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Review

Metaverse for advancing government: Prospects, challenges and a research agenda

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ABSTRACT

A number of government agencies have started deploying the Metaverse to connect better with their constituents. The Metaverse provides a rich interaction environment and has the potential to engage with, especially, the younger generation. However, the Metaverse's potential impact on the government sector has been given limited attention. This discussion paper aims to fill this void by reviewing the state of the art, analyzing possible roles of the Metaverse for governments and providing research directions. We found six facilitators and nine barriers and risks. The Metaverse offers much more than a virtual presence or copy of the physical world; significant transformations are needed in government to reap the benefits. Given the evolution of the Metaverse, government presence also needs to evolve, and different governments make different decisions about their Metaverse presence. We recommend more research into the nature, use, applications, transformations, and implications of the Metaverse on government functioning.

1. Introduction

Utilizing three-dimensional (3D) virtual reality (VR) or augmented reality (AR) to create immersive environments and enable real-time synchronous communication, the Metaverse has captured the attention of various government agencies worldwide, spanning central/federal, state, and local levels (Eurostat, 2023). This burgeoning trend is fueled by diverse factors, as evidenced by the UAE government's embrace of the Metaverse to enhance administrative functions' effectiveness and efficiency (Kshetri, 2023a). Notably, the country's Ministry of Economy has established its headquarters in the Metaverse to cultivate connections and collaboration among a wide array of stakeholders, offering VR experiences to governments, global corporations, and the public (Abdulmalak, 2022).

Another high-profile case of the use of the Metaverse in the government sector is Metaverse Seoul, launched by South Korea's capital city. The use of the Metaverse by cities is sometimes referred to as the Cityverse. Metaverse Seoul is a virtual replica of the city of Seoul, which aims to expand and improve its public services. A beta test run of the first stage of the Seoul Metaverse was launched in August 2022 (Park, 2022).

The initial phase of Metaverse Seoul makes it possible for users' avatars to engage in diverse public services such as tax counseling, youth mentoring, and access to e-books. Metaverse Seoul acts as a support center for struggling businesses (Park, 2023; Sung-Eun, 2023). In the 'Corporate Support Center', companies can consult with experts in start-ups as well as law, human resources (HR), and other fields (Cryptoflies, 2023). The project is expected to be completed by 2026 (Thompson, 2023). Metaverse Seoul is available on Google Play and the Apple Store. For foreigners, conversations are translated into English. Chinese and Japanese services are expected to be available in the second or third phase of the platform (Sung-Eun, 2023). Users can visit key tourist attractions in Seoul and ask questions to the city's 24-h call center, 120 Dasan Call Center, which can answer questions related to city life (Sung-Eun, 2023). Time magazine recognized The Metaverse Seoul as one of the best inventions in 2022 (Heussner, 2022). One of the main reasons why Metaverse Seoul made it to the list was that the platform ensures an equitable Seoul experience, unrestricted by time or location and devoid of biases related to gender, disability, or profession (Flint, 2023).

The Metaverse provides governments the ability to reach their constituents and provide richer interactions, which can make this

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innovation useful for governments and citizens alike. The Metaverse is increasingly becoming a successful platform for engaging with younger customers (Kshetri, 2022d). Thus, the Metaverse might emerge as an important channel for delivering digital government services to young people and for participation and voting. Moreover, the Metaverse was reported to play an important role for the government during crises such as the COVID-19 pandemic (Ruchkin, Kruzhkova, Rushitskaya, & Dyuzelbayeva, 2021). For example, during the pandemic in Russia, digital government served as the sole means for accessing benefits, seeking assistance, and lodging complaints. In a crisis such as a pandemic, the Metaverse can thus help deliver some public services and enable engagement that traditional digital government channels cannot.

While the *Metaverse's potential* to transform diverse industries and markets is well documented in academic (Dwivedi et al., 2022, 2023; Kshetri, 2023b) and industry (PwC, 2023) publications, scholars have yet to examine the potential impact of the Metaverse on the government sector. This discussion paper aims to understand the Metaverse's potential to transform government service delivery. The research questions of this article should provide a deeper insight into the benefits or disadvantages of the Metaverse and what drives or hinders the deployment and use of the Metaverse by government agencies (Table 1). These insights result in a research agenda:

- 1) What are the benefits and drawbacks of the use of the Metaverse in government?
- 2) What are the facilitators and barriers to the deployment and use of Metaverse in government?
- 3) What are the research directions and future research topics?

The utilization of the Metaverse represents an innovative approach to digital public service. Therefore, to effectively address the aforementioned questions, it would be prudent to leverage the different stages of the digital public service innovation (Bertot, Estevez, & Janowski, 2016) along with e-government objectives (Dawes, 2008).

This paper is structured as follows. In Section 2, we look at Metaverse initiatives undertaken by some governments. Section 3 examines how the Metaverse technologies influence government functions. Section 4 discusses the facilitators for the use of the Metaverse in the government sector. Section 5 highlights the key barriers hindering the use of the Metaverse in government. Section 6 develops emerging propositions related to the Metaverse's effect on government functions and discusses implications for research and practice. Section 7 provides concluding comments.

2. Metaverse initiatives undertaken by governments

Although many governments are reluctant to join the Metaverse, a large number of Metaverse initiatives are also being undertaken by governments. Table 2 presents some government Metaverse initiatives, which gives an impression of the variety and diversity of such initiatives. While South Korea and the UAE, which ranked No. 3 and No. 13, respectively, in the United Nations' (2023) *E-Government Development Index* (EGDI), are among the "first wave of national governments" that are making heavy investments in Metaverse platforms (Smith, 2022), other countries are also engaged in developing Metaverse-based applications.

Table 1
Governmental agencies' responses to the Metaverse: Balancing internal realities and external influences.

	Positive effect on the adoption of the Metaverse by government agencies	Negative effect on the adoption of the Metaverse by government agencies
External	Benefits	Drawbacks
Internal	Facilitators	Barriers

Table 2
Metaverse initiatives in selected countries.

Country	EGDI rank	Example government Metaverse initiatives
Finland	2	Tampere's Metaverse development: initiative As of March 2023, the city of Tampere was in the research phase of understanding more about the Metaverse and was working on a Metaverse strategy. The goal is to develop itself as "a Metaverse city" (Wray, 2023). Key areas planned for Metaverse deployment in Tampere: mobility, healthcare, utilities, safety and security, and events (Wray, 2023). Helsinki: VR studio ZOAN created the Metaverse Virtual Helsinki, (Kshetri, 2023a).
Republic of Korea (South Korea)	3	Digital new deal: "Digital New Deal" initiative involves a significant expansion of its Metaverse efforts, with plans announced in February 2022 to allocate \$200 million in grants to universities and companies for technology expansion (Thompson, 2023). In 2022, a public-private partnership for the Metaverse Content Creation Project was announced. Four companies, proficient in Metaverse content creation and NFT issuance were selected to receive a grant of 200 million won each (approximately \$160,000) (TokenPost, 2022).
Australia	7	New South Wales exploring Metaverse in education and transport: As of 2023, the Government of New South Wales (the NSW Government) was exploring the use of VR to facilitate teaching and learning, and train health professionals. In addition, several investments in X.R. have been made to improve transport (Digital.NSW, 2023).
The U.S.	10	AR and digital twin in U.S. cities: As of 2001, the city of Philadelphia was exploring the use of AR to improve the public transit experience for people with disabilities (Islam, 2021). Other cities such as Orlando, Las Vegas, Boston have developed their cities' digital twins (Glickman, 2022).
The U.K.	11	NHS investment in medical Metaverse training: In 2022, National Health Service (NHS) provided £1 million contract to AI learning & and assessment platform for healthcare professionals to put workforce into Medical Metaverse (Recourse AI, 2022). It plans to use extended reality (X.R.) and conversational AI (Recourse AI, 2022).
Japan	14	Metaverse in education support: In a speech to Japan's parliament in October 2022, the Prime Minister said that the country would "promote efforts to expand the use of Web3 services that utilize the Metaverse and NFTs" (Thompson, 2022). As of early 2023, the government was exploring a Metaverse-based education support system to help children who refuse to go to school (The Japan Times, 2023). The number of nonattending children at schools grew to 244,940 in 2022 (The Japan Times, 2023).
Israel	16	Opening Metaverse embassy: In October 2022, the first Metaverse embassy in South Korea was opened (AL-Monitor, 2022a). It includes meeting rooms and an exhibition on the history of the Israel-South Korea relations (AL-Monitor, 2022a).
Norway	17	Tax authority's virtual offices in Decentraland Metaverse: The Brønnøysund Register Center manages numerous public registers, and Skatteetaten, the country's tax authority, teamed up with EY to open virtual offices in the Decentraland

