists in a broader context within digital transformation and is influenced by several factors which directly and indirectly affect or impact it. These factors may be considered secondary in addition to the metaverse value chain activities; however, they tend to affect how various metaverse value chain activities are conducted.

8.1 Identification of metaverse enablers

The term metaverse enablers is used to include other value-adding supplementary factors and activities in addition to metaverse value chain. More specifically, below, comprise, inter alia, the metaverse enablers in this Technical Report:

a. Digital Laws, Regulations and Policies

b. Standards

c. Digital Skills Programmes and Courses

d. Metaverse Research and Development (R&D) Programmes

e. Metaverse Entrepreneurship

f. Metaverse Financial Incentives

g. Digital Platforms.

Digital Laws, Regulations and Policies

Digital laws, regulations and policies determine and shape various actions regarding digitalization. However, there are differences among laws, regulations and policies.

More specifically, digital laws and regulations can be thought of as digital rules promulgated by legally authorized bodies such as a government agency or an appropriating agency. They are both enforced to the full authority of the law; and violations of both may incur penalties (e.g., fines, imprisonment).
However, laws go through a legislation process before being enacted as laws, but regulations are created by an authorized agency (e.g., a government agency) and do not have to go through the legislation process. In some cases, regulations are formulated to implement a given law.
On the other hand, digital policy is a deliberate system of principles to guide decisions and achieve certain intended outcomes from digitalization. Policies are generally adopted by a governance body within an organization. In a broader form, a policy is a plan of action adopted or pursued by an individual, government, organization, business, and so on.

Hence, authorized agencies can formulate digital laws, regulations, and policies within their jurisdictions, where applicable (organizations can also formulate policies). Each of the three can be considered as an alternative (or potentially viable) instrument (or tool) to guide digitalization activities within a jurisdiction.

Digital laws, regulations and policies can address several issues. Some examples are given below.

- Digital transformation strategy – sets the vision, strategy, and related strategic performance indicators (at national, local and organization levels) for digital transformation.

- Data and data rights ownership – defines who owns data and data rights, rules for transferring or delegating ownership, etc.

- Data protection and security – defines who is authorized to process data and for what purposes, how integrity and accuracy is maintained, how to store, archive and dispose data, how to secure data to achieve confidentiality, integrity and availability.

- Data privacy – indicates how personal data can be stored or collected, how or whether data can be shared (exchanged) with other parties (e.g., anonymization, synthetic data).

- AI regulations – public sector policies and laws for promoting and regulating AI and AI ethics.

- Competition laws and regulations - defines rules to stimulate competition within a certain jurisdiction (e.g., anti-trust laws).

- Public sector procurement regulations (and private sector procurement policies) – may encourage and, in some cases, may include clauses to use procurement as a lever to boost digital (or specifically metaverse) economy.

Existence of digital laws, regulations or policies may enhance trust in digital systems including metaverse. Therefore, they play an important role in the overall metaverse ecosystem.

Standards

Standards ensure consistency through documented agreements for digitalization. Standards enable compatibility, conformance, and interoperability among digital systems.
Standards have several benefits as they:
- provide efficiency;
- enable further innovation; and
- avoid proprietary solutions and implementation decisions.
Hence, standards development organizations (SDOs) formulate various standards to address these needs. Standards, in some cases, can be industry specific (e.g., healthcare data standards), as well as industry neutral (e.g., generic open data standards) depending on the context and actual need.
Standards play an important enabling role in establishing a robust digital economy. Having commonly agreed standards catalyse and enable collaboration and cooperation potentially for metaverse innovation and solutions implementation as well.

Digital Skills Programmes and Courses

General digital skills availability may catalyse harnessing metaverse opportunities. Such skills certainly help in acquiring specific metaverse skills in addition to general ones. Availability of related training programmes, courses, certifications, academic degrees, and programmes will help boost metaverse economy.

Metaverse Research and Development (R&D) Programmes

Metaverse R&D programmes are programmes and activities (available in academic, private, and public sectors) that aim to advance metaverse knowledge and its applications. R&D programmes are precursors to innovating new metaverse products and services and to enhance existing ones. Since metaverse is a nascent concept, it can significantly benefit from R&D activities during its evolution and progression.

