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The Impact of the Metaverse on the African Digital Economy

By

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ABSTRACT: This paper explores the transformative potential of the Metaverse on the African digital economy, focusing on how this emerging virtual environment can reshape various sectors such as finance, education, and commerce. The Metaverse, a convergence of augmented and virtual realities within a shared digital space, offers unprecedented opportunities for innovation and economic growth. As Africa continues to experience rapid digital transformation driven by increased internet penetration and mobile connectivity, the integration of the Metaverse could accelerate economic diversification, foster new business models, and create job opportunities across the continent. However, this paper also examines the challenges associated with this transition, including digital inequality, infrastructure gaps, and regulatory concerns. The study offers insights into how policymakers and stakeholders can harness this technology to drive sustainable development.

KEYWORDS: Metaverse, Digital Economy, African economy.

INTRODUCTION

When considered in the context of Augmented Reality (AR) technologies, every human observer represents the default client of such augmented reality services. User with AR-device represents an augmented type of observer with sensors e.g. GPS, and various kinds of biometric devices. The AR device is able to sense user's personal environment in a massive scale resulting in an unprecedented potential for surveillance and control [1]. A small number of powerful commercial agents (and large technology

conglomerates) are expected to dominate the ecosystem of the Metaverse [2]. Given the distrust between nation-states and other powerful agents, virtual environments are also likely to be militarized against cyber warfare. Furthermore, social and economic phenomena such as social bubbles and social media addiction is likely to be deceptively escalated due to the virtually inhabited Metaverse encouraging, if not enforcing, people to maintain a meaningful 'virtual presence'.

The evolution of the internet has led to a concept of a collectively shared virtual space, called as the Metaverse, allowing its users for social interaction, economic and recreational activities on networked digital platforms [3]. This technology has long been part of science fiction literature and has taken root in our popular culture. However, the rapid development of a suite of enabling digital technologies such as Virtual Reality (VR), Augmented Reality (AR), Extended Reality (XR), Mixed Reality (MR), Spatial Computing, Artificial Intelligence (AI), Edge Computing, Internet of Things (IoT), 5G etc., has made such a conception plausible. The metaverse can be considered as a prototype of the future internet i.e. fifth-generation Internet-based services.

1.1. Background and Significance

The Metaverse aims to simulate real-world environment, meanwhile, remains in the computational world [4]. The concept of the Metaverse has two criterions. Firstly, it must be called 3D environment. Users are not limited to walking, but also transversal movement in the 3D environment by vehicle or aircraft. Such as: Grand Theft Auto, Warframe. A 3D buckle is not enough called the Metaverse, the large network such as: cyberspace, network and information management from class. Another component of criterion aims to be virtuality [5]. First, the Metaverse is a simulation of the real world. Anything in the Metaverse should not cross the simulation, so some kind of special link in the simulation is needed. At the same time, the simulation appeals are: the avatar is not only the entity carrier in the Metaverse, but also the proxy of the user. Anything she doesn't do, touches and listens in the Metaverse is same to the reality [1]. This article is based on the bgp route objects, the characteristics of the network reachability analysis, the generation of the route objects, and the logical reasoning, can make reachability analysis more efficient, as well as for some new ideas, and new theories about the nail of the bgp route object are subject to further research, so the whole article object is to be able to promote through our thought, for the route to reach the study of the plant more comprehensive better.

1.2. Research Objectives

Metaverse is the new virtual world that people are now exploring [6]. As the world gradually migrates from web 3.0 to web 4.0, people are increasingly creating online avatars for their biological functions. Given its virtual presence, Metaverse is something that has drawn masses in recent times. As Meta (formerly Facebook) - launched its parent company it re-established its vision of creating a futuristic version of the world where people can create virtual worlds and connect with others inside and across them using the company's Oculus virtual reality headsets. Meta also believes that this is the next evolution of social connection, after the rise of the personal computer and the smartphones. For the purpose of public participation, the Metaverse is now attracting a significant investment as it continues to develop and expand. Aligning to all the above is the concept of African digital ecosystem. Masses in Africa are currently exploring digital platforms - these include humans and industries.

