IMPACT ON DATA PROTECTION AND PRIVACY IN METAVERSE: CHALLENGES AND OPPORTUNITIES

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Abstract – The metaverse great potential for business, economy, and society are available as a result. A number of crucial issues remain unaddressed, and the study of their impact is nearly non-existent. They make a number of contributions in this work. Finally, we expand the scope of our contribution by emphasising some of the metaverse's far-reaching yet logical consequences in a variety of fields, not only in technology. They start by reviewing its underpinnings, then focus just on new privacy and security challenges posed by this new paradigm. They also explore possible study avenues throughout the report. Additionally, they feel the metaverse foundations, technologies and concerns presented here might open up a few new transdisciplinary study pathways in addition to being an intriguing contribution on its own..

Keyword: Metaverse, virtual worlds, multiverse, security, privacy, Meta

Introduction

As a portmanteau of the Greek words for "beyond/after," 'meta,' and "universe," there seems to be no agreed-upon definition of the term. In this incarnation of the internet, it is a speculation. An alternate economy or universe in which people may engage with one other in a lasting computer-generated environment is the most prevalent description of the metaverse.

It's called the "Metaverse" for a reason. A glimpse into the near future. The internet's next evolutionary step. The real and digital world is becoming increasingly intertwined. Because of the Pandemic's strict lockdowns, the immersive virtual and augmented reality industry has gained traction.

Real-time communication is possible in this virtual environment, where individuals may share and discuss their experiences. Microsoft describes it as "a new internet." Metaverse data protection will indeed be necessary due to the sheer volume, variety, and speed about which users will be generating data. Deep neural networks for accurate hand tracking and deep learning for eye tracking are already being employed in VR and would very certainly be used in metaverse, as will other AI-based VR technologies, B. Falchuk, S. Loeb, and R. Neff, (2018).

"A metaverse is a collection of permanent, multi-user, shared, 3D virtual places that are linked to the actual world and integrated to form a cohesive and perpetual virtual cosmos." Avatars let users to engage with one another and also the items, applications, services, and organizations found therein. "Initially attributed to the vision of American

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author and tech advisor Neal Stephenson in his 1992 science fiction novel Snow Crash, however the conception may be traced back to at least Plato's The Cave." [1], As Ethan Zuckerman masterfully illustrated in a recent edition of The Athlantic1, metaverses have previously provoked intense disputes among both tech specialists and the general public, in the wake of more or less effective attractor systems (e.g., Second Life).

While several of the world's most powerful digital companies recently revealed large investments and ambitious plans for the establishment of new and future metaverses, they made headlines again. Microsoft, Epic Games3, and Meta4—the technology holding companies under which Facebook was (coincidentally) rebranded—are among them. In particular, Mark Zuckerberg (Meta and Facebook CEO) saw the metaverse also as Internet's next evolutionary step. A cyber-physical Internet 3.0 enabled by technology that outperforms the current mobile Internet paradigm.

To understand the huge excitement around the metaverse, one must understand his concept of that as the next evolutionary step in both physical and digital networking capacities, as well as in our social lives. There are a number of recent technology developments that will be used to establish the first metaverses. Virtual reality (VR) and augmented reality (AR) are two examples of technologies that will be utilised to build immersive 3D environments. Similarly, digital twins will make it possible to transport, view, and exchange physical items across the metaverse. Other sensors, including those built into next-generation smart gadgets, will transmit real-world data into the metaverse, allowing avatars in virtual settings to mirror real-world motions, J. D. N. Dionisio, W. G. B. III, and R. Gilbert,(2013).

All these tangible products and virtual things will indeed be available in the metaverse's marketplace. For the sake of the avatars, they will be built as non-fungible tokens that can only be used on them (NFTs). Next generation networking technologies and algorithms would make the metaverse much more widespread than existing social media and social platforms.

Main challenges

There are no agreed-upon standards for interoperability between the many metaverses because the technology underpinnings are continually developing. In our opinion, this is an important aspect, since consumers and developers alike want to be able to effortlessly move and exchange virtual assets and experiences between multiple platforms. As they look to the future, they expect that many significant platforms would have to change their business models in order to function in a metaverse that is interoperable. Due to the vast volume of personal information that might be at risk, the protection of privacy and security of computer data are also top priorities. Mental health is also a worry, as virtual worlds may cause people to avoid real-world obligations and relationships.