Metaverse Entrepreneurship

Metaverse entrepreneurship plays an important role in nurturing start-ups that can provide promising metaverse products and innovations to meet customer needs and expectations. Start-ups and new businesses are known for their agility and in adopting new technologies for real-life use cases while managing the risks and rewards associated with them.

Metaverse Financial Incentives

Financial incentives are monetary benefits offered to encourage certain behaviours or actions that would not otherwise have occurred. They can be used to foster a flourishing metaverse economy. Some examples of financial incentives include, among others, tax deductions, tax exemptions, tax holidays, lower loan rates, and investment subsidies. Utilization of these financial incentives, if any, will differ by jurisdiction depending on its specific economic priorities and structure.

Digital Platforms

A digital platform is a technology-enabled business model that creates value for an organization by allowing data exchange among different users. The platform brings users together to transact with each other. Existing digital platforms may accelerate innovation and implementation of digital services, including metaverse and its components as well. Digital platforms providing AI, data processing and management, digital twin, and blockchain services help facilitate a metaverse economy.

8.2 Metaverse enablers enhancement

The hitherto identified metaverse ecosystem enablers in section 8.1 can be utilized to potentially enhance the effectiveness of metaverse strategies and related initiatives/action items for implementation. A jurisdiction (local or national level) can utilize an appropriate mix of enablers to implement its own metaverse strategy. In other words, combinations of enablers can be used during the implementation.

In this context, jurisdictions are recommended to:

- capitalize on existing complementary regulations (e.g., data governance frameworks, emerging technology regulations) where applicable;
- utilize additional regulations, if and where needed, as policy levers and tools to catalyse implementation of their metaverse strategies by engaging a broad range of stakeholders;
- identify the appropriate regulation tool which is fit for purpose (e.g., guidelines, frameworks, policies, standards, regulations, laws) depending on actual need;
- leverage certification programmes, if deemed feasible and beneficial, to incentivize and encourage both the public and the private sectors to support implementation of metaverse

strategies (successful implementations may be recognized under certification programmes and would encourage similar or novel implementations);

- overcome knowledge and awareness gaps for metaverse, where needed, through education and training programmes, university programmes, vocational programmes, among others, to enhance skills and competencies and to disseminate existing publications in this area, which can be distributed to the public and interested parties as well as various related entities;
- conduct and/or develop targeted metaverse capacity building programmes in different industries, which require specialized topics and technologies knowledge and expertise (expertise, knowledge, and even awareness of different metaverse topics may not necessarily be readily available; hence, training and awareness programmes could be beneficial to close such skills gaps), if needed;
- consider boosting skills and expertise, where needed, among the public, as well as among policy makers (to avoid a potential barrier) by novel programmes such as peer learning, twinning among cities/nations, national, regional, and international metaverse cooperation and knowledge-exchange programmes and initiatives;
- develop recognition programmes for successful metaverse implementations, if deemed viable, to promote promising implementations, to award success and to incentivize sustainability;
- use procurement as a lever for boosting metaverse implementations, where viable (e.g., procuring trusted and high-performance metaverse solutions with well-defined specifications);
- consider using local and national governments' purchasing power as a lever to help shape the progression and evolution of a successful metaverse and related implementations;
- consider using financial incentives (e.g., tax breaks, reductions, exemptions, holidays, lower loan rates), if deemed viable, for fostering a rich metaverse ecosystem (suppliers of metaverse-related goods and services can be made eligible to utilize these financial incentives);
- consider developing Public Private Partnerships (PPPs) and other appropriate financial mechanisms, if feasible, to foster a rich metaverse ecosystem (successful metaverse implementations may have significant benefits and positive impacts; hence, both the public and the private sector have an interest in achieving them. This allows forming public and private sector partnerships (PPPs) whereby costs, benefits, and the risks may be shared among them. The public sector can opt to utilize PPP as a procurement alternative for implementing metaverse solutions);
- formulate and implement metaverse R&D programmes in collaboration with academia and the private sector to boost metaverse implementations, where deemed beneficial;
- consider developing R&D programmes and partnerships at city, national, regional, or international levels if deemed beneficial (metaverse as a nascent technology contains novel areas of research, which entail further exploration and development. R&D programmes may play a key role in enhancing innovation and knowledge in metaverse and boosting related intellectual property, which can then be put into practical use and potentially commercialized);
- nurture an enabling innovation ecosystem and involve and incentivize entrepreneurs and SMEs to address metaverse challenges and requirements;