(continued on next page)

Table 2 (continued)

Country	EGDI rank	Example government Metaverse initiatives
China	43	Metaverse (Fortis, 2022). It reportedly took only 12 days to complete the project (Fortis, 2022). Metaverse initiatives in public services: By 2025, China intends to implement the Metaverse in public services (Global Times, 2023). Different cities have their own initiatives. A virtual replica of a real performing center in Shanghai’s Fengxian district has a 3D model on the Metaverse platform Xirang. It allows people to experience urban development progress and access government services in the future (Yang, 2022).
Egypt	103	Adoption of the Metaverse for local development and healthcare promotion: Ministry of Local Development is using Metaverse technology for the first time to enhance training for local workers and improve services (Egypt Today, 2022). General Authority for Health Care uses the Metaverse to promote its medical tourism project (Hanafi, 2022).

As depicted in Table 2, China and Egypt, both with comparatively low EGDI, have initiated various government Metaverse projects. China has plans to integrate the Metaverse into public services by 2025. In major cities like Shanghai, the implementation of Metaverse projects is geared toward providing access to government services. Likewise, the Metaverse projects of the Egyptian government focus on improving healthcare services and providing training for local workers.

Recent developments in the decentralization of the provision of public services have been observed (OECD, 2020). Hence, many of the cases in Table 2 are city-based. The cases are often presented as best

practices, but they might suffer from the shining object syndrome (SOS) in which politicians and governments might think that the Metaverse is worth pursuing as a modern technology, whereas the actual use and benefits are limited and do not outweigh the cost and disruption caused.

3. The roles of the Metaverse technologies in facilitating government functions

A major objective of governments is to deliver enhanced public services, which entails providing “access, convenience, and choice” to citizens and businesses seeking information or public services (Dawes, 2008). Furthermore, another goal is to engage with their constituents for policy-development, receiving feedback, and other forms of participation (Luna-Reyes, 2017). To this end, in Table 3, we present the key roles of the Metaverse technologies in achieving this objective.

While numerous companies have downsized or shuttered their Metaverse divisions, their commitment to Metaverse projects remains unwavering in the long term. For example, Meta regards AR, VR, and other Metaverse ventures as “long-term investments” and has pledged to augment investments in these domains, even in the face of anticipated short- and medium-term losses (Kshetri, Voas, Dwivedi, Torres, & O’Keefe, 2023). Certain technological limitations of the Metaverse have already been resolved. For instance, the GPU in Meta Quest 3, which was released in October 2023, is more than twice as fast as that of Meta Quest 2, ushering in new possibilities for developers and marking a significant advancement (Bezmalinovic, 2023). Key Metaverse players such as Meta have recently shifted their focus away from the Metaverse to generative artificial intelligence (GenAI) (Kshetri et al., 2023). GenAI has the potential to aid in advancing the Metaverse. For instance, the creation of a virtual space is expedited by integrating tools from Metaverse creator Ilumine AI and image generator Midjourney (ecommercenews.eu, 2023). While these experiments currently are primarily occurring within

Table 3
Key roles of the Metaverse technologies in government functions.

Function	Explanation	The roles of the Metaverse	Examples
Delivering information	Providing information to citizens, businesses and other stakeholders	The Metaverse can be used to provide information in an interactive way and media enhanced formats.	<ul style="list-style-type: none"> Metaverse Seoul’s ‘Tax Square Virtual Helsinki
Supporting two-way communications	Using ICTs to support two-way communications with citizens and businesses.	The Metaverse environment offers a richer and faster communication medium for delivering public services.	<ul style="list-style-type: none"> Metaverse experience involving spatial audio and visual sensing developed by police in Ajman. Norway’s tax authority offers tax-related services in the Decentraland Metaverse, which facilitates two-way communications.
Enabling transactions and public services	Using ICTs to enable transactions for citizens and businesses.	The Metaverse can give a near real-world-like experience in transactions.	<ul style="list-style-type: none"> Metaverse Seoul issues proof of citizenship and resident registration certificates. Egypt’s General Authority for Health Care offers Metaverse-based services. Shanghai plans to use the Metaverse to allow people to access government services. The exploration of a Metaverse-based education support system for children was underway in Japan.
Facilitating information sharing and collaboration	Receive feedback and opinions of various constituents and enhance collaboration among various agencies such as police departments, courts, and social services to transform government practices.	The Metaverse can be used to simulate different scenarios for policy-making, which can help urban planners, developers, administrators, and other stakeholders to collaborate on projects, make plans, and identify solutions to address issues facing the cities.	<ul style="list-style-type: none"> Cities such as Orlando, Las Vegas, Boston, and Seoul have their virtual replicas, which can be used by urban planners, developers, administrators, and other stakeholders to make plans and identify solutions to address various issues.
Engaging in international relations and attracting foreign investments.	Use ICTs to contribute to international relations-related activities and attract foreign investments.	Metaverse can add capabilities such as VR to conduct these activities in a virtual environment. An online presence can be established by having an embassy in the virtual world and using it for diplomacy among countries.	<ul style="list-style-type: none"> Metaverse Seoul’s second phase: plan to connect local companies with foreign investors. Israel’s Metaverse embassy Barbados Metaverse embassy. The UAE’s plan to deploy advanced technologies in the Metaverse to sign bilateral agreements. Barbados has already opened a virtual embassy in Decentraland. Israel has opened Metaverse embassy in South Korea.

the gaming realm, the transition to an online shopping or digital government setting is expected to be feasible soon (ecommercenews.eu, 2023). Thus, as Metaverse technologies advance, companies are expected to reorient their attention toward the Metaverse.

The examples in Table 3 are inductively derived from Dawes (2008) and Bertot et al. (2016), and inductively from the current practices. Specifically, based on information from secondary sources, we analyzed how government agencies at different levels in countries with diverse economic and institutional characteristics have adopted and implemented this technology. We summarize the key results of our analysis and discuss them in relation to the framework suggested by Bertot et al. (2016), which is based on the United Nations (2014). The framework consists of four stages. In the emergent stage, which is the initial phase, government websites furnish information about policies, laws, regulations, available services, and documentation. Progressing to the enhanced stage, government websites facilitate one-way or basic two-way communication between the government and citizens. This includes the provision of downloadable forms, audio, video, and content presented in multiple languages. Moving into the transactional stage, governments establish two-way communication channels with citizens. This involves handling processes like license applications, permit submissions, tax filings, and other related forms. Finally, advancing to the connected stage, government websites expand their scope to participate in cross-agency e-services. Utilizing a variety of technologies and platforms, they aim for comprehensive citizen engagement, emphasizing enhanced interaction with the public.

First, the Metaverse is being used as an official information channel to distribute information. This function is related to the emergent stage in Bertot et al.'s (2016) Digital Public Service Innovation Framework. Government agencies are using the Metaverse to provide information to citizens (government-to-citizen (G2C)) as well as businesses (government-to-business (G2B)). The Metaverse can provide information in an interactive and media-enhanced format compared to traditional digital government methods. For instance, residents can get tax-related assistance in Metaverse Seoul's 'Tax Square'. Users can ask the tax chatbot IZY, which connects them to the Seoul Internet Tax Payment System (E-TAX). They can calculate car, property, and acquisition taxes (Cryptoflies, 2023).