> *"Looking ahead, we anticipate that many large-scale platforms will need to adjust their business models in order to operate within an inter-operable metaverse"*

Challenges of Metaverse

With the IPO of Roblox, Meta Universe's concept stock, on March 10, 2021 in the United States, Meta Universe began to accelerate its emergence into the public eye. Some individuals are quite hopeful about Metaverse and call it the "Next Generation Internet." Many giants have likewise built out the meta world one after another, aiming to be the first one to eat crabs. In the subsequent five years, the social behemoth Facebook transformed into a meta-universe company and continued to invest $5 billion annually in the establishment and growth of meta-universe. Roblox, which was backed by Tencent and just went public, has a market value of $43.4 billion; in April, Nvidia said that it will construct Omniverse, a real-time simulation and collaboration platform for organisations, a virtual work platform known as the "engineer's meta-universe." The titans all have enormous meta-universe-spanning moves, and the competition has increasingly intensified.

There are both advantages and disadvantages to new items. However, the truth is that the meta-problems universes will be too great for most humans to handle. Intellectual property problems, data protection and privacy difficulties, legal issues, currency and payment system issues, technological limits, along with limited public acceptance, are just

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a few of issues that must be addressed. High capital investment and if the Metaverse is becoming a very monopolistic sector are further challenges.

1. Intellectual property disputes

In each new online space, there is always the question of who owns the intellectual property (IP) rights to the content that is generated there. No, you can't file a lawsuit if your brand is used illegally in the virtual world.

In the virtual world, things become murky if content assets are created or generated based on real-world assets. Legally, users of virtual worlds must seek permission to exploit others' intellectual property rights, but Metaverse will certainly lead to numerous associated intellectual property conflicts. The situation is still apparent. Companies and creators today have a difficulty in ensuring the protection of their intellectual property rights both in the physical world and online. Those content and product producers must work together with Metaverse-affiliated firms to monitor for trademark infringement on a regular basis. As a result, suppliers are indeed concerned about how far Metaverse users can go with the material or property they produce. M. Maximo and D. Grider (2021)

You may engage with the planet and other people in a virtual world. Depending on the value of both the content, the subject of intellectual property ownership may arise. The real-world norms of joint copyright and joint ownership are already incredibly complex. The interplay between different parties' interests will be more difficult in a virtual world. A related question is whether the meta-material universe's is recognised outside of it. If indeed the material created in the meta-world is to be recognised in the real world, what processes must be followed? Authenticating and verifying ownership & integrity are only a few of the complexities involved in each of these processes.

Data protection and privacy

In the actual world, privacy data protection has long been a major problem, drawing the attention of everyone. In today's Internet world, there is a great deal of data and privacy protection, as well as the meta universe. Unlike the Internet, the Metaverse has a lot more data and privacy. There's a good chance that in the future, Meta Universe will be the result of the efforts of many different businesses. The much more troubling problem for customers and users will undoubtedly be how to manage and secure data across numerous firms and how to maintain the protection of personal information.

Data collected by Metaverse would be unparalleled, including physiological responses, exercise, and even brain wave data, which will be captured in unprecedented detail. Will this data employs a specialised security firm to look after the safety of its data? Who is liable and what are the ramifications for real-world users if meta-universe users' personal data is stolen or misused? Metaverse creation necessitates careful attention to the protection of personal information, which each organisation must take into account.

However, many as 57% of worldwide consumers expressed concern about the privacy of the Internet in some kind of a questionnaire poll conducted by the Center for International Governance Innovation and Ipsos. More than 24,000 Internet users between ages of 16 and 64 were surveyed in 24 countries for the study. Web users in every area express worries about privacy at least half of the time.
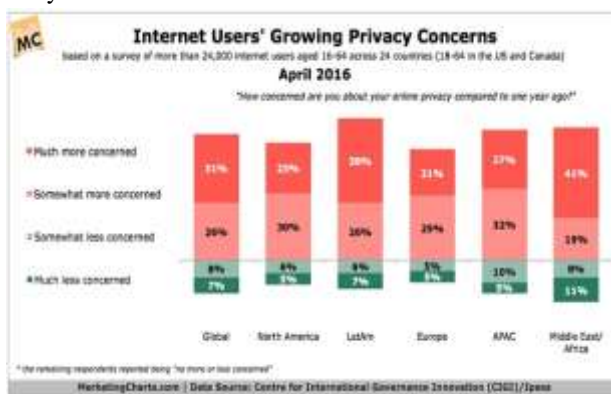
Global users express worries about internet privacy and security survey findings.