- leverage incubators, accelerators, hackathons, and so on. for enriching the city innovation ecosystem around metaverse, if feasible and beneficial (since metaverse is relatively a novel technology which commands significant innovation, entrepreneurship and SME support would be significant to improve its chances of success in the long run); and
- develop new, or utilize existing, digital platforms to enable implementation of metaverse solutions, where deemed beneficial, while upholding competition and compliance with existing laws and regulations.

These recommendations are potential non-exhaustive enhancements for metaverse ecosystem enablers, which can help accelerate the implementation of metaverse strategies and related action items. Each jurisdiction depending on its specific circumstances and context can utilize an appropriate mix of enablers.

8.3 Evolution of business models on metaverse

The metaverse, with its virtual, interconnected and immersive spaces – often powered by technologies such as virtual and augmented reality, although it is in an evolving phase – has captured the imagination of entrepreneurs, technologists and investors around the world. The new economic aspects to be observed with the advent of the metaverse cover several areas, from business opportunities to transformations in the job market and consumption models. One of the main aspects is the virtual economy, in which users can carry out transactions, invest in digital assets and participate in virtual markets.

Telecommunications operators are not immune to this digital revolution and must incorporate new approaches to projecting investments in network infrastructure, demand for services and revenue into their business models, so that their businesses can keep up with the challenges that the transition to the metaverse will bring to the telecommunications scenario.

8.3.1. Metaverse and telecommunications infrastructure projections

The presence of some basic aspects has been considered in the characterization and implementation of modern metaverse environments, as observed in recent studies [01]. Among these aspects, the following stand out:

• **Virtual worlds** – existence of one or more worlds that serve as a means for social interaction, for moving around and visiting spaces and for the use of digital assets;

• **Three-dimensionality** – perception that the virtual space is three-dimensional;

• **Real-time rendering** – presentation of the virtual space and its objects and characters, constructed in real time during the user's movement and interaction with the environment; fast communication and interoperable network – support high-bandwidth, low-latency data connection between user devices (cell phones, computers and VR glasses) and the metaverse, as well as the possibility of integrating, via network, maintained services by different providers, such as digital asset portfolio management, 3D simulation environment and a single, sign-on mechanism with linked avatar;

• **Scalability** – possibility of significantly extending the space of virtual worlds and the quantity of digital assets, as well as people present in these worlds, including creating new worlds;

• **Persistence** – preservation, in the virtual environment, of the effects of actions carried out by people with digital elements, as much as possible or necessary;

• **Synchronicity** – experience of synchronous communication and immediate interaction with digital elements to be perceived by all users who share the same virtual space.

The advent of the metaverse and the dizzying growth of immersive applications require telecommunications operators to make strategic investments aimed at supporting broadband services, focusing on the expansion of mobile (especially 5G and 6G) and fixed (fibre-optic) networks.

Firstly, the implementation and improvement of mobile networks, in particular 5G technologies and the future prospects of 6G are key pieces in this technological puzzle. High-speed data transmission, along with low latency, is essential to support the immersive applications present in the metaverse. Operators must channel significant investments in this area, considering not only transmission speed, but also the density of connected devices, aiming to provide a flawless experience.

In the same way, the expansion and modernization of broadband networks are crucial to meet the growing needs for speed and data capacity. In the context of the metaverse, where digital immersion is the norm, fast and reliable connectivity is critical to delivering seamless virtual experiences. Operators must invest in advanced technologies, such as fibre-optics, to ensure adequate bandwidth and minimize latencies.

