

UT Metaverse: Beyond Universitas Terbuka Governance Transformation and Open Challenges

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Abstract—The Open and Distance Learning (ODL) system as we know is among the field that will be altered by Metaverse technology due to the benefits it offers. Various initiatives for embracing the Metaverse for distance learning are now underway. Universitas Terbuka (UT), the earliest government-mandated university for managing ODL in Indonesia, is also now at the first stage of preparing to harness the benefit of the Metaverse. This initiative is called Universitas Terbuka Metaverse (UT Verse), a Metaverse framework architecture developed by UT encompassing all its business processes. Towards this purpose, UT Verse Audit Centre (UTVAC), an instantiation as a sub-UT Verse, is proposed. This paper presents the complete architecture of the UT Verse as the foundation of the UT governance transformation to be a cyber university and the initiative for the VAC. As both initiatives are still in their infancy, we aim to share our lessons learnt and highlight the challenges to obtain feedback for mitigating their ongoing developments as earlier as possible which might be costly otherwise.

Keywords—Universitas Terbuka, Open University, Metaverse, Virtual Audit Centre, University Governance Transformation

I. INTRODUCTION

One way to characterise the Metaverse is as a future version of the Internet in which users are able to connect socially and professionally in shared, permanent and immersive virtual environments that are persistent over time [1]. In both literal and symbolic terms, the concept of the Metaverse is continually being developed. With early adopters and corporations reaping real-world advantages, its potential for triggering a new wave of digital disruption is becoming more obvious [2, 3]. We've seen this before in technological transitions like the rise of the internet, followed by social media, mobile, and the cloud. Everything from employee involvement to customer experience, omnichannel sales and marketing, product innovation, and community development may be impacted by the metaverse [4]. This includes Open and Distance Learning (ODL) [3, 5].

In fact, in ODL context, Metaverse offers students a better and immersive experience in learning processes so that they can be able to visualise the teaching materials in the e-learning classes that might be tedious to be interactive, exciting, and gamifying [6]. As UT is experiencing a University Governance transformation, this initiative to embrace Metaverse that is essentially beyond what is expected to be Cyber University (CU), in many ways, is required. This is not only because the great benefits offered by harnessing

Metaverse in ODL mandated to UT, but most importantly it addresses the shifting paradigm to re-creation and connection knowledge in an open space learning processes [7].

Withstanding all these benefits, the initiative to materialise the Metaverse concept is not without challenges. Not only is the concept itself still in a nascent stage, but what is more is there is no lesson that can be learnt by UT to adopt and adapt in realising the initiative. In other words, to the best of the authors' knowledge, this paper is among the first that contributes to describing the harnessing of the Metaverse in ODL. In the context of the challenges of embracing Metaverse, with more than 2000 academic lecturers and staffs, a half of million students located across Indonesia in 39 UPBJ (Unit Pembelajaran Jarak Jauh/Distance Learning Unit) and only less than 15% of them who have a representative internet access [8], this initiative is even more challenging. The fact is that Metaverse is characterised by a persistent, self-sustaining, infinite, interoperable, and in [1, 6] web powered by virtual reality (VR) and augmented reality (AR). This means a set of representative Information Technology tools to assist learning processes between students and teachers in these particular environments is crucial.

However, as the great benefit it offers and the positive disruption potential by way of ODL processes earlier highlighted, UT is initiated to utilise Metaverse to address the challenges. UT per se is experiencing digital transformation as a part of university transformation to be fully autonomous higher education: PTNBH/State University as Legal Entity. This is as shown in Figure 1. Towards this, in this paper, we define a Metaverse framework as the foundation for UT in Metaverse which is named UT Metaverse (hereafter UT Verse for short) and as an instantiation to embody this initiative, a sub-UT Verse for Virtual Audit Centre (VAC) in UT Verse described in this paper. We also demonstrate the prototype of this initiative later in this paper. Design Science Research (DSR) in Information System (IS) [9, 10] is employed as the methodology to frame this development and the evaluation [11] of the prototype.

