The Metaverse and the Public Sector: an Opportunity for Public Healthcare?

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Abstract

Over the last few years, increasing attention has been paid to the Metaverse, particularly by large private organisations; above all, Facebook, the social media giant, decided to invest heavily in the Metaverse and even changed its name to Meta. The public sector has also started to investigate to what extent the Metaverse can be a way to innovate public service delivery, and a few publications have begun to appear on this topic.

Despite this growing attention paid to the Metaverse by academics and practitioners, to the best of the authors' knowledge, there has been no formal review of the literature on delivering public services in the Metaverse. This paper aims to fill this gap. After providing an introduction to the Metaverse and its main elements, it reports the main elements that emerged from the published literature such as its wide potential application to healthcare. The paper also reflects on the future of public services in the Metaverse and the opportunities and risks related to its use.

Introduction

This paper is about the use of the Metaverse for delivering public services. The Cambridge Dictionary defines the Metaverse as "a virtual world where humans, as avatars, interact with each other in a three-dimensional space that mimics reality" (Cambridge Dictionary, 2023). Similarly, Madiega et al., 2022, p. 1 define the Metaverse "as an immersive and constant virtual 3D world where people interact through an avatar to carry out a wide range of activities". Broadly speaking, it is a virtual space "where people can do all sorts of things they do in real-life such as shop, play, socialise, and party" (Bhugaonkar et Al. 2022).

Why is the Metaverse relevant for Public Organisations and Public Management Scholars, and why should we care? Traditionally, digital government consisted of an one2one relationship between a public organisation and a citizen. In a few cases, it involved multiple public and private organisations and citizens. We believe the Metaverse is relevant for Public organisations as it allows an n2n interaction. The possibility to interact is one of the main characteristics of the Metaverse, as it is "an interconnected web of social, networked immersive environments in persistent multiuser platforms. It enables seamless embodied user communication in real-time and dynamic interactions with digital artefacts" (Mystakidis, 2022).

The main implication for public management is that delivering public service in and through the Metaverse may change the relationship between service providers and users. In fact, in the Metaverse, not only can a public organisation interact with a recipient of a public service, but

more citizens can interact with each other, as can multiple public and private organisations. We argue that this is a significant change in public service delivery, and it potentially opens the door to new forms of interactions and co-production in the public sector.

Compared to Virtual and Augmented Reality, the Metaverse simultaneously allows interaction with other human beings in the same virtual environment. A big leap forward was made by the acceleration towards digitalisation carried by Covid-19, and by the Gen Z social concept of the likeness of the online and offline self (Park & Kim, 2022), thus thinning the line between the two layers of existence. Second Life, Fortnite, Roblox and even Minecraft are considered to be examples of metaverses. Previous examples of metaverses existed in the past, but what makes today's metaverses different is technology: wearable technology such as visors allow for easier access, a more accurate vision, and a more immersive environment and natural movement, thus providing a completely different experience from earlier PC-mediated attempts (Park & Kim, 2022).

The American writer Neal Stephenson coined the term Metaverse in 1992 in the science fiction novel Snow Crash, set in futuristic Los Angeles (Stephenson, 1993). There, individuals interacted in a virtual world that he named the Metaverse:

> "So Hiro's not actually there at all. He's in a computer-generated universe that his computer is drawing onto his goggles and pumping into his earphones. In the lingo, this imaginary place is known as the Metaverse" (p. 24).

The term is composed of the Greek prefix *meta*, which means "beyond", and *verso*, a contraction of universe: it can be considered the convergence of physical and virtual reality (Mystakidis, 2022).

Since then, the Metaverse has taken significant steps forward, and several companies have been investing in creating the infrastructure, software, and hardware to create their own Metaverse platforms (Mystakidis, 2022). Some estimates say that the Metaverse sector will grow up to $800 billion by 2024 (Career Communications Group, 2022) and that by 2026 about 30% of organisations around the world will offer products and services for the Metaverse (Verma & Singla, 2022).