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Huge flow is an essential part of the success of the meta-universe. The meta-universe has the energy it needs to continue growing in a healthy manner with the help of the flow. Several people throughout the world are concerned about the safety and privacy of their personal information. On the route to the rapid growth of Metaverse, it is clear that improving data security and reducing people's worries about privacy were challenges that have to be tackled.

Legal challenge

As effectively and more efficiently monitor unlawful activity, national laws have been pushed to adapt as a result of the Internet. Regulating today's large amounts of data and artificial intelligence is becoming more commonplace. As Metaverse evolves, so will the rules of physics as we know them. In order to better regulate Metaverse on a national scale, it is unavoidable that relevant legislation be drafted.

There are more and more virtual areas available to people all over the world as Meta Universe develops. It is possible for Meta Universe to connect and communicate with a vast number of users, but that also allows users to be free of legal and regulatory constraints. Attacks or fraud can easily infiltrate the system. What the world must do is address the difficulty of determining jurisdiction and building a legal structure to ensure that virtual space was secure for users.

Is perhaps the Meta world subject to the same rules as the physical universe? Depending on the situation, what country's laws should indeed be followed? In the meta-universe, there have been many instances of bad language or unlawful activity. Is it possible to utilise them as evidence with in real world to punish individuals who breach the law, etc.? Existing laws must be constantly updated to keep up with the rapid evolution of the Metaverse.

As a virtual environment, the rules of the actual world ought not to be implemented there, according to certain opinions. In the actual world, governments will have to deal with all of these issues.

Currency and payment system

Because the meta-universe is still a world, it necessitates the use of a money system to facilitate trade and keep the world running smoothly. In other words, how should Metaverse handle payments?

Most people throughout the world are familiar with the US dollar as a unit of currency. People who aren't from the United States may have an issue with the use of the U.S. dollar in the metaverse. In contrast, the usage of other currencies is less likely to be accepted by that of the general public than the US dollar.

According to Bitcoin advocates, the currency may be utilised throughout the meta-universe and is incredibly secure and reliable. People are sceptical about its safety and reliability, however, after recent instances. A cyber group blackmailed Colonial Pipeline, the country's major fuel provider, in June 2021, and the oil pipeline was shut down as a result. A total of $4.4 million in bitcoins were exchanged between Colonial Pipeline and the hackers to get everything back to normal. 63.7 bitcoins was reclaimed thanks to the help of the US Federal Bureau of Investigation (FBI). Bitcoin's security and irreversibility of transactions are its main advantages. After the event, the FBI collected 63.7 bitcoins, which led some to question bitcoin's previously described qualities.

Another key problem Metaverse will face when it becomes popular is the necessity for a safe and highly reliable payment mechanism and a widely accepted currency.

Technical challenge

Virtual reality and augmented reality (VR/AR) will allow individuals to enter the metaverse in the future. This technique has the potential to overcome the problem of "showing" us the virtual world up to a certain point in time. However, at present time, this technology could only send visual and auditory information, and can transfer information via other perceptual faculties including such touch, smell, or taste. A realistic virtual environment allows us to encounter extra perceptual capacities, hence increasing the impression of realism inside the environment. As a matter of fact, this is indeed a technological problem that must be handled. M. Zhang, (2020).

Input parameters, such as speech, gestures, or actions, must also be entered into the virtual environment. Today's VR/AR mostly relies on holding sensors (or wearing gloves) to input parameters into the virtual environment. In comparison to when the sensor is not held inside the real environment, this decreases our feeling of realism.

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Although there are certain motions and gesture detection technologies based on machine vision currently, these have indeed experienced numerous practical challenges, including the field of view and occlusion.


VR/AR device with handheld sensor

The insufficiency of tactile feedback is another issue. It appears that today's technology is momentarily unable to address the problem of making our hands and bodies feel the items in the virtual world. The number one player in the movie depends mostly on force feedback garments all over his body to perceive virtual objects and perceptions. To have a full feeling of body while wearing such a piece of clothing, since everyone agrees to do so, the meta-universe will remain a technological problem. People's willingness to spend money on a costume that allows them to enter the metaverse is another question.

Another technical problem is Metaverse's high computational needs. Actual-world simulation, scene rendering, and interactivity with other characters (including real people and computer-generated artificial intelligence) all need the computer's use. It takes a lot of computational power to do this. Developing the computational power necessary to run Shangyuan Universe also is a major task. Despite the enormous computing power, there is an issue with energy usage. As computing capacity increases, so does energy consumption, and as a result, stronger hurdles to entry into the meta-universe will indeed be placed in front of consumers.