This paper comprises seven sections. First is the Introduction, explaining the background and motivation of the research. The second is related to Metaverse in ODL and VAC. The following section is about the proffered solution as the lesson learnt, and the fourth describes the methodology employed in this research. Subsequently, Sections five and six present the initial prototyping and challenges. This paper is then concluded by the Discussion and Conclusion Section.

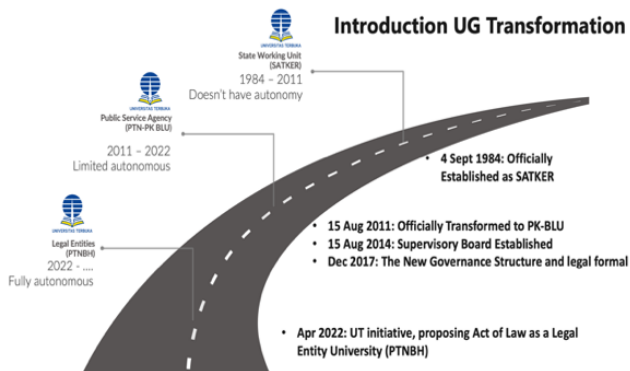


Fig. 1. The UT governance transformation roadmap.

II. RELATED WORKS

A growing body of literature recognises the importance of improving User Interface and User experience (UI/UX) in ODL systems [12]. Particularly since the Pandemic Covid-2019 hit the world, all the social and learning processes were restricted to Work From Home (WFH). While the learning process can be efficiently managed from home through existing e-learning and video meeting system, its effectiveness was challenging. This is due to the fact that its learning experiences cannot replace face-to-face interactions [13].

In this context, Metaverse is envisaged as the most representative paradigm to address this issue [3, 14]. This is because Metaverse offers its users more affluent, more interactive, immersive possibilities in the learning process [15]. It is a post-reality cosmos in which physical reality and digital virtuality coexist in an ever-changing multiuser environment.

UT, since its establishment, has been a state-mandated university to offer a learning process in ODL mode. This particular characteristic directly sets IT as the core of all its business processes, ranging from academic activities, administrations, financials, etc. The fact that UT's students are not only across Indonesia but also the Indonesians oversea who aim to pursue higher degrees renders the reliance on IT becomes more crucial. However, as this implies that the students' and teachers' meetings are facilitated by a learning management system (e.g., e-learning) and video-recorded materials, the effectiveness of the learning process becomes a concern to many scholars [16, 17].

Acknowledging these issues in the first place, UT has put tremendous efforts into defining innovative ways to improve this, for instance, through Panutan (office automation Information System: <https://panutan.ut.ac.id>), Promise Terbuka (Procurement Information System: <https://promiseterbuka.ut.ac.id>) and SIPPP (Planning and Accountability Information System: <https://sippp.ut.ac.id>) among others. Figure 2 presents the roadmap of UT's digital governance transformation. All these efforts are with the aim to materialise UT as the leading cyber university in Indonesia.

Recognising these concerns on the one hand and the Metaverse on the other, UT is now taking a leapfrog to incorporate them beyond its ongoing IT governance transformation. What is more important is that we have entered the Metaverse. Like TikTok, YouTube, and Facebook, it will soon be everywhere. The way we educate children and train teachers must keep pace with technological innovations that open up new immersive and imaginative worlds for them to explore. When educational advancements lag behind

technological advancements, educational opportunity is defined by the latter rather than the former. With the development of educational applications aimed for usage on smartphones and tablets intended for adults, this is what occurred. Researchers, educators, politicians, and digital designers have a unique opportunity to shape the future of the Metaverse while it is still being built. As such, the initiative to leverage the Metaverse aims to define what is best for ODL when it comes to embracing the technology.