Several elements characterise the Metaverse, such as a technical infrastructure to allow marketplaces and digital shopping to work, using digital currencies and non-fungible tokens and allowing interactions with "digital humans" (Fig. 1).

Figure 1: Elements of the Metaverse
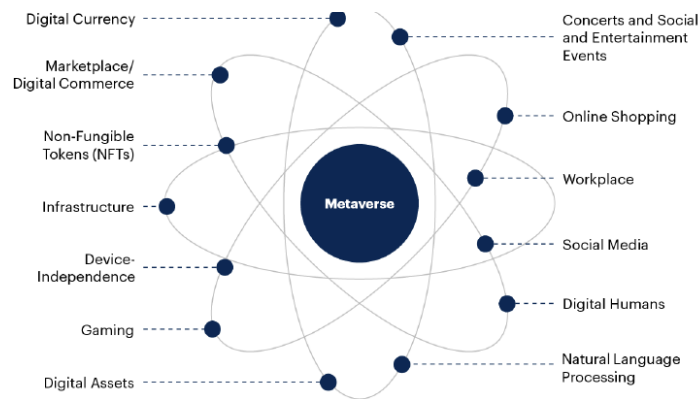
Source: (Verma et al., 2022)

Today, there are multiple metaverses, but some believe that there will be just one Metaverse and several virtual worlds in it, such as there is one Internet (Ball, 2022).

As of now, there are several kinds of metaverses, and they can be grouped into two main blocks, "service platforms" (such as Roblox and Minecraft) and "configurable environments" (e.g. Unity) (Park & Kim, 2022).

Over the last few years, research in different fields started to investigate the transformative impact that the metaverse is likely to have on several sectors, including marketing, education and healthcare. In addition, the Metaverse is expected to impact social relations, trust, privacy, and juridical and psychological aspects, with particular attention that has to be paid to the most vulnerable individuals (Dwivedi et Al., 2022).

Despite this growing interest, not as much has been made regarding the possibility of using the Metaverse for business functions, particularly for public sector organisations. For these reasons, this paper aims to investigate the potential and actual uses of the Metaverse in the public sector and for delivering public services. We adopt a systematic methodology to systematically review the literature on using the Metaverse to deliver public services.

With this review, we contribute to the discourse about innovation in public service delivery by exploring the use of Metaverse-like applications to public services whilst also addressing the potential risks and benefits related to the implementation of the Metaverse in public services, from privacy to systemic discrimination, and we highlight new research avenues while raising critical standpoints.

To the best of our knowledge, this is the first review of Metaverse-based public service delivery.

In the next section, we define the Metaverse according to state-of-the-art research. In section 3, we draw out the conceptual framework for this study. The following sections will outline the methodology and results of the literature review. We conclude by discussing the results in light of current expectations and setting a research agenda for using the Metaverse for delivering public services.

The Metaverse: what it is and what it is not

The Austrian philosopher Karl Popper in his book *Objective Knowledge*, published in 1972, theorised the so-called "Three Worlds". He postulated that the first world is made of physical attributes and has physical properties (e.g. a house). The second world is the mental representation of the physical world (e.g. memories). The third world is the "symbolic world of language, ideas, propositions, schemes, models etc. that exist independent of the first and second world" (Nugent et al., 2015), e.g. the concept of a house). Although the three worlds can exist independently of one another. The advent of the Metaverse now opens the doors to a *fourth* world "that can be concretely experienced and inhabited…and is not simply a map or model of the physical universe, but its digital twin" (Tagliagambe, 2022, p. 33).