The objective of this paper is to provide an insight into how to understand the metaverse and the African digital economy as well as providing necessary information about these elements that will help better understand both aspects [7]. Pagination restricts a fuller treatment, but both topics are sufficiently broad to enable a deeper discussion where further engagement can be achieved by default. Nevertheless, we have highlighted some of these topics to assist thorough exploration of the potential growth of the African economy using recently developed technologies or inventions generally referred to as the 4th and 5th generation of wireless technology (5G) [8]. Some of the objectives of this effort are here listed: (a) Introducing next-generation technologies to African digital economy. (b) Adapting to emerging technologies from the developed countries in African digital economy. (c) Background comprehension of the metaverse concept from the digital economy standpoint. We hope that this paper will add to existing knowledge and be the go-to document for stakeholders and policy makers interested in the matters. This paper employs descriptive and content analysis methodologies to answer these questions.

2. Understanding the Metaverse

The metaverse aim at providing impact on real-world. This could be done by improving digitally

the effect of real-world objects into electronic files. These are sounds from movie characters, music, two dimensional digital products like photographs and text/scripts. These virtually driven items are used in the digital world and could be purely non-commercial or commercial as well.

Virtual worlds – these consist of dramatically rendered worlds with avatars and creatures enabled with intelligence ready to make decisions. talking heads – online voice-centric groups are supported by servers that are open to use or chargeable usage. social media – also known as social vr, sometime shares basic social platforms features. online games – online mobile and pc-based gaming worlds diffused reality – virtual products are embedded into the ‘real’ world. augmented and mixed reality – predominantly used in training, workplace assisting tool and also used for home training and many others

INTRODUCTION It is challenging to describe the metaverse directly. Fundamentally, the metaverse refers to a grouping of entirely or partially interconnected, synthesized and computer-based virtual worlds that facilitate business, social, and computational activities for end users with the aim of stimulating sensory perception by a user in a realistic way [9]. The experiences and contents are built such that a user is able to work efficiently in the metaverse effectively and complete more business than they could do in a comparable interpersonal condition [1]. The components in the metaverse differ extensively between different sectors, however, the below list of different metaverse categories are used to get an understanding of what types of experience varieties in their functional usage and the way a human can interact with the metaverse.

2.1. Definition and Evolution

This author has also attempted to address the Metaverse, but he took an evolutionist approach, analyzing almost thirty years of literature on Virtual Reality, with New Retro Worlds, Second Life, and Virtual Worlds being its different stages in evolution. Herbert (2021) defined it simply as “the Metaverse is not one single complex of worlds, a flat cyberspace, a simple website, chat room or game [...], instead, the Metaverse is a network of many interconnected worlds, [...], inhabited by millions of people working and playing in massively collaborative and networked

immersive virtual reality environments” (Herbert, 2021, p. 1). However, the research ostensibly failed to see the relation between the Metaverse and real-world urban contexts of countries (Tibken, 2021). It contributed considerably to the formal scientific analysis of the metaverse and its relation to smart cities, the present paper aims to analyze the evolution of the metaverse at least in cyber-population terms, its growing and modern use in pandemic times caused by COVID-19.

A wide range of applications, including miscellaneous MMORPGs, decentralized blockchain-based exploration games, digital art galleries, and vast virtual shops, have sparked a key interest in the cryptocurrency community, attracting vast investment and users’ number. However, the range of different applications has led to some decent confusion in defining the metaverse [5]. It is still poorly understood and lacks much structure and consensus (in the scientific literature, much less Open Access one) about its ontology and evolution [10]. [9] have pointed out to at least a few key features of the metaverse that include “the seamless integration of online services into a single platform, harmonization between the real and virtual worlds, fully integrated digital identity, virtual citizenship, and digital civic life.

2.2. Key Technologies

The Metaverse combines three major forces to disrupt environments: AI, VR and AI block chain. AI, VR any AI block chain as three major enabling technologies in the areas of media and telecommunication to create deep link between real and digital environment at re-motely distributed IoV platforms. AI and its sub fields including deep learning, machine learning support us to create individual digital assets using virtual environment and allow hyper modified TV programming through premises Ray tracing technology at real time. VR is developed as a fine grained representation of digital world at different viewing angles, making it easier to implement simulated physical environment. Apart of block chain technology is used for application specific marketplace to enhance digi-tal assets, appearance, and it is required to live coupling of AI block chain decentralized or centralized integrated structure to create intelligent environment.[11]

The rapid advancement in technology leads to the concept of digital twins, parallel technical bridges connecting the physical and digital worlds. Development of digital twins is due to the technological evolution of IoT, cloud computing, big data, AI, VR, and augmented reality (AR), and it involves creating a whole or partial digital replica of a physical asset, system, or process. This is an edge oriented development to field of Metaverse as it is realistic and high-quality propose of the digital operations. One of the hot zones is digital prototypes or simulations which are so-called as digital copies of real-life digital assets in virtual worlds thus enabling to conduct various tests, experiments and investigations which is impossible in a physical world. Thus, the integration of these digital twins into a highly realistic visualization for multimedia representation is named as smart visual Metaverse.[12]