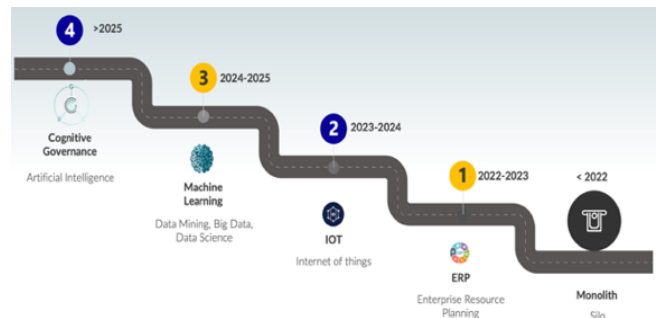


Fig. 2. UT digital governance transformation.

Previous studies have explored the relationships between the Metaverse and its efficacy in ODL [12, 18]. [12], for instance, posited that from the lecturers' perspectives, adopting the Metaverse in the learning process, although challenging, is optimistic. However, as some of the surveyed lecturers are not native digital, factors such as learning cost and technology anxiety are the major issues that need to be addressed in addition to the IT infrastructure provision. On the other hand, from the students' perspective, various issues emerge as the manifestation of their apprehensiveness that the Metaverse does not motivate them to succeed but wastes their time [19].

Taken together, what types of gamification that might attach students' attention, the benefit they perceive from them, or whether they help the students to succeed instead of procrastination to learning engagement, interaction, and peer collaboration are among the issues to be concerned to developing the Metaverse for ODL [14]. Thus, in this paper, instead of sharing a complete instantiation of UT Verse and/or UTVAC, we present the proposed architecture and an instantiation of it in a very nascent stage. The aim is to provide constructive feedback as early as possible during the development stages.

III. RESEARCH METHODOLOGY

This research, by nature, is a Design Science Research (DSR) in Information Systems (IS) [9]. This is because in this research, the IS artefacts will be developed as a result of demonstrating the concept earlier explained. In other words, the focus of the research is not to test nor create a new theory, but rather to solve real problems. That is to say, the goal is to develop a new IT artefact to address the university transformation that goes beyond the digital transformation [8].

Different kinds of artefacts, such as constructs, models, methods, and instantiations, are produced as a result of DSR research [10]. This is seen from the point of view of the product. To ascertain this research with its compliance with the DSR paradigm, we follow [20] that describes the methodology in DSR seven research stages, as follows:

TABLE I. DSR GUIDELINES FOR UT VERSE DEVELOPMENT.

Design research cycles	Our artefact design
<p><i>Relevance cycle:</i> identifying problems and the artefact type</p>	<p><u>Stage 1: Design as an artefact</u></p> <p>This research aims to develop UT Verse as a complete Metaverse framework for UT governance transformation and demonstrating an instantiation as an embodiment of a sub-UT Verse, that is UT VAC. This UTVAC serves as a showcase of learning process in learning process of financial auditing at UT.</p>
	<p><u>Stage 2: Problem relevance</u></p> <p>Metaverse has a great potential to offer improvement in ODL. This is because Metaverse allows a more student engagement particularly in distance learning by which students and lecturer are met mostly through online media: e-learning, video content, etc. By harnessing gamification, a new approach in a more interactive and excitement will induce student to learn more for they own benefit.</p> <p>However, Information and Communication Technology (ICT), prevalence of internet access across Indonesia will be the major challenges as Metaverse is a 3D internet that requires persistent and real-time internet connection. Let alone a sophisticated Metaverse gadget that should be equipped by all the Avatars, the end user representation.</p>
<p><i>Design Cycle:</i> developing and evaluation the artefact</p>	<p><u>Stage 3: Design evaluation</u></p> <p>The DSR evaluation is about measuring the efficacy and effectivity of the to-be-developed IS artefact, UT Verse. The aim is to ascertain (1) whether the to-be-developed UT Verse works as it aims for; and (2) whether it works in the specified conditions.</p>
	<p><u>Stage 5: Research rigor</u></p> <p>As in DSR of IS, once built, the evaluation of the UT Verse is the next to be proceed. Both development and evaluation are undertaken rigorously and conducted to both developers and the end users alike. The aim is to acquire the feedbacks to improve the application.</p>
	<p><u>Stage 6: Design as a search process</u></p> <p>The DSR is an iterative research methodology by default. Therefore, the building and evaluation procedures will be kept active until they meet all the requirements previously itemised. That is the condition in which the developed artefact/prototype, the UT Verse works as it aims for. Those iterative processes are guided by the constructive feedbacks from a previous condition.</p>
<p><i>Rigor cycle:</i> research contribution and communicating of the developed artefact</p>	<p><u>Stage 4: Research contribution</u></p> <p>This research contributes to developing UT Verse as a general architecture for UT to harness Metaverse. It will be future platform in distance learning process at UT as the benefit in improving students' engagement and immersive experience in distance learning. In addition, an instantiation of UT Verse, that is UTVAC will be developed to demonstrate that (1) Accounting and auditing processes can be transformed to Metaverse since it can be used to teach, educate, and provide continuing professional development for those who work in that world's metaverse version, and that (2) UT Verse is viable as a concrete platform for UT to</p>