Government agencies can also use the Metaverse to facilitate two-way communications with citizens and businesses. Bertot et al. (2016) consider this to be the enhanced stage. The Metaverse environment offers a richer and faster communication medium for delivering public services. For instance, police in the UAE's emirate of Ajman have created a Metaverse experience involving spatial audio and visual sensing, allowing users to walk to an official's virtual avatar and ask questions (Essaid, 2023). Likewise, Egypt's General Authority for Health Care uses the Metaverse to promote its medical tourism project. Tourists can visit the Metaverses of the health facilities affiliated with the authority, such as those in Port Said, Luxor, and Ismailia, to understand whether these facilities' capabilities match their needs. Potential health tourists can also get ideas about other facilities, such as city hotel amenities (Hanafi, 2022).

The Metaverse is being used to enable transactions for and provide public services to citizens and businesses. This is viewed as the transactional stage in Bertot et al.'s (2016) framework. Some examples include tax-related services (e.g., filing, withholding, and returns), municipal services and tracking business license applications and payments. The Metaverse can leverage the human senses to give a near real-world-like experience when citizens and businesses engage in transactions with government agencies. For instance, Metaverse Seoul provides residents with access to administrative services in five domains — economy, education, tax, administration, and communication (Cryptoflies, 2023). Services offered by Metaverse Seoul include issuing proof of citizenship and resident registration certificates (Park, 2023; Sung-Eun, 2023).

As another example, in October 2022, Sharjah Emirates OF the UAE's government launched Sharjaverse, arguably the world's first

government-backed Metaverse city. The project features a "Virtual Transaction Center" for official document processing. It also aims to boost the country's digital economy and local tourism (Singh, 2023). In the Metaverse platform, customer service agents process the documents for their users. The Metaverse platform also has information about government services provided by Sharjah's Department of Town Planning and Survey in audio and video forms (Al-Monitor, 2022b).

The Metaverse can facilitate information sharing and collaboration, which is referred to as the connected stage of Bertot et al.'s (2016) framework. For instance, cities in the U.S. such as Orlando, Las Vegas, Boston (Glickman, 2022, and South Korea's Seoul (Kshetri, 2023b) have their virtual replicas, which allow local governments to simulate different scenarios, such as energy consumption, proposed land use, and impacts of new streets. By combining these digital twins with M.R. technologies, urban planners, developers, administrators, and other stakeholders can make plans and identify solutions to address various issues facing the cities (Allam, Sharifi, Bibri, Jones, & Krogstie, 2022). For instance, digital twins can make it possible to predict flooding and other climate disasters and model prospective scenarios. This can help make decisions related to infrastructure planning and emergency risk responses. The Metaverse can play a key role in the reduction of emissions from sectors such as transportation, manufacturing, and energy generation (Allam et al., 2022). Likewise, in 2022, the UAE's Dubai Emirate announced a plan to launch the city's digital twin in the Metaverse. Before implementing them in the physical world, the digital twin can help simulate actions and decisions in diverse sectors, such as retail and real estate (O'Malley, 2022).

Finally, the Metaverse is being used by some governments to engage in international relations and attract foreign investments. For instance, the second stage of Metaverse Seoul is expected to start in 2024, which will provide additional services such as real estate counseling and connecting local companies with foreign investors (Park, 2023). On the international relations front, Israel opened its first Metaverse embassy in South Korea. Israeli ambassador to South Korea Akiva Tor noted that the Metaverse is "the way forward... the embassy Metaverse will become the essential standard, just as websites became the essential standard ... and [social networking service] SNS channels are now" (Indraswari & Kungwanjerdasuk, 2023). Likewise, the UAE is planning to deploy advanced technologies in the Metaverse to sign bilateral agreements with other nations in the Metaverse (Abdulmalak, 2022).

4. Facilitators and benefits for the use of Metaverse in government

Several factors have facilitated the growth of the Metaverse in the government sector (Table 4). First, public-private partnership (PPP) efforts have been a key driving force in the recent rise of the Metaverse in the government sector in countries such as China and South Korea. PPP involves arrangements and cooperative relationships between the public and private sectors, under which the latter undertakes actions that have been traditionally performed by the former (Savas, 2002). Prior research suggests that the public and private sectors have different strengths, expertise, and experience, which could lead to complementary roles in

Table 4
Facilitators for the Metaverse use in government

Facilitators	
1. PPP efforts	Government agencies have recognized the potential benefits of PPP in developing Metaverse-based government services.
2. Well-developed technology industry and skilled labor	A strong position on these fronts can help develop Metaverse applications (e.g., South Korea's domestic hardware industry).
3. Appropriate regulatory framework in some economies	A regulatory framework addresses the unique needs and challenges faced by the Metaverse users in economies such as the UAE.

meeting developmental and social needs (Linder, 1999). Private and public sectors engaged in PPPs have different objectives, and interests. The public sector can benefit by employing the private sector’s capital and technology. In this way, the former can share risks with the latter to provide the delivery of public services or goods. On the other hand, the private sector can increase profitability by winning the public sector’s support (Kshetri, 2015) and increasing its legitimacy for its customers. For example, in 2022, the Korean Ministry of Science and ICT unveiled a plan to enroll companies as participants in the 2022 Metaverse Content Creation Project. The objective was to choose four companies skilled in the Metaverse content creation and NFT issuance, with each participant slated to receive a grant of 200 million won (approximately \$160,000) (Table 2) (TokenPost, 2022).

Prior researchers have reported that collaborations between the public and private sectors have been fruitful in developing and delivering public services. Chen and Gant (2001) examined the potential of application service providers (ASPs), which had developed applications for a number of online transactions, such as e-hiring, e-permitting, and e-voting, to transform public services. Their analysis indicated that ASPs can help local governments meet demands for public services. Depending on the application’s complexity and level of customization, ASP-hosted applications could be implemented in a few days or weeks (Chen & Gant, 2001). On the other hand, in-house application development and implementation often take months or even years (Newcombe, 2000). Surprisingly, government agencies have recognized that such collaborations have many potential benefits in developing Metaverse-based government services. The Chinese government’s vision is to enable the private sector to develop key technology (Pascual, 2022). The Chinese Academy of Governance teamed up with Mengke to develop the education platform for the party-building experience. (Kshetri, 2022b). In South Korea, the private sector is expected to take the lead in developing various types of the Metaverse, such as the ones planned for the Metaverse Seoul (Table 3), while the government’s primary focus will be on providing support to individual developers and companies through a diverse array of measures (Kan, 2022).

Second, countries with Metaverse capabilities, such as a well-developed technology industry and skilled labor, are in a strong position to develop Metaverse applications for the government sector. In such countries, domestic firms are likely to create a rich ecosystem of hardware and software components required for the development of the Metaverse industry. For instance, South Korea’s domestic hardware industry is expected to offer hardware solutions required for the development of the country’s Metaverse initiatives (Pessarlay, 2023). Similarly, the Chinese government wants to develop a domestic Metaverse (Pascual, 2022).

Third, an appropriate regulatory framework that can meaningfully address the unique needs and challenges faced by users of the Metaverse can facilitate the growth of the use of this innovation by government agencies. In 2022, the UAE’s Economy Ministry created its Metaverse department. A number of other government entities launched their services on the Metaverse. In July 2022, Dubai Emirate launched the Dubai Metaverse Strategy, which aims to make the city among the world’s top 10 Metaverse economies. Its goal is to attract more than 1000 blockchain and Metaverse companies to the city and support more than 40,000 virtual jobs by 2030 (Handagama, 2022). Dubai’s Virtual Assets and Regulatory Agency was also established in 2022. It has created bespoke rules, laws, policies, and guidelines and provided incentives for working in the Metaverse. It grants licenses to companies operating with virtual assets (Essaid, 2023). Likewise, in late 2022, South Korea’s Science Ministry released a Metaverse strategy. The strategy focused on four major areas: a) creating an enabling environment that can help Metaverse platforms thrive; b) developing the talent pool; c) helping Metaverse companies; d) developing a standard for Metaverse ethics to prevent the misuse of technology. The ethical principles included in South Korea’s Science Ministry’s Metaverse strategy include three core values: sincere identity, safe experience, and

sustainable prosperity (Pessarlay, 2022). Respect for privacy and personal information protection are key components of South Korea’s standard for Metaverse ethics (Pessarlay, 2022).