The Metaverse is based on two simulated experiences, Augmented Reality (AR) and Virtual Reality (VR). AR and VR are respectively known as the augmentation of a layer of reality, obtained by applying a virtual layer over an existing tangible environment and producing a virtual environment accessible through different kinds of devices (visors, wired gloves, etc.) (Mystakidis, 2022). The concept of Metaverse, though, differs from both as it aspires to be a self-standing "persistent multiuser environment" (Mystakidis, 2022 p.486, Park & Kim, 2022). The interaction among participants characterises the Metaverse and distinguishes it from augmented and virtual reality: "The metaverse has the potential to extend the physical world using augmented and virtual reality technologies allowing users to seamlessly interact within real and simulated environments using avatars and holograms" (Dwivedi et Al., 2022).

There are two main types of challenges related to the Metaverse. The first one is technical. Several authors have pointed out technical challenges, such as wide bandwidth, network connection, fault management and security (Park & Kim, 2022). The technical aspects also impact human activity, and acting in the Metaverse may determine consequences such as simulated motion sickness and physical fatigue (Park & Kim, 2022).

The second type of challenge is about what we will do in the Metaverse. In fact, it is now mainly used for gaming (e.g. the already mentioned Roblox and Minecraft). Still, there are several works in the literature that highlight many potential other uses, for example, to deliver services using "digital twins". From this point of view, we consider the metaverse a twofold concept. On the one hand, it is the "fourth world" in a Popperian approach in which humans will be able to perform several activities, partly twinnings of what we do in the real world (for example, attending a concert), partly performing ad hoc activities, most of which we still can't imagine. On the other hand, the Metaverse is a tool that, we believe, can be used to deliver services and satisfy private businesses' customers' and public organisations' users' needs alike.

Conceptual framework

Mulgan & Albury, 2003 p.3 define innovation as 'new ideas that work' and "successful innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes efficiency, effectiveness or quality". Karakas, 2020 p.2 defines public innovation as "the process of generating new ideas and implementing them to create value for the society. To this end, public sector innovation is about new or improved processes and services". The same author suggests four public sector innovation types: product, process, organisational and communication innovation. The first one relates to a new or significantly improved service or good. The second is about a new process to realise and deliver goods or services, which should be substantially new compared to the existing ones. The third form of innovation regards new ways to organise or manage work, significantly different from previous methods. The last type is about implementing a new way to promote the organisation or its services or goods. Similarly, Hartley, (2005) lists seven types of innovation: product, service, process, position, strategic, governance and rhetorical. The main differences with the previous list of innovation types are position innovation, which refers to a new context or new users; strategic innovation, which regards new organisational goals or purposes; governance innovation which is about new forms of engaging with the citizens and new democratic institutions. Although the Metaverse is still in its infancy in general and the public sector in particular, we argue that service delivery in the metaverse is an innovation that meets several elements of the definitions mentioned above. It is a *product* and *service* innovation that involves delivering new or improved services (for example, in public education). It is a *process* innovation as it creates new ways to deliver the service, for example, how individuals interact

with each other and with the public organisations delivering public services. The Metaverse also create a completely new context, a form of *position* innovation and new forms of citizens' engagement (*governance* innovation). It is also an *organisational* innovation, as public organisations will need to significantly modify the internal organisation and the organisational structure, for example, to deliver medical services. Finally, the Metaverse will ask public organisations to change how public services are promoted and how the organisations communicate themselves externally by using new languages and concepts (*communications* and *rhetorical* innovation). The Metaverse will give those organisations that invest in this form of innovation a *strategic* advantage compared to those that decide not to do so.

(Walker, 2008) suggests that innovation in the public sector may occur in search of legitimacy and may not get to the implementation stage. For this reason, to be able to talk of innovation, actual implementation is needed. Innovation in the public sector is also linked to the behavioural, cultural, structural and environmental conditions in which it is produced (Newman et al., 2001). This is why we are particularly interested in observing the actual uses of the Metaverse to deliver public services.