<p>enter Metaverse. This work will pave the way to the better ODL in the future.</p>
<p><u>Stage 7: Communication of research</u></p> <p>In this stage, this research will be presented to academics and professional, in particular to those who are interested and work in this domain. This is conducted verbally in workshops, conferences and/or journals. The presentation encompasses the initial development including the one presents in this paper. These presentations are also with the aim to expect feedback for the later improvement of the to-be-developed artefact.</p>

IV. PROFFERED SOLUTIONS

This paper seeks to contribute to the issues raised earlier by demonstrating the initiative of UT Verse specifying the Virtual Audit Centre (VAC). However, as UT Verse Virtual Audit Centre is part of UT Verses to be created to support UT's long-term goal of university governance transformation initiative, a complete architecture of it needs to be defined. It is drawn in Figure 3. As can be seen, on top of the architecture is ultimately the main objective to be achieved by all the digital transformation initiatives currently being undertaken and for years to come at Universitas Terbuka. This is essentially the value to be generated by all these ongoing efforts.

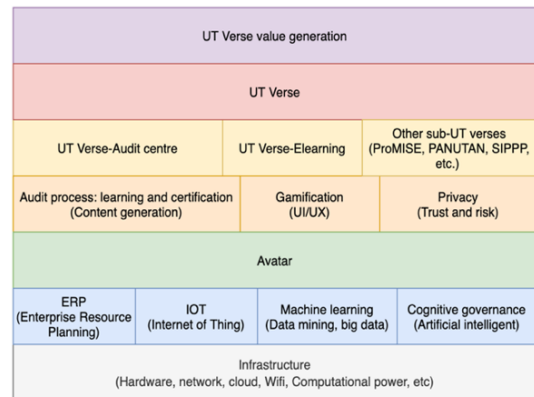


Fig. 3. The architecture of the Universitas Terbuka Metaverse (UT Verse).

However, as the UT Verse will be the backbone to pursuing such an objective, revisiting the value beyond the existing one is required. This is because embracing Metaverse means that digitalised all the business processes at Universitas Terbuka is "only" the steppingstone for a more diverse, rich, and immersive experience in ODL processes [7, 14]. Guaranteeing such an objective persistently in all digital transformation activities, including the distance learning process, is challenging [21]. The first step towards this is addressing the demand not only for more effective and efficient but also achieving these objectives is providing a better experience [22] of the learning environment in ODL. UT has been in an ongoing project to instantiate this purpose. As first, UT Verse is now in the development phase of materialising a sub-UT Verse –Virtual Audit Centre (VAC). As this is part of a larger work to transform UT into a Cyber University in Indonesia, a concrete technological foundation needs to be developed. In this context, the UT Verse framework is orchestrated. In what follows, we describe all the elements in each layer.