Government agencies can also derive various benefits from using the Metaverse (Table 5). First, in times of a pandemic such as COVID-19, utilizing the Metaverse can emerge as a highly effective channel for delivering some key government services. For instance, the COVID-19 pandemic helped governments recognize the benefits of the Metaverse in delivering public services. The increasing trend of contactless lifestyles has been a key driver of Metaverse Seoul (Dong-hwan, 2023).

Second, the Metaverse’s use of government functions is likely to get a big boost from the increasing influence of young people in society and politics. Their growing desire for the Metaverse to socialize, shop, and play games has stimulated the Metaverse diffusion. For instance, younger generations’ higher preference for Metaverse-based information has been a key factor behind the development of Metaverse Seoul (Table 3) (Dong-hwan, 2023).

Third, leveraging the Metaverse can significantly enhance government services compared to other available channels (Table 2). As noted, Egypt’s Ministry of Local Development utilizes the Metaverse to improve local worker training and service delivery. Similarly, the Brønnøysund Register Center provides tax-related services through Decentraland. Governments are exploring Metaverse-based education solutions. Meanwhile, cities such as Philadelphia are exploring the use of AR to enhance public transit accessibility for individuals with disabilities.

Finally, technological advancements have allowed government agencies to deliver previously impossible services. For example, advancements in AR technology, like AR headsets and glasses, enable users to overlay digital content in the real world, offering a rich experience (Tolani, 2023). Similarly, though VR was developed in the 1900s, modern advancements now enable applications to take full control of a user’s senses, such as sight and hearing, offering a highly engaging experience. While users are in a fully virtual environment, they feel that the environment is real (Marr, 2020). This enables government agencies to provide some types of services effectively. For instance, when a user visits a virtual tax office such as the one offered by Norway’s tax authority (Table 3), they feel as if they are speaking to a real tax officer.

Advancement in ICTs has been noted as a key factor that inspired the development of Metaverse Seoul (Dong-hwan, 2023). Another South Korea city, Incheon has created Incheon Craft, which is a virtual city of Incheon that uses Mojang Studios’ sandbox game Minecraft. This Metaverse entertainment content provides ‘Incheon experience’. In Minecraft, players explore a virtual world as avatars. This feature allows users to create and experience Incheon in the Metaverse world. In this way, Incheon delivers the Metaverse experience to tourists without physically being in the city.

Incheon’s ‘virtual world’ provides an experience that is not possible in the real world. Users can create their avatars and interact with other players’ avatars. Incheon Craft makes it possible to experience historical events, interact with historical figures, and learn historical facts in Incheon Metaverse (Um et al., 2022). Unlike VR Metaverse Incheon Craft, Incheon AR provides one-way interactive content. Tourists can use their smartphone camera and AR application to experience AR in the

Table 5
Benefits for the Metaverse use in government

1. COVID-19	The pandemic helped governments recognize the benefits of the Metaverse.
2. <i>The increasing influence of young voters</i>	Young voters’ growing desire for Metaverse-based applications has stimulated the diffusion of this innovation.
3. <i>Enhancing government services</i>	<i>The Metaverse to improve local worker training and service delivery, tax-related services, and public transit accessibility for individuals with disabilities.</i>
4. Technological advancements	Advancements in technologies such as VR and AR have allowed government agencies to deliver services that were not possible or easy before.

real world, which is expected to increase tourism attractiveness (Um et al., 2022). Recent advancements in ICTs, especially VR and AR, have made these offerings possible.

5. Barriers and disadvantages hindering the use of Metaverse in government

Governments face barriers and disadvantages in the utilization of the Metaverse across various categories. (see Tables 6 and 7 for the overview). First, a concern noted is that e-government can potentially make government employees less transparent and less responsive to citizens' needs (Jaeger & Thompson, 2003). Another important barrier centers on the costs of devices to access Metaverse-based services. There are concerns about the affordability of required hardware, especially in low-income countries.

A third barrier concerns the lack of readiness of key Metaverse technologies such as AR and VR headsets. For instance, in October 2022, Meta hosted a hands-on press demo of Meta Quest Pro which was among the most advanced VR headsets. According to a Wired article, the Meta Quest Pro, while technologically more advanced than ever, exhibited several technical limitations. and it failed to "make a great case for VR". The article pointed out that the headset is "a great escape from reality, but a good reminder that physical presence is better" (Goode, 2022). Likewise, Microsoft demonstrated its HoloLens AR device in 2015 and launched two commercial versions in 2016 (Foley, 2017). The company started working with the U.S. Army in 2019 to develop HoloLens-based mixed-reality (M.R.) headsets to rehearse and train in more realistic scenarios. The Integrated Visual Augmentation System (IVAS) used in the devices was expected to allow soldiers to see through smoke and around corners. In mid-2021, Microsoft announced that the U.S. Army would start equipping its soldiers with the devices in September 2021 (Bach, 2021). A number of deficiencies were identified in the early testing. The most glaring shortcoming of the headsets was that when combat exercises were held, they disconnected from local wireless networks, which disabled the built-in weapon trackers.

A huge obstacle is also that many devices used in the Metaverse lack ease of use (Scyt, 2022). For instance, Microsoft's M.R. headsets used by the U.S. Army were heavy and uncomfortable. The screens were reported to cause eyestrain. Based on an initial round of testing conducted in October 2022, the Army noted that the headset "fell short" in some key areas and needed "additional improvements" (Tilley, 2022). The insufficient preparedness for key technologies hinders the effective utilization of the Metaverse products like Virtual Helsinki, spatial audio and visual sensing developed by police in Ajman, Metaverse-based services of the Egypt's General Authority for Health Care and virtual city replicas of Orlando, Las Vegas, Boston, and Seoul (Table 3).

Table 6
Barriers to the Metaverse use in government

1. More general barriers associated with electronic channels	There might be concerns that Metaverse-based services can make government employees less transparent and less responsive to citizens' needs.
2. Costs of devices	Devices used to access the Metaverse lack affordability for the majority of users.
3. Lack of readiness for key technologies	AR and VR headsets and other devices used in the Metaverse are deficient and lack ease of use.
4. Metaverse's current decline	Some government officials may use this decline to argue that there is a lack of public demand for Metaverse-based government applications.
5. Perceived risks and costs associated with transitioning to the Metaverse	Substantial immediate costs involved in learning new ways of doing things involving the Metaverse.
6. Lack of appropriate regulatory frameworks	There are no well-defined regulations to address the dark side of the Metaverse, which can make this channel unsafe.

Table 7
Disadvantages for the Metaverse use in government

1. Privacy and other risks	Such risks can negatively affect responses to Metaverse-based government applications, especially in more advanced functions like voting.
2. Security & auditing	Also hacking might be possible and security might be dependent on others, making it impossible to audit the trustworthiness and ensure security.
3. Protection of rights	Children and other societal groups might be exposed to undesired behavior. Governments might not be able to enforce their legislation (like police), whereas having a presence in a virtual location that does not comply with their own legislation.
4. Computationally intensive	Metaverse-based applications can lead to a significant increase in the energy demand.
5. Influence mental health	The Metaverse can result in addiction and influence mental health negatively. After being in an ideal world, the real world might be disappointing.
6. Expensive and use of resources	The Metaverse is another channel that needs to be maintained. Constituents will expect a fast response. Both development and maintenance can be expensive and require significant resources that cannot be used for other purposes.
7. Image	Government role might not be visible, and their existence might be viewed as endorsing undesired behaviors, resulting in a deteriorating or unclear perception of government. Government and business might not be viewed separately anymore.
8. Inclusion and inequality	Not everybody might be able to use the Metaverse under the same conditions (devices, costs of presence etc.), resulting in exclusion. Even freedom of expression is controlled by businesses instead of governments. Users with more resources might be given easier access to the government.