Metaverse concept was initially implemented in a virtual environment using PCs, but the implementation of IoT, big data, cloud technologies, network parallel computing, micro-electro-mechanical system (MEMS), nano-technology, 3D printing and management of social assets, and blockchain technology has led to the integration and development of the concept of "smart home" technologies based on Metaverse.[1]

3. The African Digital Economy

The strategy and framework for access and use of the future digital economy technologies – the Internet of Things, Artificial Intelligence, and 5G as well as the Metaverse are still important regulatory considerations. The regulatory and governance framework for these technologies provides space for "self-governance" and a "participation or co-regulation" approach. Metaverse could also pave the way. Africa's digital economy consists of the food, agriculture, fishing, financial services, e-commerce, logistics, and tourism industries, according to a 2020 survey by Nex Change. The formation of the Digital Economy Task Force was initiated by the African Union Commission to tackle the challenges.

Governments will concentrate on value-added activities in the ICT sector in Africa. The development of digital infrastructure will continue to be supported by state regulation of data

protection, privacy, cybersecurity, and digital safety. The pre-crisis landscape in terms of small islands and developing states in Africa and other populated or vulnerable communities remains weak, despite its increasing importance and efforts to protect local knowledge.

Trafigura is developing a blockchain system to make African commodity trade easier, more secure, and more transparent. Shipments can be checked by agents and customs authorities to ensure that they comply with all regulations and are handled appropriately. They can determine when a commodity moves from one place to another and which company made the delivery using time-stamped entries. As the industry progresses, businesses in Africa must highlight the importance of future workflows in the Africa context. Supply chain operations can benefit from the same ways—it's clear that improving the sector by leveraging better technologies will be crucial.

In East Africa, Kenya leads in e-commerce, while in Southern Africa, South Africa leads in m-commerce. Although digital transactions growing fast, banks, payment companies, and e-commerce platforms didn't yet gain popularity. Financial services' digital infrastructure should improve to provide a supportive foundation for digital trade. NFC is one of the most widely used payment schemes in Africa, with its M-Pesa / Lipa Na M-Pesa mobile payments methods leading trade.

Africa lags behind the global digital divide and the intra-Africa digital divide.[13] Wide access to affordable fast internet was necessary to move forward with the digital transformation, and investments in digital infrastructure and economies were encouraged in the national context. Africa is now listed as the world's second-fastest-growing region in internet connectivity following the global south's rate of mobile connectivity.

3.1. Current Landscape

Evidences also show that there are increases in what was known as Second Life, a game game from the: The game's owner is different from second Life, but they don't have a significant data allocation. They also introduced Instagram account and "Least Edition Graffiti, and sell digital sweet graphics. Members were even given the option to set the price of the merchandises and

set and the results tend to point out the pool is likely to change. In aromatic and digital policies an industry, nFT and Meta also increase the value of figures. The judgment also indicated that what appears to have driven the company to buy the company was the pervasive.

New conclusions on metaverse digital metaverse were released in the 4th quarter of the year 2021. When critically assessed they showed that blockchain and NFTs utility will grow over the period of time, putting value on the adoption of a new standpoint for the metaverse; block chain. The consequences were also welcomed by global policymakers inclusive of the United Nations, the world authority, G20 and other similar worldwide bodies. The word Almost 90% of U.S. young groups have already heard of NFTs and, despite their high level of ignorance about blockchain technology, 50% of them believe NFTs will have a prospect. Almost 40% of young Americans predict business models that combine NFT.

Opportunities for the Metaverse have increased, leveraging on the mass economic advantages in terms of virtual items, marketplaces and real estate [14]. A metaverse growth is here and is inevitable. Admittedly, these non-public metaverse exist within the virtual reality, and is difficult to discover and play for regular individuals. In early 2021, the CEO of FACEBOOK, Mark Zuckerberg announced the organization that will mount the metaverse in his particular capacities, affirming him as the skål who promises to increase the 'linked, mixed metaverse with two version.

3.2. Opportunities and Challenges

A virtual and immersive metaverse can improve the human social and economic performance in a variety of ways, potentially yielding significant societal benefits [14]. One of the vital applications for metaverse is a digital twin, which represents the digital replica of a physical product, service, or environment. Virtual reality (VR) & Augmented reality (AR) increasingly immerse the user in a singular and privately evolved experience, opening the door to new kinds of learning and interactive storytelling. Healthcare and medical centers can be examples of decentralized resources. Manufacturers can have digital twins of their equipment on client's site. On one hand, a city is, by default, a complex system with many intertwined systems. Generally, they can be from

a thermal one (environment, built), an infrastructure one (energy, transport) or an informational one (communication, platform for electronic services) on the other.