Also, according to Institutional theory, innovation arises "where it is perceived to be becoming widespread practice elsewhere, with adoption viewed as providing additional organisational legitimacy (Meyer & Rowan, 1977 p.67). From this point of view, our study highlights increasing attention towards the Metaverse in public sector settings, as witnessed by several recent studies, for example, by the European Union (European Commission, 2023; Madiega, 2022). Although most studies in our review relate to projects and hypothetical implementation of the Metaverse in public organisations, they tell us a story of growing awareness towards this topic. Some authors state that innovation, especially in the public sector, is usually evolutionary rather than radical (Walker, 2008), which respectively refers to *incremental* (or cumulative) innovation – based on gradual changes over time – and *sudden* innovation, based on radical change. We expect that the application of the Metaverse in Public Administration would be incremental, despite the significant speed the Metaverse has been experiencing over the last few years, not to mention the diffusion rate of Artificial Intelligence, which has a key role for the Metaverse (Thien Huynh-The, 2023). Similarly to the Covid-19 dynamics, we predict an evolutionary component in how PA would apply the Metaverse; as with digitalisation after the Covid-19 pandemic, PA will probably rely on the experience and trial-and-error of other sectors before implementing the Metaverse.

In our work, we refer to the innovation diffusion theory with the five stages suggested by Rogers (2003): knowledge, persuasion, decision, implementation and confirmation. In the knowledge stage, awareness of a specific innovation arises, and individuals learn about the existence of innovation. In this phase, it is important to understand what are the potential implications of innovation, for example, what the innovation may be used for, or what are the benefits and risks that public organisations may incur from implementing such innovation; with persuasion, individuals build a negative or positive attitude towards innovation. In the third stage, individuals decide to adopt or reject an innovation. In case adoption is decided, it is followed by the implementation when the innovation is put into practice. The last stage is confirmation, when the decision to adopt an innovation is reinforced, as the previous decision may be subject to change, and an innovation may not be confirmed. We argue that the Metaverse is now in the knowledge phase.

From the above analysis, we formulated three research questions to investigate what services public organisations can deliver through and in the Metaverse and what the benefits and risks related to using the Metaverse for delivering public services.

As we will show in the results section, even though there are very few actual implementations of the Metaverse in the public sector (which reinforces the idea that the Metaverse is in the knowledge phase), there started to be a growing number of studies aimed at investigating the potential role of the Metaverse in delivering public services. For this reason, the first research question is the following:

RQ1: "What are the existing and hypothetical Metaverse **applications** for delivering public services reported in the literature?"

Introducing such an innovation is not risk-free, and the use of the Metaverse is likely linked to potential social and psychological outcomes. For this reason, we formulated the second research question:

RQ2: "What potential risks can arise from using the Metaverse?"

Finally, the last research question refers to the benefits linked to the use of the Metaverse by public organizations, which is the main reason for implementing it, also considering that, from an organisational point of view, the processes to deliver public services will likely change if Public organisations use the Metaverse. For this reason, we formulate the third research question:

RQ3: "What are the perceived **benefits** of using the Metaverse for both citizens and public organisations?"

In this way, we intend to open new perspectives on this emergent topic (Torraco, 2005).

Methodology

We decided to develop an *Integrative literature review* and articulate it using the five steps proposed by Cooper, 1989: (1) Problem and hypothesis formulation to guide the review; (2) Data collection strategy; (3) Inclusion criteria and evaluation of the data; (4) Analysis and interpretation, and (5) Results of the review. This kind of review is "a distinctive form of research that generates new knowledge about the topic reviewed" and is suitable for both mature and emerging topics (Torraco, 2016 p.357).

With regards to Metaverse implementation in the public sector, this is an emerging field where little research has been conducted so far in general and by public management scholars in particular. When a new research field is emerging, it will result in scientific publications. We, therefore, believe that a literature review is the appropriate research method to take stock of what has been done so far in this field and lay the foundations for future research.