A. Infrastructure

As in Figure 3, a representative infrastructure is essentially the foundation of the Metaverse. This is because Metaverse is a software run in three-dimensional (3D) computer simulation representing the real world virtually [3, 23]. In other words, users will explore the metaverse with the assistance of technologies such as virtual reality (VR) or augmented reality (AR), similar to how we traverse the Internet with a mouse cursor today.

In addition, Artificial Intelligence (AI), blockchain technology, and 5G and Beyond (B5G) will power the Metaverse, enabling peer-to-peer interactions and supporting novel, decentralised service provisioning ecosystems. This will result in a blurring of the lines between the physical and virtual worlds. The Metaverse is expected to become a reality soon. Therefore, an advanced infrastructure with computational power to support the development and interaction is highly required. It includes the network infrastructure and the secured cloud based for the storage, including blockchain technology to ensure privacy, etc.

B. Decision-Support Tools

Above the representative infrastructure layer is the applications that better support the decision-making system. This layer essentially supports UT Verse's long-term goal, as seen in Figure 2. As UT is now transitioning to be fully autonomous (State University as Legal Entity/PTNBH), both effectiveness and efficiency in all the university business processes should be guaranteed. This is not only to ensure that all the optimisation is achieved but, more importantly, to pursue the competitive advantage. PTNBH means the university is governed fully autonomous as a private sector.

Thus, to be able to achieve such objectives, empowering the university's business processes with all the supporting tools is mandatory. For instance, equipping the university with the Internet of Things (IoT) facilities to monitor all the resources: electricity, the entrances and all the business units for efficiency is needed. In the context of this research, all these supporting applications will be connected to the UT Verse to ensure that they can be optimally utilised.

C. Avatar

Avatar is the representation of a user in the Metaverse. In other words, avatars represent themselves digitally in the Metaverse. Avatars would be the primary means through which users could express themselves virtually [24]. The concept of Avatar has been widely used in many applications, for instance, in Blogs, Social media such as Facebook, WhatsApp, etc.

In the Metaverse, a human user's digital image mirrors their actions and interactions with other users. In social interactions in the Metaverse, the appearance and design of avatars may influence user perceptions, such as a feeling of realism and presence, trust, and body ownership. As such, the avatar has a key role in shaping how the virtual social interaction performs in the multi-user scenarios inside the metaverse.

As avatars are increasingly used in a wide range of virtual settings, research should focus on more than just their aesthetics, as described above. [25] posited that there should be at least six concerns in the relations between avatar and the

metaverse, as follows: 1) avatar user behaviour; 2) avatar and their context of virtual environments; 3) avatar-induced user behaviours; 4) user privacy; 5) fairness; and 6) connections with physical worlds. In our context, as UT is obligated to serve all its students administered in the 59 academic centres across Indonesia and overseas, each representation in UT Verse should be adequately managed and effectively understood.

D. Content Generation

The next layer of the UT Verse is the learning processes through interaction between the avatar and the learning centres. This layer's contents will be massively generated due to interactions in the learning processes. As we might envision, in the real world, a student from a particular ODJ unit (UPBJ/Unit Pembelajaran Jarak Jauh) will interact with a tutor for any given issue. As they interact, they will generate content: tasks to be done, the answers in text, images, and video, the discussions, etc. In a similar vein, this applies if a student interacts with the system, other students, or staff with the system. As more than half a million active students and staff at UT, their day-to-day interactions will massively create content.

Avatars serve as representations of content providers who work in virtual environments. These digital creations may be connected to their physical equivalents in certain cases, but they can also live only in the digital realm [25]. Thus, learning processes, for instance, for improving one's capability can proceed in this layer. In addition, the gamification elements to improve the engagement with the Avatars and the privacy issues will allow users to create enormous content in this context. While gamification is about putting game elements into a non-gaming context to improve user experience in the learning process [15], privacy, including trust and risk, will be the concern to the users as they all need to be authenticated in the Metaverse [25].