Popular acceptance

There is also the question of whether people's acceptance of the meta-universe can maintain pace with its rapid development. For this purpose, a poll was done by Forrester Research (a consulting firm in the United States). A total of 1,263 persons were surveyed for this study, with 572 of them being from the United States and 691 from the UK.

**Which of the following describe the thoughts about the metaverse?**
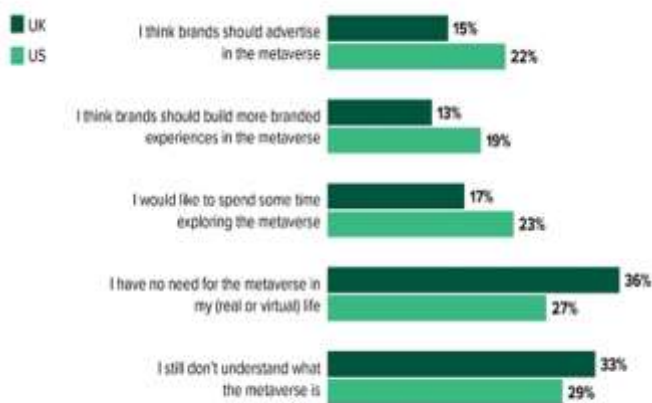
People's reaction to the meta universe
Source: Forrester Research

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"The study results suggest that 27% of Americans and 36% of Britons believe that the metaverse is a non-essential item that has no impact on either the actual world or their personal virtual experience." More than a quarter of Americans and a third of Britons don't know what the term "meta universe" means. There are just 13% of Britons and 19% of Americans who agree that firms should aggressively extend and improve the experience of the Metaverse world and its universe. 23% of Americans and 17% of Britons are prepared to put in the time to explore the metaverse.

As part of its research into emerging technologies, Loup Fund (a fund that keeps tabs on the latest developments in areas "such as computer vision/artificial intelligence, financial technology, robotics, self-driving cars, and VR/AR) conducted a poll to gauge public opinion on the Meta universe."
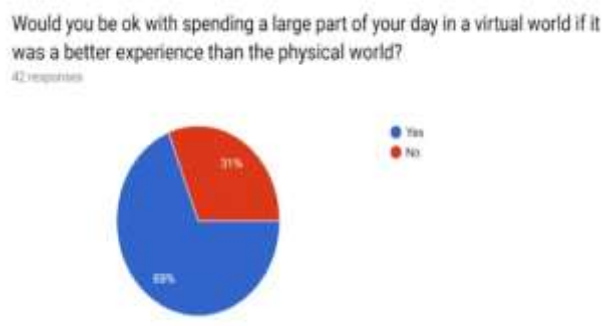
70% of individuals are eager to spend more time in the virtual world, according to the survey (provided that the virtual world has a better experience)

Source: Loup Fund

Nearly two-thirds (69%) of those polled believe that when the virtual world provides a better experience than reality, they'd be prepared to spend more time there.

Challenges in Global Data Privacy and Protection

The personal information private and secure is no simple feat. Professionals in the field of information security should categorise data according to its level of risk and use suitable security technologies and tactics to secure it (both sensitive and personally identifiable information). Cresci and Di Piotro, S (2021).

Many significant and satisfying technical improvements have been made feasible due to data over the last decade. The problem, though, is that protecting consumer data privacy and preferences today. First, individuals need to know what your organization's top data privacy and protection concerns are before you can appreciate the impact and necessity of global data privacy.

1. **The Growth of Data is Exponential**

Data is expanding at an ever-increasing rate. in excess of 1.7 megabytes of new data is created every second. Customers' personal information and sensitive personal information must be protected by organisations. Breach Level Index, reports of a public platform for documenting data breaches since 2013," over 9,198,580,293 data records have been misplaced or stolen.

More and more firms are putting themselves at risk due to weak security policies, even while data has risen tremendously in the previous decade. Information that may be used to identify individual (PII) is a major source of worry when it comes to protecting the confidentiality of personal data. Managing millions of data records might be difficult because of the veracity and volume of data in today's technology-driven environment.