Fourth, the Metaverse's current decline can hinder the use of this innovation in the government sector. For instance, the headsets used to access the Metaverse are reported to pose various challenges, such as being heavy and uncomfortable, and the screens caused eyestrain. Furthermore, the Metaverse is a vision that is under development and continuously evolving. Many different companies can provide virtual worlds that make up the Metaverse together. But the Metaverses operated by different companies lack compatibility. Companies in diverse industries have recently downsized or closed their Metaverse divisions (Kshetri et al., 2023). In the early 2000s, some government officials who were against the idea of digital government argued that the dot-com bubble burst of 2000 showed a lack of public demand for any type of Internet interaction (Margetts & Dunleavy, 2002). Some government agencies may use a similar logic to argue against governments' use of the Metaverse.

Fifth, perceived risks and costs associated with transitioning to a new medium may lead to businesses' and citizens' unwillingness to use Metaverse-based services. Prior researchers have noted that the transaction costs of such changes can create a strong initial barrier for citizens to adopt electronic communication with the government (Margetts & Dunleavy, 2002). Many people find it difficult to change an established way of doing things. For instance, they could be more comfortable visiting or calling the tax office instead of adopting a new technology or channel of communication, such as creating an avatar and wearing virtual reality glasses to visit the Metaverse channel of the tax office and interacting with the avatars of tax officials. There are often substantial immediate costs involved in learning new ways of doing things, such as the cost of finding relevant information, the time and frustration costs, and the cost of correcting any mistakes produced by unfamiliarity (Margetts & Dunleavy, 2002).

Sixth, there are risks of governments not being in control, impersonated, or invisible. Due to the lack of appropriate regulatory frameworks to govern the Metaverse, they are well recognized (Dwivedi et al., 2022; Dwivedi, Hughes, et al., 2023). The risks of the Metaverse are that it is a wild-wild west with fake information, blaming and shaming,

impersonation, and all kinds of undesired behaviors. It can be an unsafe environment for citizens, businesses, and governments. Currently, there are no well-defined regulations to address dark side issues such as cyberbullying, harassment, and racism in the Metaverse. This poses a concerning issue since the *effects of trauma associated with these offenses are more severe in the Metaverse than those associated with the regular Internet (Dwivedi, Kshetri, et al., 2023).*

Government agencies encounter various disadvantages when leveraging the Metaverse (Table 7). First, privacy and other risks, are usually cited as a major disadvantage that might negatively affect businesses' and citizens' responses to Metaverse-based applications. At the heart of this category of challenge is identity management. The avatars used might reveal the identity or characteristics of a person, such as age and education.

Second, the potential for hacking exists, and security may rely on external entities, hindering the ability to audit trustworthiness and ensure robust security measures. Such concerns are especially relevant in more advanced government functions, such as voting and use for private purposes that one does not want to share with others. Challenges such as those related to the security of a Metaverse-based voting system and mechanisms to ensure the integrity of votes cast have not been fully addressed (Scytl, 2022).

Third, children and other societal groups may be exposed to undesirable behavior, and governments might struggle to enforce legislation, such as police interventions, within the Metaverse.

Fourth, the computationally intensive nature of Metaverse-based applications results in a substantial rise in energy demand, presenting another disadvantage. One estimate suggested that the Metaverse will require a 1000 times increase in the current computing power (Signé & Dooley, 2022).

The fifth disadvantage highlighted pertains to Metaverse addiction and its considerable implications for mental health, forming part of broader concerns related to digital addictions. (Sternlicht & Sternlicht, 2022). In South Korea, 20% of the population faces the risk of developing video game addiction (Asskoumi, 2021). The risk of this issue worsening becomes a concern when the Metaverse gains recognition as a government platform.

Sixth, the Metaverse constitutes an additional channel that necessitates ongoing maintenance. Constituents anticipate swift responses, and both development and maintenance prove to be costly, demanding substantial resources that could otherwise be allocated for different purposes.

Seventh, the government's role might not be readily apparent, potentially leading to the perception of endorsing undesirable behaviors and contributing to a deteriorating or unclear public perception. Furthermore, the distinction between government and business entities may become blurred or indistinguishable.

Finally, not everyone may have equal access to the Metaverse due to

varying conditions, such as devices and associated costs, leading to potential exclusion. For instance, the elderly might not fully utilize the services provided by Norway's Tax Authority's virtual offices in the Decentraland Metaverse (Table 2). Additionally, the control over freedom of expression might be in the hands of businesses rather than governments, potentially giving users with greater resources easier access to government interactions within the Metaverse.

6. Implications for research and practice

6.1. Emerging propositions

Overall, the current efforts of governments should not be translated in a one-to-one manner to the meta-verse. The Metaverse provides unique opportunities, and governments should transform their way of working and find the appropriate way to deal with their constituents. Given the Metaverse's appeal to younger populations, we also look at the effects among younger versus older generations. As a visual aid, Fig. 1 schematically represents the proposed relationship between these concepts and the key features of the Metaverse. The directional arrows serve as a visual representation, illustrating how the key features of the Metaverse play a crucial role in facilitating digital government capabilities. The previous analysis results in emerging propositions that can be analyzed in further research.

6.1.1. Impactful delivery

Prior researchers have suggested that audio-visual technologies, such as films, have a more powerful, persuasive, and longer-lasting impact on the information receiver than *sources that lack such features (D'Augustino, 2022; Scheiner-Fisher & Russell III, 2012).* That is, the former modes are more effective in helping the receiver of information understand certain issues and the world around them (D'Augustino, 2022; Scheiner-Fisher & Russell III, 2012). Metaverse content has the potential to be even more influential (D'Augustino, 2022). For instance, VR is likely to provide an even deeper impact on how the receivers of information view and understand certain issues (D'Augustino, 2022).

The Metaverse offers various mechanisms for government agencies to deliver relevant information in an impactful way. In the case of emergency, integrating data from multiple sources, including aircraft, sensors, maps, and databases, allows for the superimposition of an augmented-reality layer of information onto live drone camera feeds. This allows first responders to identify hidden roads and powerlines obstructed by fire or floodwater, track their vehicles and team members, and even tag individuals who may be in danger or suspected of wrongdoing (Times of Israel, 2022).

Prior researchers have suggested that information delivered synchronously is likely more impactful (Gong & Yan, 2023). In the Metaverse Seoul, government officials share information in a synchronous

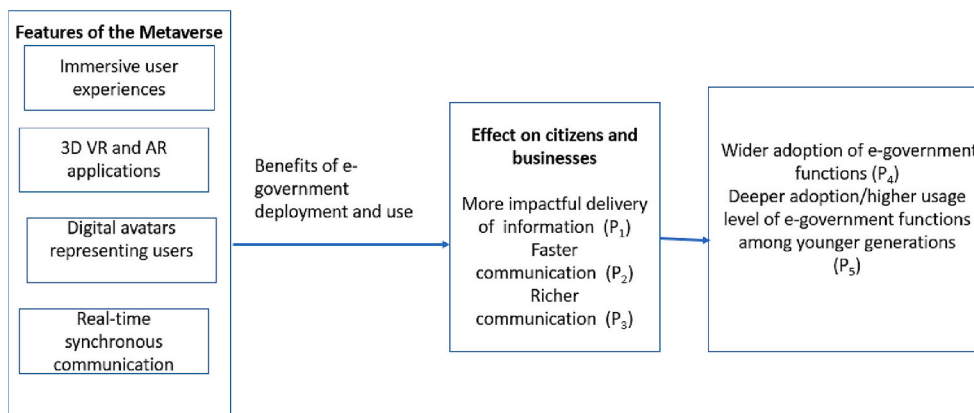


Fig. 1. Effects of the Metaverse on digital government.

manner in virtual town halls, public forums, and other interactive events (World Economic Forum, 2023). Hence, formulate Proposition 1:

Proposition 1. The Metaverse environment can help deliver information in a more impactful way.

6.1.2. Responsive communication

A number of government agencies are using the Metaverse to facilitate two-way communications with citizens and businesses. We argue that the Metaverse has far superior communication capabilities compared to traditional e-government applications such as web forms, e-mail, bulletin boards, and chat rooms. This requires different practices from the government. Experimenting with different, innovative ways, is needed to facilitate learning and to arrive at more effective ways of communication.