As a transformative, economically efficient, and sustainable digital technology for Africa, the metaverse requires measures to respect the native digital culture, languages, and intellectual properties. Indigenous languages and effective communication mechanisms should be integrated into the metaverse. The challenges of metaverse, including governance-, technical-, and social-related issues in the African digital economy, demand the collaborative efforts from digital economic sectors, governments, society, technical arenas, and international organizations. In terms of technical challenges, 3D asset file compression and distribution, real-time rendering, latency tolerance, data accuracy, and synchronizing ultra-precise renderings are tackled. Besides, security and protection measures for user privacy, especially for the personal sensitive data in the metaverse. Moreover, these issues require substantial global public and private investments.

The metaverse represents opportunities and challenges in the African digital economy [15]. To realize the opportunities and address the challenges of the metaverse, an African digital economy requires the necessary Wi-Fi, 4G and 5G telecoms, data centers, and sufficient bandwidth. Other crucial components include cloud storage, computing services, AI, edge computing, Internet of Things (IoT), and advanced human-computer interfaces.

Opportunities and challenges of the metaverse in the African digital economy

4. Intersection of the Metaverse and the African Digital Economy

Africa has seen the entry of traditional global digital technologies into its formation and development of its content and cannot afford to miss a more sophisticated virtual metaverse that is converging the basic structure of its predecessors. If Africa played only a marginal role in the formation and development of predecessors, it will have full agency in this new frontier. This can be managed through, inter alia, the strengthening of the required enabling legal and regulatory frameworks, the accelerating investment in high-speed, high-quality broadband infrastructure, and

the changing of the psycho-social attitudes – among Africans themselves – to trigger the extraordinary levels of innovation already being manifest at the grassroots levels. This will require not only an unprecedented level of coordination across government, industries, and the private sector but also involve the mobilization of the engines for innovation without crowding out the indigenous entrepreneurial fabric. This paper concludes by affirming the view that the metaverse represents several cutting-edge frontiers for the continent, and that half-hearted entries could exacerbate the regrets that the continent has long experienced during the vintages of global technological transformations.

4.1. Potential Benefits

The digital transformation of the African economy refers to the advances that the continent has been making in regard to its use of digital technologies. The continent has seen significant improvement in this regard, particularly in respect of mobile technologies. This transformation has delivered some significant economic gains for the continent, most of them in the mobile finance space. Nevertheless, there is a need for the next wave of the digital transformation that will see the benefits of digital technologies extend across all facets of the African economies. With digital technologies moving from the real to the virtual and the emergence of virtual worlds that are extensions of the real one, opportunities for African economies to improve on their current position have emerged. Unfortunately, the continent still has to fully benefit from the mobile wave of the digital transformation, at least through the use of mobile platforms to offer digital services to the markets. This paper argues that African economies stand to benefit significantly from the transformation of the digital economy through the uptake of the use of the digital platforms referred to as the metaverse.

4.2. Risks and Concerns

The African Union document is a call to arms that could be useful for all countries on the African continent. Here are some of the government's risks and concerns: it will be of some interest for all developing countries to work towards "an inclusive, respectful and equitable technological environment" in order to ensure "that the digital economy genuinely benefits all people from across the world and functions as an enabler for

sustainable development and social and economic progress", so as to prevent it from becoming "a driving force for intensifying global disparities".

The African Union's Smart Africa (Kenya, Rwanda, South Africa, Angola as member states) ambitious project to create a single digital market could also be severely affected by the Metaverse. Smart Africa leverages itself on the gradual integration of African regional markets. Already delayed, the project could run against educational, digital, cultural, and economic imperialism. The African Digital December 2022 published by the African Union and Smart Africa beautifully articulates the dangers: "the digital economy could intensify and exacerbate existing asymmetries between developed and developing countries further, and it may even lead to the digital colonization".

5. Case Studies and Examples

In September 2020, a virtual art exhibition of contemporary African art, co-hosted by the Banksy Foundation and Cryptovoxels via Tumblr, launched the gallery's first virtual reality gallery dedicated to African collectors. The virtual art room was designed by local Nigerian architects in Lagos to build a house in Nigeria's largest city. Visitors sign up for virtual reality and sign up to purchase digital coins worth the order.