2. **Cost of Maintaining Data Privacy**

An organization's income could be lost by millions of dollars if a data breach occurs. Furthermore, as the Ponemon Institute discovered, The average breach cost $3.62 million in 2017. In the next two years, a data breach would be 30% more likely to occur at a company. A wide range of organisations will apply harsh regulatory penalties even

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when an organization's security is breached. "Companies inside the European Union who suffer a significant security breach might face fines of up to 4% of their Adjusted Gross Revenue or €20 million (whichever is greater)." It really is imperative for organisations to invest in some kind of a variety of important security technologies, including data archiving, backup, and redundancy infrastructure, to guarantee that their data is safe.

3. **The Number of Open Vulnerabilities**

As per CVE, "the most authoritative source for information security flaws, over a quarter of all known vulnerabilities were found 15,000 disclosed vulnerabilities reemerged last year. It is more than 56% greater than the total number of vulnerabilities that existed in 2016."
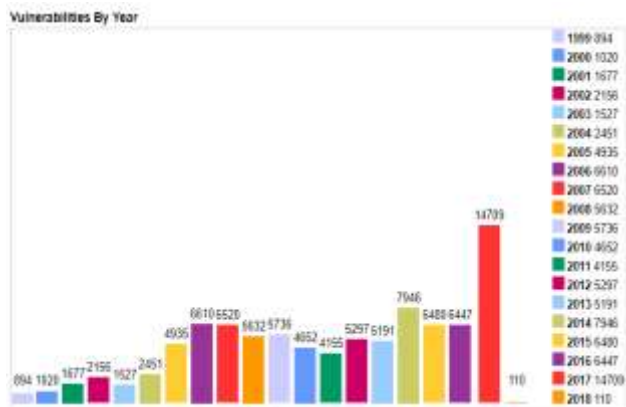
Public data breaches have reached unprecedented levels due to the fast expansion of vulnerabilities. More than 1,254 data breaches were discovered by Dark Reading in the first half of this year.

Each year, hundreds of patches are published, making it difficult for IT security administrators to keep track of them all. Being prepared for emergencies is critical, as is having a documented patch management strategy or template in place, along with understanding the reality of patch management best practises.

4. **An Advanced Technology Landscape – IoT and Mobile**

There is no doubt that the Internet of Things (IoT) is a serious issue for all security experts. An overwhelming majority of information security professionals (90 %) believe that IoT security is much more important than network security for the future of computing.

IoT companies are doing nothing when number of connected devices increases at an alarming rate.

Security experts need to rethink BYOD rules in light of the Internet of Things, complete an IoT readiness plan, detect all linked IoT devices on your network by scanning the network The network must be constantly monitored with IDS/IPS, SIEM technologies, and other sophisticated security analytics to find out what is going on now with company network, applications, and data.

5. **Human Error Creates a Level of Complexity**

Human errors may have a substantial impact on your data security and privacy. Human mistake, according to several security experts, seems to be the greatest threat to data privacy and security. Weak passwords, accidental data deletion, and phishing schemes may all be the result of staff who aren't up to speed on security issues, have privileged account access, visit the websites that aren't meant for them, and so on. You and your team of security specialists are responsible for creating a security awareness and training programme that empowers the staff and reduces risk. End-user data leakage may be prevented with data loss prevention solutions, whether the leakage is deliberate or accidental.

As individuals can see from the numbers, safeguarding data is no small task. Information security is riddled with hazards and roadblocks. Individuals may increase the organization's security posture or maturity by following the advice outlined above.

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BACKGROUND AND RELATED WORK

Several of the metaverse's foundational technologies are already in existence or in an advanced level of development. While some of these technologies are now in use, other are still some years away. Following this introduction, they'll go through the fundamental aspects, traits, and functions of the metaverse as well as some of the potential long-term routes it may go. They begin with — and later develop — Zuckerberg's view of the metaverse, as it's the most extensive of all those put forward thus far without losing generality.

A. Core Elements, Characteristics, and Functionalities

- **Activities:** In the metaverse, we have a virtual world or substrate that can host and link a wide range of applications. Since the metaverse has a wide variety of uses, so do the activities that people could engage in there. The metaverse's extraordinary networking options make it a great place to meet new people. In the metaverse, users would be able to engage in more traditional methods of communication, such as friending and chatting with others through audio and video conversations. Existing messaging and videoconferencing applications will be integrated into the metaverse as one method of making these features available.

- **Immersiveness:** During the last decade, they've seen the Internet get mobile, allowing us to access our online services and social networks from nearly anywhere. At the moment, however, the usage of displays and mobile devices limits our ability to enter and experience virtual environments.. The metaverse, from the other hand, could make it feasible to use AR and VR to explore online virtual environments. Metaverse's pervasiveness and immersion are two of the greatest and defining qualities of the metaverse, achieved by an unparalleled merging between virtual and real worlds, R. Di Pietro, M. Caprolu,(2021).