Traditional e-government applications, such as web forms and e-mail, are relatively slow. Asynchronous digital government systems often function as a slow communication channel. For instance, the median times taken to respond by government agencies in Australia and New Zealand, which are among the top 10 countries in terms of UNDESA's (2023) EGDI, were 4.4 h and 1.4 h, respectively (Gauld, Gray, & McComb, 2009).

Metaverse-based applications focus on real-time communication. For instance, the UAE's General Pension and Social Security Authority's (GPSSA) interactive Metaverse platform allows users to enter a virtual session and engage in a live chat with a customer happiness agent (Bowen, 2022). Likewise, as noted above, the Metaverse used by police in the UAE's emirate of Ajman allows users to walk to an official's virtual avatar and ask them questions (Essaid, 2023). The users receive an immediate response in a richer environment. It is thus proposed that:

Proposition 2. The Metaverse environment offers a medium for communicating and delivering public services in real-time.

6.1.3. Rich communication

Despite their speed, some traditional channels are used for communications, such as downloadable forms, audio, video (Bertot et al., 2016.) and social media (Yi, Oh, & Kim, 2013) lack media richness. On the contrary, the Metaverse offers a media-rich communications channel.

For instance, at a Metaverse discussion held in October 2021, Seoul Mayor Oh Se-hoon appeared as an avatar and greeted the participants. 3D-features were implemented in the conference room and the avatar, which gave a realistic feel. The speakers and other attendees participated from their respective spaces and connected as avatars (Jun-sung, 2021). This form of communication is likely to have a richer and more powerful impact and create a more lasting impression on the viewers. Previous research suggests that most users have a preference for richer information (Simon & Peppas, 2004). In sum, we argue that:

Proposition 3. The Metaverse environment transforms communication by offering a richer medium for delivering public services.

6.1.4. Wider adoption

In the Metaverse public services can have more width and depth. The width of Metaverse public services adoption can be defined as the number of different use cases offered by the government on the supply side and the number of different public services used by citizens and businesses on the demand side (Gatignon & Robertson, 1985). Similarly, the depth of Metaverse public services adoption can be defined as the amount of digital services used by citizens and businesses (Dholakia, Dholakia, & Kshetri, 2004). In the context of digital financial services, this concept is also referred to as usage level (Levy, 2014), which assesses the depth of utilization of such services (Niu, Jin, Wang, & Zhou, 2022). Niu et al. (2022) use the term "usage index" to measure this phenomenon.

A main reason why the full potential of government cannot be used

to increase the efficiency and effectiveness of government administration is that some of the services must be provided outside the web, such as in physical service facilities (Layne & Lee, 2001). The Metaverse makes it possible for government agencies to deliver some of the services that were not possible before. For instance, the U.S. Department of Veteran's Affairs was reported to be piloting the use of VR for treating PTSD in people with past traumas that are triggered by real-world situations (Tross et al., 2023). Individuals wear VR headsets and practice experiencing those challenging activities without having to be physically present in healthcare institutions, such as hospitals (Maxwell, 2010). This resulted in a transformation of the government functions.

The governments of some countries, such as China, aim to prioritize healthcare as a key area in the development of the Metaverse (Jiang, 2023). With the further development of the Metaverse technology, government-owned healthcare facilities can provide more advanced real-time healthcare applications such as remote surgery. Indeed, such applications are already emerging outside the government sector. For instance, in 2022, VR and other technologies helped a team of surgeons to separate *two conjoined Brazilian twin* children with fused brains (PYMNTS.com, 2022). Pediatric surgeon from London's Great Ormond Street Hospital Noor ul Owase Jeelani directed the surgery on the twins at the Instituto Estadual do Cerebro Paulo Niemeyer in Rio de Janeiro, Brazil, where a surgical team carried out the actual operation (McArdle, 2022). Based on the above discussion, the following proposition is presented:

Proposition 4. The Metaverse can help to transform and expand the width of government functions.

6.1.5. Deeper adoption

Different units of adoption differ in their times of adoption of an innovation (Rogers, 1963). In the case of the Metaverse, innovators, which represent the first 2.5% to adopt new technology (Rogers, 1963), are young people. For instance, the gaming platform Roblox, in which independent developers create games popular with children and young adults, is arguably the "nearest and most expansive vision" of the Metaverse (Herrman & Browning, 2021). In 2021, about half of Roblox players were under the age of 13 (Revoredo, 2021), and 66% were under 16 (Zafar, 2021). Likewise, Epic Games' Fortnite had more than 350 million registered players in April 2021, of which two-thirds were young adults (Kshetri, 2022b).

The Metaverse is thus emerging as an effective channel to reach young customers (Kshetri, 2022d). As noted above, younger generations' higher preference of Metaverse-based information has been a key driver of Metaverse Seoul (Dong-hwan, 2023). The Metaverse Seoul also aims to realize the new definitions of "freedom, companionship and connection" (Dong-hwan, 2023). The Metaverse, in the context of these definitions, is especially meaningful to younger generations. *Seoul City's mayor* Oh Se-hoon observed that younger generations are more likely to benefit from the current version of Metaverse Seoul (Tan, 2023).

The Metaverse is thus likely to deepen the adoption of government applications among younger generations, who show a higher level of interest and involvement in the Metaverse. Compared with older generations, the younger demographic is more experience-driven (Harrison, 2022) and sees interesting and exciting learning opportunities in the Metaverse (Morning Consult, 2022). This is because higher proportions of younger generations, such as Generation Z, grew up with VR technologies (Harrison, 2022). A study found that 50% of children who experienced swimming with whales wearing a VR headset thought that the experience was real (VHIL, 2020). In a survey conducted in the U.S. in March 2022, 64% of Gen Z respondents were interested in having a digital avatar, and 56% were interested in attending a music event in the Metaverse. The proportions were 28% and 25% for baby boomers (Teale, 2022).

While the young generation's lower propensity to engage in face-to-face interactions is also likely to result in a higher propensity to use the

Metaverse and a higher usage levels of this innovation, the opposite effect is likely to occur for older generations. Commenting on the relative ease and preference of younger and older generations to interact with an avatar and a real government official, the head of the Metaverse team in the Seoul Metropolitan Government put the issue this way: “Sometimes young people are hesitant to go talk to the counselor due to social pressures and physical distances. But young people can easily go into the Metaverse platform and talk to an avatar, who is a professional, to get proper advice” (Bloomberg Cities, 2022).

As mentioned earlier, individuals may resist changing their established routines due to the perceived discomfort in adopting new technologies. For example, they might prefer traditional methods like visiting or calling government offices rather than using emerging virtual reality tools to access services in the Metaverse. These changes often entail immediate costs, including time, frustration, and the effort required to acquire and apply new knowledge (Margetts & Dunleavy, 2002). These costs and hence the resistance are likely to be higher for older generations. The discussion in this subsection results in the following propositions:

Proposition 5. Government applications in the Metaverse are likely to increase the depth or usage level of such applications among younger generations.

6.2. Future research directions

The concepts discussed and the propositions presented in this paper raises many questions that present an opportunity for future investigation. Some potential future research avenues are presented in Table 8. These *research directions to the impacts of the Metaverse on government functions, and factors defining such impacts. They are broadly aligned with the propositions presented above.*

The Metaverse provides a richer and completely different interaction environment and brings the virtual world closer to the physical world. By providing *synchronous* interaction in a 3D world, this innovation enables the delivery of online services that is not possible with other digital innovations. Compared to most other digital innovations, the roles of government agencies are closer to the reality in the physical world. Among the issues to be considered in future research are the adaptations and transformations that government agencies such as Norway’s

Table 8
Future research areas.

	The Metaverse affected by/effects on	Research question
1	Richer interaction than other channels and closeness of the virtual to the physical world	What adaptations should government agencies make to deliver online services in a richer and completely different interaction environment of the Metaverse?
2	Formal and informal institutions	How do formal and informal institutions affect the types of Metaverse uses in government functions? And which transformations are needed?
3	Immersive and rich media content	How can we regulate behavior, avoid privacy and security risks, misinformation, abuse, identity theft, etc., and ensure that constituents feel safe and secure to engage with the government?
4	Public-private partnerships	What are the roles of PPP in developing Metaverse applications to facilitate government functions?
5	ICT readiness of a country, region or city and the availability of necessary infrastructures, services, and skills	How does a ICT readiness of a country, region or city influence the width and depth of Metaverse adoption in government functions and the availability of necessary infrastructures, services, and skills?