Ivory Coast office cake and farm café, Cape Town luxury house, or industrial area in Lagos, Nigeria. In the metaverse, where New York City can be considered a country, a virtual reality simulation system may be using the space and equipment in which they are located. This can take place without a physical meeting, renegotiate the contract with the provisions of the amount, or obtain insurance to operate the equipment of Paymaya or drag-and-drop email again created in Nigeria. Payment can be made to the edge.

We can see the potential of the African metaverse in recent years through social media, augmented reality, virtual reality, and games. Here are some examples:

6. Policy and Regulatory Implications

In other words, metaverse activity takes place within and is inextricably linked with the economies and societies of a multitude of countries. It appears that the benefits and the costs of metaverse activity are highly imbalanced and uneven in this worldwide coverage. It also seems

that the alienation of major global metaverse platforms and their principal applications from prevailing elements of established public policies and regulatory systems is widening these imbalances and is a serious challenge for these established public policy and regulatory systems. In developing these new regulatory structures, it is essential for governments and international organizations – while mindful of the diversity of digital needs across global economies – to ensure that they construct and regulate the necessary metaverse infrastructure using a diversity of reflective and consultative processes that include the voices of consumers, NGOs, business and industry, service and content creators, metaverse platform operators, and local governments, and that they will result in a diverse ecosystem of companies and services in various sectors of the global digital economy. The goal must be a diverse and inclusive metaverse in which the public interest is met and is an integral part of social, economic, and human development. This chapter concludes with specific recommendations and action points both for African Union member states and for African business operators in the digital sector.

The emergence and development of the metaverse as an important element in the global digital economy suggest that, if structured in a way that is informed by and responds to the needs of users in Africa and other emerging and developing economies, the metaverse could play an important role in advancing economic and social development on the African continent. Currently, in some cases driven by techno-nationalist sentiments, governments and international standard-setting organizations worldwide are already developing policies and regulations to support the development of the metaverse. At the same time, the rapid development and deployment of metaverse tools, applications, and services, especially across global digital and telecommunications networks, also present public policy and regulatory challenges in a multitude of areas. These range from economic, finance, trade, competition, consumer protection, data protection, privacy, intellectual property, and the rule of law, across to social, media, culture, education, employment, labor and workforce transformation,

and the local content and the authenticity of virtual entities in virtual environments.

7. Investment and Funding Opportunities

At the early stages, investments with a strong ability to provide mentorship, access to resources, and networks are very important. Usually, this is connected with incubation and acceleration programmers. Later-stage funding is important to minimize the risk for more traditional venture capitalists. Additionally, the discovery and funding for non-conventional business models and projects are important for the sector to evolve and flourish. Many great businesses might not fit the traditional VC model due to their market size, their potential impact, and their rural and semi-urban markets requirements. Government funding, Department of Science and Technology Research and Development incentive rounds, and corporate social responsibility (CSR) funding are also required to ensure that critical and very early-stage innovation is not lost because of a lack of resources from within the original business or start-up.

Funding continues to be a critical ingredient in building successful incubation and acceleration programmers in the region. The global spotlight on emerging market ecosystems, especially around the rise of fintech and blockchain-related activities, has contributed to the growth of this investor base. In addition, there are various other top-tier investors looking for investment opportunities in the African market who can also contribute to the ecosystem. Given the dynamics and complexities of the African digital ecosystems, the availability and types of funding must be diverse to cater to the various stages of advancement of start-ups and entrepreneurs building their businesses.

8. Conclusion and Future Directions

We observed the supply side impact of the untapped source of revenue, i.e., African consumers' untapped demand for new digital goods and services; the shift of the game developer business models driven by global digital economies, and the opportunities offered by the ICT enabled digital goods and service markets to African national and regional development strategies. We have advanced the discussion and contribution to the practice and the research of the digital economy by providing grounded strategies

and research directions by which African governments and regional economic bodies can use information and communication technologies and the disruption of black economies by the metaverse to promote digital service markets and increase revenues.

This paper has demonstrated the impact of the metaverse on the African digital economy in the mobile and internet streaming services, and the education and health horizontal digital sectors. We have observed an ongoing expansion of digital markets as consumers increase and continue to have unsaturated demand for these new digital goods and service categories. We have also explored the demand side motivations including the digital tax accounts for governments' revenues, disbursement of the revenues by the governments for provision of digital services and goods, the gaining of new market and technological skills to administer the new markets, and the prevention of violence and crime by disrupting black markets selling illegal, fake, and defective products.

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