- **Interoperability:** The metaverse may be thought of as a unifying framework or substrate that unites the many applications and services that are embedded within it from an architectural viewpoint. Since a result, interoperability is a key feature of the metaverse, as users may interact with everything in a multitude of ways. For example, kids will be able to engage with many programmes at the same time, just like we can on our desktop computers or mobile devices. For general-purpose physical devices, this level of app compatibility is already commonplace and anticipated.

- **Beyond Current Technology:** The present definition of the metaverse, its applications and activities, as well as its essential features and qualities, primarily based on existing and generally well-established technology. As a result, the creation of a metaverse that supports this vision is projected to happen within the next several years. Metaverses, but at the other hand, offer to bring additional and ground-breaking functionality, far above the capabilities of present technology.

OBJECTIVES

The main objective of the research is:

• To see where metaverse technology capabilities influence virtual team project procedures and outcomes.

• To back up our conceptual model and show how technological capabilities, actions, and outcomes interact.

• Participants were able to combine communication strategies while dynamically constructing real-time, three-dimensional visual artefacts thanks to communication, rendering, and interaction capabilities.

STATEMENT OF THE PROBLEM

In terms of how teams interact in some kind of a metaverse, there is still a lot to learn. There is still a lot of work to be done on our conceptual model after this investigation. For example, the connections between cultural synchrony and coordination merit additional investigation. Process losses and profits can also be studied.

No benefits or losses there in procedure were recorded (Nunamaker, et al., 1991), furthermore, there seems to be indirect evidence to indicate process benefits related to synergy based on the data obtained. Synergy seems to be a process gain that occurs when members use knowledge in a manner which that original holder did it's not because the member has different information or abilities.

SIGNIFICANCE OF THE STUDY

The 'Metaverse'. A picture of the future. The internet is about to take another giant step forward. The physical and digital worlds are becoming increasingly intertwined in our daily lives. It really is possible for people in this virtual globe to share their experiences and communicate to each other in a virtual environment in real time. Metaverse is described by Microsoft as "a new internet." Artificial Intelligence (AI) applications will be required to analyse the vast amounts of data that will be generated by users in the future. Deep neural networks for accurate hand tracking and deep learning for eye tracking will also most likely be employed there in metaverse, where virtual reality (VR) technologies now leverage AI technology.

LIMITATION

While the study has a number of limitations, each drawback provides an avenue for further investigation. There was a lack of previous teamwork among the participants in this study; individuals had a fair amount of expertise constructing VW objects. As a result, the study had a somewhat narrow scope due to the time constraints of the participants. The project's artificiality also poses a constraint, as this was not a job that most virtual project teams could encounter. There was no need to leave the VW to complete the job or to transport the finished products. As limiting as the study's project deliverable may be, it offers a chance to rethink the concept of tasks as well as the objects associated with them.

SCOPE AND AIM

The purpose of both the study was to examine how the employment of metaverse technological capabilities influences the process and outcome of virtual team projects. The findings back up our theoretical model and show how technological capabilities, behaviours, and outcomes are intertwined. While each technical capacity contributed to the project's execution and results, a lot of the environment's strength came from the interaction of these several technologies working together. It's time to rethink how to use the visual and three-dimensional power of an environment. There are many ways in which VWs were different from typical collaborative technology.

Participants were able to mix and match communication methods whilst dynamically constructing three-dimensional visual artefacts in real time. The conventional dependence on written or spoken communication to achieve a common understanding was lessened by such skills. Instead, researchers used the capacity to see it and touch a thing to create a common understanding.

EXPECTED OUTCOMES

The arrival of the metaverse seems approaching. To avoid the scrutiny of the public and because it's merely a great commercial opportunity. Neither of these reasons is valid. But we're at the beginning of the singularity, this is becoming a reality. To put it more succinctly, because it's the right moment. Miniaturized sensing devices with the computation and communication capabilities of laptops have been brought to our attention by the rapid advancement of technology "(e.g., economics, politics, industry, social relationships, etc.), F. Salahdine and N. Kaabouch, (2019)."

While 5G and 6G should close the remaining connectivity and sensing gaps, the social acceptability of an ever-increasing data recording & sharing pace has contributed substantially to the metaverse's allure. Machine learning and AI algorithms are currently capable of predicting human wants and actions with remarkably excellent accuracy, and that they are only going to get better.

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