Results

After formulating the research questions, we searched for books and book chapters, peer-reviewed articles and conferences proceeding in Google Scholar, Web of Science and Scopus databases. The search employed the following search words in the title, abstract and keywords:

- Metaverse AND Public AND Service
- Metaverse AND Public AND Sector
- Metaverse AND Public AND Organisation
- Metaverse AND public AND policy
- Metaverse AND Public
- Metaverse AND local AND Government
- Metaverse AND regional AND Government
- Metaverse AND city
- Metaverse AND Health
- Metaverse AND Public AND Health
- Metaverse AND public AND education

We defined the following inclusion criteria. We selected peer-reviewed articles, books and book chapters, published in English. We decided to include conference proceedings as well, as we believe this is an outlet where the most recent research is likely to be published. Articles, books and book chapters must deal with service delivery in a public sector setting and could be related to actual or hypothetical services.

The first search in February 2023 produced n=591 results, n=505 references in total after removing the duplicates; we then proceeded with the screening of the abstracts and the full texts, and after excluding non-relevant studies based on the inclusion mentioned above criteria, we ended up with a total of N=169 references. A second search yielded N=131 more results. After the exclusion, N=15 more journal articles were added to the sample, reaching a total of N=184. A third search in June 2023 yielded N=55 results, of which after exclusion, N=4 were added to the sample, adding to a total of N=188. In July, after a new search N=2 more were added, to a total of N=190.

The first stage of analysis produced a descriptive overview of the references. Figure 2 depicts the sharp increase in the number of publications about the topic of the Metaverse. Out of n=190 analysed articles, n=131 were published in 2022, and the rest covers a timeline between 2001 and 2023.
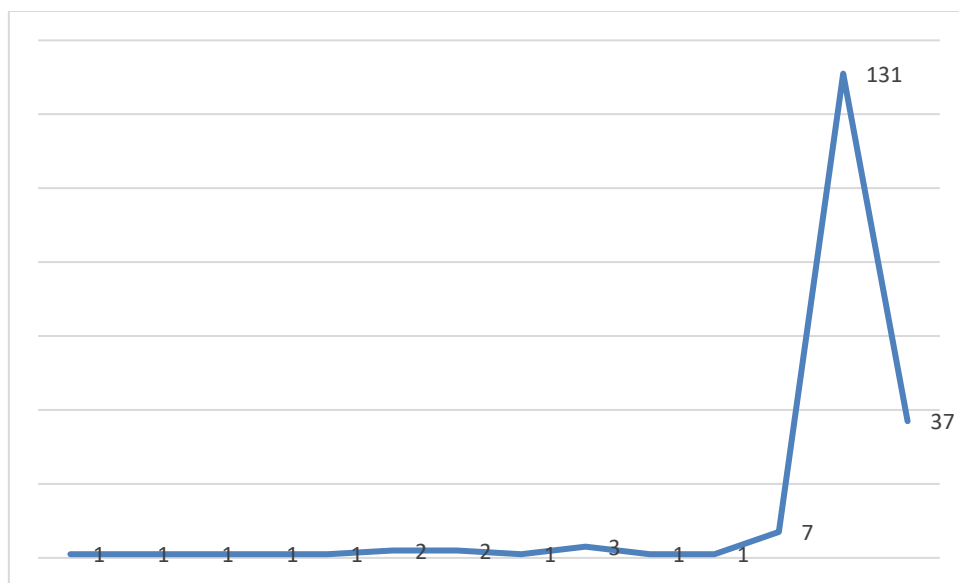

Figure 2: yearly frequency of publications

Publication outlets

Most of the studies were peer-reviewed published journal articles (N=165, fig. 3), n=6 books and book chapters and 19 published conference proceedings. Seven other resources included pre-prints, university graduate publications and one opinion paper.