Another crucial aspect to be addressed is the bidirectionality of data traffic. In the metaverse environment, interaction between users is constant and diverse. Operators need to improve their networks to efficiently deal with this characteristic, ensuring fluid and instantaneous communication between virtual participants.

The transformation of infrastructure into software-based is an essential evolution for operators to adapt to the metaverse scenario. Flexibility and agile upgradability become imperative to deal with constantly evolving demands. Furthermore, investing on a large scale to process blockchain, supporting the intensive use of IoT (Internet of Things) and machine-to-machine (M2M) communication is fundamental to building an integrated and efficient digital ecosystem.

Finally, edge computing emerges as a fundamental piece in technological architecture. Data processing close to generation and consumption sources, minimizing latency and optimizing efficiency, is essential to sustain the demands of the metaverse and immersive applications.

Given this panorama, investments in cutting-edge technologies, such as 5G networks, 5G post, fibre-optics and all elements of edge computing and data processing, become imperative to guarantee stable and high-speed connectivity, essential to meet the demands of the metaverse. Strategic investments in these critical areas will ensure telecommunications operators are competitive in the market and will play a key role in building and supporting the exciting universe of the metaverse and immersive experiences to come.

8.3.2. Metaverse and demand projections for telecommunications services

From the perspective of the number of users accessing telecommunications services, the advancement of the metaverse should not cause major impacts on current demand projections, which may remain in line with the growth that has already been predicted for fixed and mobile broadband services.

Thus, the perception is that the integration of data from the real world with the digital world with “digital twins” is a key factor for the metaverse and that it will not result in a significant increase in the demand for user access to telecommunications services.

In turn, one of the main factors to be considered is the significant increase in data traffic on telecommunications networks arising from the metaverse. Thus, although there is no significant increase in user access to telecommunications services, the massive consumption of data, driven by immersion in virtual environments and increasingly complex interactions, will have direct impacts on operators. In this context, the demand for bandwidth and high data consumption become key indicators.

A crucial point to be introduced in the analysis is the bidirectionality of data traffic over the Internet. In the metaverse, this characteristic gain even greater importance, since interactions between users are no longer limited to the simple transmission of one-way information. The ability of

telecommunications networks to efficiently support this bidirectionality becomes fundamental to guarantee a fluid and immersive experience in the virtual environment.

Faced with this scenario, operators face the challenge of adapting their infrastructures to deal with the exponential increase in data consumption and demand for bandwidth due to the growing complexity of virtual interactions.

8.3.3. Metaverse and revenue projections

Telecommunications operators should explore various strategies to increase their revenue from the metaverse, taking advantage of the opportunities presented by this virtual environment. The question that must be evaluated is how to become sustainable considering the high data consumption of the metaverse? Some aspects must be analysed for the sustainability of the sector:

Metaverse Specific Packages

- **Offer High Performance Connectivity and Special Plans for Access to the Metaverse:** Offer specific data packages and services for broadband network, both fixed and mobile, users who want to access the metaverse, providing a dedicated and optimized experience.
- **Differentiated Pricing Models:** Create pricing models that cover quality of service and bandwidth specific to metaverse experiences
- **Differentiated charging for Bandwidth and Quality of Service**

Strategic Partnerships with Metaverse Platforms

- **Collaboration with Metaverse Companies:** Establish strategic partnerships with developers of virtual environments, games or other metaverse platforms to create exclusive and integrated offerings.

Development of Specific Applications and Services

- **Creation of Metaverse Apps:** Develop specific applications for the metaverse that provide unique experiences and can generate additional revenue.

Loyalty Programmes and Exclusive Benefits

- **Offer Benefits to Frequent Users:** Establish loyalty programmes and offer exclusive benefits to regular users of the metaverse who use the operator's services.

Telecommunications operators can maximize their opportunities in the metaverse by aligning their offerings with the specific needs of virtual users, providing reliable connectivity, differentiated services and strategic partnerships that add value to the experience in the virtual environment. Innovation and agile adaptation are essential to effectively explore this new digital landscape.

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