Brønnøysund Register Center Egypt’s General Authority for Health Care, local governments in cities such as Orlando, Las Vegas, Boston (Tables 2 and 3) should make to deliver online services in richer and completely different interaction environments of the Metaverse. For instance, what technological and organizational changes need to be made to boost citizen engagement in the Metaverse? Institutional theorists view an innovation system as a “coordinated set of formal and informal institutions” (Dallago, 2002) influencing economic agents’ behavior (Matutinović, 2005). All economic phenomena have institutional components and implications (Parto, 2005). Such effects are clearly evident in the Metaverse projects initiated by governments. For instance, oil-exporting Arab countries are developing regulations and policies to diversify their economies and attract foreign investments (International Monetary Fund, 2016). The Metaverse strategies of UAE and Saudi Arabia are eager to attract foreign investments in Metaverse projects (Kshetri, 2023a). Likewise, China has been described as a combination of an empire and a modern nation (Terrill, 2005). China’s state strategies toward information and communications technology (ICT) have been to balance economic modernization and political control (Kalathil, 2003). China focused its attention on the Internet before most other developing countries arguably to maintain control over the population (Yang, 2001). This vision is likely to shape the Chinaverse. Not surprisingly, the Chinaverse’ is expected to be highly regulated and controlled (Kshetri, 2023a). China’s envisioned Metaverse projects, including the central government’s initiative for public service delivery and Shanghai’s 3D model on the Xirang Metaverse platform (Tables 2 and 3), are likely to involve a higher degree of government participation compared to similar projects in other countries. In this regard, a third area of future research might be to compare the effects of formal and informal institutions on the development of different types of Metaverses as well as different types of uses of this innovation in government functions.

Due to the Metaverse’s immersive and media-rich content, regulators have been trying to find new ways to regulate this platform. As noted above, disadvantages associated with the Metaverse include risks related to security, privacy, and other concerns (Table 5). Thus, *regulating malicious behavior* and mitigating harm, dealing with privacy and security risks and misinformation, abuse, identity theft, and ensuring that constituents feel safe and secure to engage with the government are some of the key issues that warrant attention in future research.

Previous research has examined the importance of public-private partnerships (PPP) involving government and private-sector collaboration in facilitating the adoption and diffusion of digital applications. For instance, in the non-Metaverse environment, Chen and Gant (2001) reported that a PPP project in Sunnyvale city, state of California, led to the development of web-enabled software, “e-Permits”. The software made it possible for city residents to apply and pay for building-related permits online. ASPs were reported to provide the latest business applications, which needed less time for implementation (Chen & Gant, 2001). Such collaborations are also emerging in the use of the Metaverse by governments. For instance, the development of South Korea’s Metaverse strategy, leading to projects like Metaverse Seoul (Tables 2 and 3), involved experts from diverse domains, including engineering, law, ethics, and data protection (Pessarlay, 2023). (Pessarlay, 2023). As noted above, four companies, skilled in metaverse content creation and NFT issuance were selected to participate in the government’s Metaverse initiatives (TokenPost, 2022). The roles of PPP in developing Metaverse applications to facilitate government functions thus might be worthwhile to study.

Finally, in this paper, we discussed factors that can potentially affect the width, usage level, and depth of Metaverse’s adoption of digital government functions. However, we did not link these concepts with country-specific characteristics. For instance, with a superior EGDI rank of 3 in Table 2, South Korea is poised to outperform Egypt (EGDI rank of 143) in terms of ICT readiness, infrastructure availability, services, and skills. This is expected to translate into a more extensive, higher usage,

and deeper adoption of Metaverse for digital government functions. Researchers could thus examine how the width, usage level and depth of Metaverse adoption in government functions are influenced by factors such as ICT readiness of a country, region or city and the availability of necessary infrastructures, services, and skills.

6.3. Implications for practice and policy

While the Metaverse currently has been experiencing a slowdown, several hurdles that were overlooked in its early development are likely to be overcome in the future. The Metaverse will likely appear, but the name might be different in the future. When the necessary infrastructures are put in place, compelling content is developed, devices become more affordable, and their usability improves. When appropriate regulations for misconduct are adequately addressed, Metaverse's growth is likely to take off. There are already encouraging developments on these fronts. As mentioned earlier, Metaverse devices are now more user-friendly and efficient, and generative AI has streamlined content creation. The costs of devices to access the Metaverse have also lowered. In March 2023, Meta reduced prices for two VR headsets to encourage adoption of the technology. The Meta Quest Pro headset's price was cut by \$500, down to \$999, six months after its release. The Quest 2 headset was priced at \$429.99, reduced from \$499.99 (Thorbecke, 2023). Likewise, in September 2023, High-end VR headset Varjo reduced the price of its high-end Varjo Aero VR headset by 50%, bringing it down to \$990 from the original price of nearly \$2000 (Erl, 2023).

As these technologies advance, the Metaverse is poised to become a significant catalyst for innovation in government services. Numerous mechanisms facilitate these innovations. In the Metaverse, government agencies offering services to citizens and businesses can gather a broader array of real-time data and gain deeper insights into contextual factors. Thus, the metaverse enables government agencies to provide what Bertot et al. (2016) call context-smart digital public services by leveraging context awareness for enhanced service delivery. Government services can be personalized further with the aid of such data, which is a key aspect of innovative digital public services (Bertot et al., 2016).

Favorable regulatory developments are also taking place, which is likely to facilitate the use of the Metaverse in general and in digital government in particular. For instance, in September 2023, The UK approved the Online Safety Bill, including new Metaverse protections (PYMNTS, 2023). Likewise, in September 2022, South Korea's National Data Policy Committee announced that it would develop regulatory amendments to accommodate the specific features of the Metaverse. The Committee is chaired by the Prime Minister and co-administered by the Ministers of Science and ICT and the Minister of Interior and Safety (Ministry of Science and ICT, 2022). Similarly, the government of Egypt aims to pass a medical tourism law that will define roles and responsibilities of various players and coordination between the health and tourism sectors to promote medical tourism in the country (Techxmedia, 2022).

These advancements are anticipated to drive greater adoption of Metaverse applications within the government sector. For a comprehensive understanding of the impact areas related to digital government policy and practice stemming from these developments, Table 9 provides valuable insights.

The Metaverse is likely to provide a great opportunity to transform government roles and services and improve the delivery of existing public services, especially for young citizens. As the experience of South Korea suggests (Dong-hwan, 2023), it is becoming imperative to use the Metaverse in government activities to engage younger generations, who are playing increasingly influential roles in national politics and society.

The Metaverse can help governments pursue various social, political, and economic goals. In countries with democratic governance, the Metaverse can contribute to the institutionalization of democratic practices by facilitating interactions among citizens and involving and

Table 9
Key considerations for digital government policy and practice in the metaverse development era.