E. UT Verse Audit Centre (UTVAC)

This layer is essentially an instance of UT governance transformation. As earlier described that although highly challenging, UT governance transformation is now underway. The aim is to transform all the business processes in the university to be digital, from academics, administration, finances, coordination, leave requests, etc. All these processes would go beyond these by embracing the UT Verse. However, as the concept of Metaverse per se is still emerging, materialising such a thing would be extremely difficult. Thus, as a showcase, UT will begin by defining the UT Verse Audit Centre. This is a sub-UT Verse that aims to provide an audit centre at Metaverse.

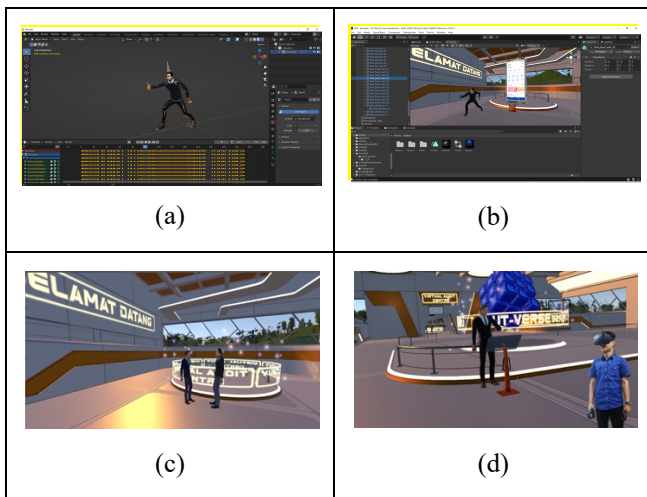
Metaverse accounting and auditing may benefit from virtual reality technology since it can be used to teach, educate, and provide continuing professional development for those professionals who work in that world's metaverse version, which has been conceptualised. Virtual reality can be used to test different patterns of behaviour as well as represent the real world, as many reports, articles, and books have noted [26].

Others have added that virtual reality can be used to test different patterns of behaviour and represent the real world for accountants and auditors [27]. There are no penalties for making wrong judgments in virtual reality since it mimics

real-life scenarios and helps accountants build communication, leadership, and collaboration skills [28]. Furthermore, research and articles on virtual reality and education in various scientific fields all agreed that virtual reality has a positive impact on educational outcomes, and through it, students can understand the many scenarios related to ethical dilemmas that occur in business practises by observing potential consequences and making decisions to solve concrete situations [27].

V. INITIAL PROTOTYPING

As earlier described, once the UT architecture is thoroughly described, the next stage is to create an instantiation using the framework. In this context, we begin by building the VAC. Figure 4 capture the development processes UTVAC.



Short footage demonstrating the UTVAC can be seen on the UT channel at this link: <https://bit.ly/3cN2bpC>. In Figures 4 (a) and (b), the animation of Avatar is developed using Blender™ and Unity™. It is then visualised as UT Verse in (c) and (d). Due to space limitations, we only show these four snippets of the development and visualisation stages of the UT Verse and UTVAC.

VI. CHALLENGES AND FUTURE RESEARCH DIRECTIONS

In this paper, UTVAC is an instantiation to demonstrate the framework we follow in pursuing UT Verse. All the ways looked at having some worth and provide a rich supply of essential actions and suggestions to be learnt. The results presented in this paper showed that specific issues still need to be clearly defined and articulated in the context of employing Metaverse in ODL. However, due to space limitations, we only present some of our priorities as follows:

- Representing human emotion.** Emotion is the element that describes us as human. However, the fact is that existing computer vision algorithms are not equipped to record and reflect users' emotions, behaviours, and interactions in real-time. As a result, another input modalities may be introduced to increase avatar granularity. For example, current body sensing technology may improve the avatar's features and reflect the user's emotions in real-time.
- Identity.** When it comes to the actual world, the subject of personal identity and representation is one that can be answered in a very basic manner. But when we talk about virtual worlds or the Metaverse, it makes one ask what exactly will be the components that comprise an individual's identity in such places. And, perhaps most significantly, how to even demonstrate that you are the person you claim to be, rather than someone else or even a bot attempting to imitate your life. While there are more than a half of a million active and registered students of UT, this will be the issue due to the ODL model. Thus, a sophisticated technology to authenticate the users is extremely required.
- Representative IT infrastructure.** The introduction of the Metaverse engine will surely increase the need for bandwidth during the massive data traffic volume necessary to power the Metaverse engine. While the fact is that UT is mandated to exist across Indonesia with various internet access and IT infrastructure. This is not to mention that the UT students might live in the area in which all the supported IT gadgets do not exist. In fact, only 85% of them are with these conditions [8]. These issues raise the challenges in the different level as these basic IT infrastructures are out of the scope what UT can control.
- Capable storage system.** The metaverse is projected to link all the world's locations. In the future, everything will be digitised, including physical things, systems, and users' avatars, large-scale fine-grained maps, and so on. Thus, astronomical volumes of data are produced. Due to the restricted network capacity, uploading such large amounts of data to cloud servers is unfeasible. Blockchain technology, on the other hand, is evolving at an accelerated pace. To ensure the decentralisation and security of the metaverse, it is feasible to use blockchains in the data storage system. However, what is best this technology to be equipped in our context will challenges us for the development of the UT Verse and the subset of it. As UT Verse all its subset (UTVAC) is the new concept in UT per se even for the rest of the world to materialise, the intention to adopt and the continuance use will be extremely challenges. These issues have been acknowledged decades ago by various scholars [29] as the consequence of innovation in disruption the existing situations.
- Content ownership protection.** NFTs, also known as Non-Fungible Tokens, have ramped up the pace of their popularity growth and have been generating news recently. This has attracted more investors and users to the digital assets and tokens that are now being traded. In the same way that NFTs currently represent real-world objects, granting and proving ownership rights for art, music, videos, and a great deal more, the challenge will be to create a unified system that could be used to verify the possessors of virtual assets in the UT Verse. This will be similar to how NFTs currently represent real-world objects, granting and proving ownership rights for art, music, videos, and a great deal more. This becomes the concern as digital products can be easily transferred, copied, modified, and so forth. Thus, protecting the content ownership hinders these and also guaranteeing integrity.
- Interoperability 3D asset.** A single 3D asset is represented by numerous files since there is no common file format for 3D content. In addition to being interactive and location-aware, 3D material may be moved about and

re-arranged as needed. The file size of 3D assets is enormous. So many essential tools and infrastructure are lacking for developers to be able to create better and more scalable for 3D or AR or VR applications across various platforms and for a variety of functions.

VII. DISCUSSION AND CONCLUSION

In this paper, we presented the UT Verse framework and its instantiation, UTVAC. This is part of a larger work of UT to transform and disrupt the existing ODL model to be more immersed, interactive, and gratifying. Ultimately, these initiatives aim to go beyond the digital transformation UT is pursuing. As this is part of the larger project in UT and the core of UT governance transformation, we aim to share our lessons learnt. The fact that UT is a state-mandated university in ODL, ensuring that the learning process has to be effective is the utmost objective.

Thus, by sharing our ongoing initiatives and progress, we expect constructive feedback throughout the development processes, which will be costly otherwise. In addition, the Covid-19 pandemic that has hit the world since 2019 has opened a Pandora's box to utilise IT on another level, particularly in providing more effective, engaging, and interactive yet still efficient ODL modes. Our lesson learnt will be worth sharing the similar initiatives in the future.

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