	Opportunity area for policy makers	Mechanisms/examples
1	Increasing effectiveness in the delivery of existing public services, especially for young citizens	Younger generations' higher preference for Metaverse-based information (Table 4)
2	Increasing participation	New ways of online deliberation and participation become possible.
3	Achieving social, political and economic goals	Institutionalizing democratic practices by promoting citizen interactions and engaging them in decision-making processes (e.g., Metaverse Seoul (Tables 2 and 3)). <i>Enhanced efficiency of services with citizens' synchronous interactions</i> with government officials, (e.g., Metaverse Seoul and the UAE's Metaverse initiatives, (Tables 2 and 3)), which can lead to higher trust and approval of the governments.
4	Enhancing cost-effectiveness of government operations	Saving time and travel costs (e.g., Egypt's General Authority for Health Care's use of the Metaverse to promote its medical tourism project (Tables 1 and 2)).
5	Attracting digitally marginalized groups such as older generations	Offering Metaverse-related education (e.g., Metaverse Seoul development's second and third phases (Tables 2 and 3)).
6	Providing an alternative channel to access public services	Development of a digital twin of the government entity (e.g., Metaverse Seoul five-year plan (Tables 1 and 2)).
7	Stimulating economic development and foreign investments	Service delivery to businesses via the Metaverse can be used as a strategic planning priority to facilitate economic development and attract foreign investors (e.g., the UAE's Metaverse initiatives (Table 2)).

engaging them in decision-making. For instance, Metaverse Seoul's features allow users to play games, chat, and hold meetings, which facilitate citizen-to-citizen interaction and connections (Sung-Eun, 2023). Yet different governments might prefer different ways of democracy and have different requirements that might conflict with other governments. Functionalities such as this would aid in achieving key government objectives—citizen engagement in democratic processes—also referred to as “e-participation” (Dawes, 2008). This objective is concerned with democratic processes, which involve improving the processes of engaging citizens in agenda-setting. Concerted efforts are made to ensure that there is a comprehensive public discourse and consultation (Dawes, 2008). This objective also tries to address the culture of government and change the perception of the roles of public service by citizens and society (Dawes, 2008). The examples discussed above, such as those of Metaverse Seoul and the UAE, are illustrative of how *the Metaverse facilitates citizens' synchronous interactions* with government officials and provides an immersive 3D experience. When Metaverse technologies advance, these changes are likely to lead to more positive attitudes toward and perceptions of government services. Also, government officials are required to engage in Metaverse-based live and synchronous interactions using their digital avatars instead of asynchronous actions such as sending emails. Thus, a significant cultural change is likely to result from governments' use of the Metaverse.

Similarly, the Chinese government wants to use the Metaverse to achieve the CCP objectives (Pascual, 2022). The CCP has already utilized the Metaverse's potential as an education platform for the party-building experience and to transmit the CCP ideology to the young (Kshetri, 2022b).

The Metaverse can be used as a platform for collaboration and information-sharing, which can lead to increased efficiencies and cooperation. For instance, remote teams can use Metaverse technologies

to engage in planning. Personalized forums for virtual support groups can be built, which can increase community outreach, engagement, and support.

The Metaverse can be used to improve the quality and cost-effectiveness of government operations objectives. Egypt's General Authority for Health Care's use of the Metaverse to promote its medical tourism project discussed above can be used as an example to illustrate how the Metaverse can help improve the quality of public services.

Likewise, among many benefits, the Chinese Academy of Governance's new Metaverse-based system was reported to save time and travel costs (Kshetri, 2022b).

The benefits to citizens can be increased by using incentives to encourage citizens' use of electronic services. This can increase the use of electronic services, further reducing government service delivery costs (Margetts & Dunleavy, 2002).

Dawes (2008) suggested that the key to a project's success is a policy framework that establishes policy goals and specifies the rules and conditions for collecting, using, protecting and sharing information by government agencies, individuals, and the private sector. Citizens' concern about privacy and confidentiality of personal data has been a major obstacle in realizing digital government (Layne & Lee, 2001). Prior researchers have emphasized that cybersecurity is important for such data due to the sensitive nature of data in projects (Alharbi, Halikias, Rajarajan, et al., 2021; Smith & Jamieson, 2006). The growing use of public services has led to increased cybersecurity threats (Zhao & Zhao, 2010).

Such concerns are likely to be even more acute and pressing in the application of the Metaverse-based public services. The Metaverse is being built on many advanced technologies such as VR, AR, artificial intelligence (AI), machine learning (ML), and sensors of various types, which create all kinds of complexities. Prior researchers have noted that the increasing number of layers and complexity of these technologies would amplify potential cybersecurity vulnerabilities (Dwivedi et al., 2022). These issues need to be addressed in order to increase the acceptance of the Metaverse's use as a channel to deliver public services. Smith and Jamieson (2006) noted that key cybersecurity issues include awareness, active management support, training, and appropriate levels of funding. These measures are also relevant in the context of the Metaverse. The success of Metaverse-based digital government endeavors thus hinges on the presence of essential laws, regulations, and enforcement mechanisms to tackle privacy and security concerns. Prior research has suggested that government initiatives must ensure the accessibility and usability of technologies and improve information content (Dawes, 2008). Seoul City's mayor Oh Se-hoon acknowledged that there is a digital divide between the older and the younger generations (Tan, 2023). Metaverse Seoul development's second and third phases are expected to address the divide (Tan, 2023). The South Korean government has plans to bridge the digital divide by providing Metaverse-related education to digitally marginalized groups such as older generations.

In order to improve the quality and cost-effectiveness of government operations, it is important to take actions to increase investment in infrastructure, manage and use information effectively, enhance workforce capabilities, and assess performance (Dawes, 2008). The early adopters of the Metaverse in the government sector have taken initiatives on these fronts. For instance, in 2022, South Korea announced a \$185 million investment in Metaverse-related projects. The goal is to build a Metaverse ecosystem in the nation (Park, 2022). Likewise, in 2021, the capital city Seoul announced a five-year plan to build the city's digital twin to provide another channel for citizens to access municipal services (Park, 2022).

The examples above illustrate that the Metaverse can be used to stimulate economic development and attract foreign investments. In the early 2000s, Latin American economies such as Chile, Paraguay, Argentina, and Uruguay had online service delivery to businesses as a strategic planning priority in order to facilitate economic development (Banerjee & Chau, 2004). Prior researchers have noted that a country's

strong business-enabling environment is positively related to foreign investments (Banerjee & Chau, 2004). The use of the Metaverse is likely to have a more powerful effect on attracting foreign investment.

7. Conclusion

The Metaverse has already opened up a number of opportunities for the government sector and can transform government functions and roles. The Metaverse provides rich interactions between governments and their constituents. This innovation can help deliver some services without being physically present, which is not possible using other media. The aforementioned examples, like the pilot project by the U.S. Department of Veteran's Affairs utilizing VR for PTSD treatment in individuals with prior traumas and the potential for the Metaverse in enabling advanced real-time healthcare services such as remote surgery, underscore this point. This means that the Metaverse can help expand public services and participation, engagement, diplomacy, and policy-making and stimulate economic growth by attracting foreign investors. This technology also can include emotions and other aspects that are often not included. Initially, the Metaverse might be especially attractive for engaging with young consumers, such as children and young adults, who are the dominant demographic of the Metaverse. At a later stage, this likely will change. Increasing use of such applications in the government sector is expected in the future.

While there are alternative technologies for addressing issues tackled by the Metaverse, it offers a quicker and more impactful solution with enhanced information richness. The adoption of the Metaverse can also contribute to a wider adoption of e-government functions. Additionally, it can lead to deeper adoption and higher usage levels of these functions among younger generations.

The utilization of the Metaverse in digital government necessitates careful consideration of its inherent limitations. As noted in Section 3, the Metaverse applications are currently in the early stages of development. Additional limitations encompass the absence of suitable regulatory frameworks, the computational intensity involved, the costs associated with devices, and the various security, privacy, and other risks inherent in the use of the Metaverse in digital government/.

Now that the Metaverse is being shaped, governments can influence the development to ensure it meets their requirements and the challenges can be overcome. Researchers and governments must experiment already in the early stages to understand the transformations the Metaverse might bring. Yet, different governments might want to use the Metaverse differently, and these differences need to be considered.

With respect to the facilitator-barrier framework mentioned earlier, some factors fall within the domain of governments endeavoring to integrate the Metaverse into their operations and procedures, while others remain outside their control. For instance, governments can facilitate PPPs to advance Metaverse solutions. In contrast, many factors associated with technology and human behavior may remain beyond their control, however, legislations can be used to direct the efforts.

Finally, given the early stage of Metaverse development in government services, our research predominantly emphasizes exploration and theory building. As more government agencies embrace this innovation across a broader range of services, an opportunity arises to engage in empirical research. Future research could validate the propositions posited in this study and further expand our findings.

CRedit authorship contribution statement

Nir Kshetri: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Yogesh K. Dwivedi:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **Marijn Janssen:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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