Overall, the n=190 resources were published on n=154 outlets (including journals and conference proceedings, fig. 4), which suggests extended albeit fragmented interests in the topic across sectors. Future analysis will cover a descriptive report of the publications and a network analysis of the sources.
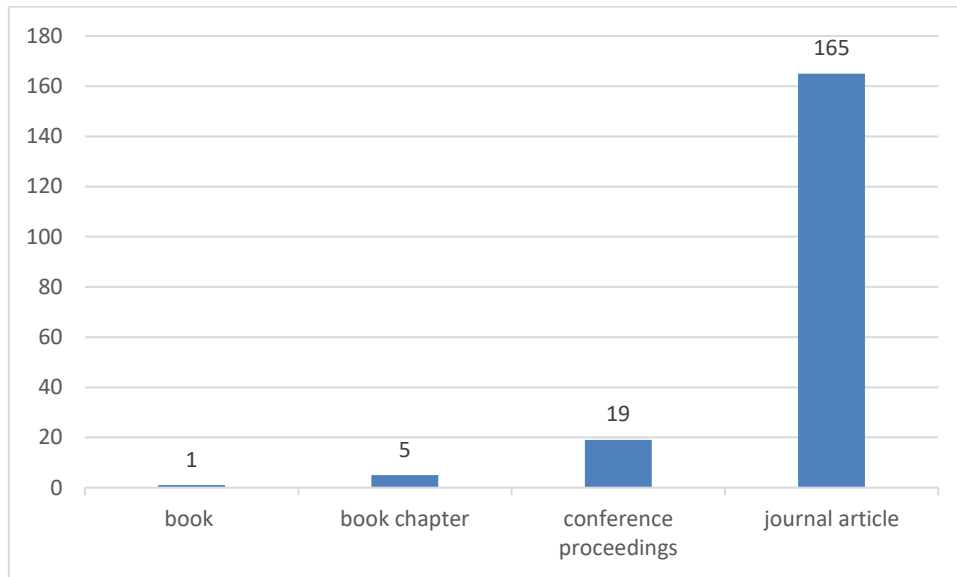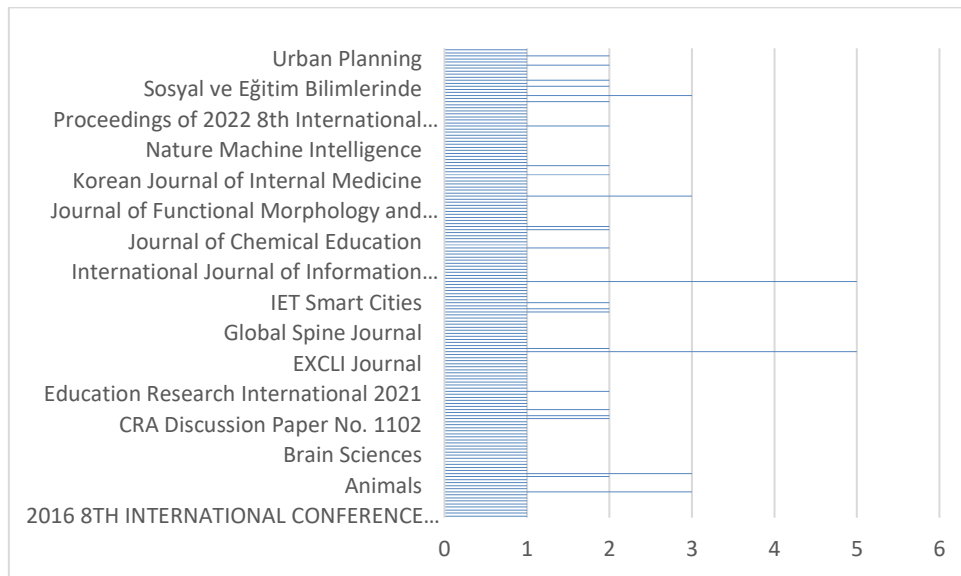
Figure 3: typology

Figure 4: publications

Research design and methods of the reviewed papers

Most analysed studies are literature reviews (n=118, fig. 5), including theoretical frameworks, definitions, scoping reviews, systematic reviews, and similarly structured articles. The rest covers several methodologies, including surveys, experiments, quasi-experiments and case studies.
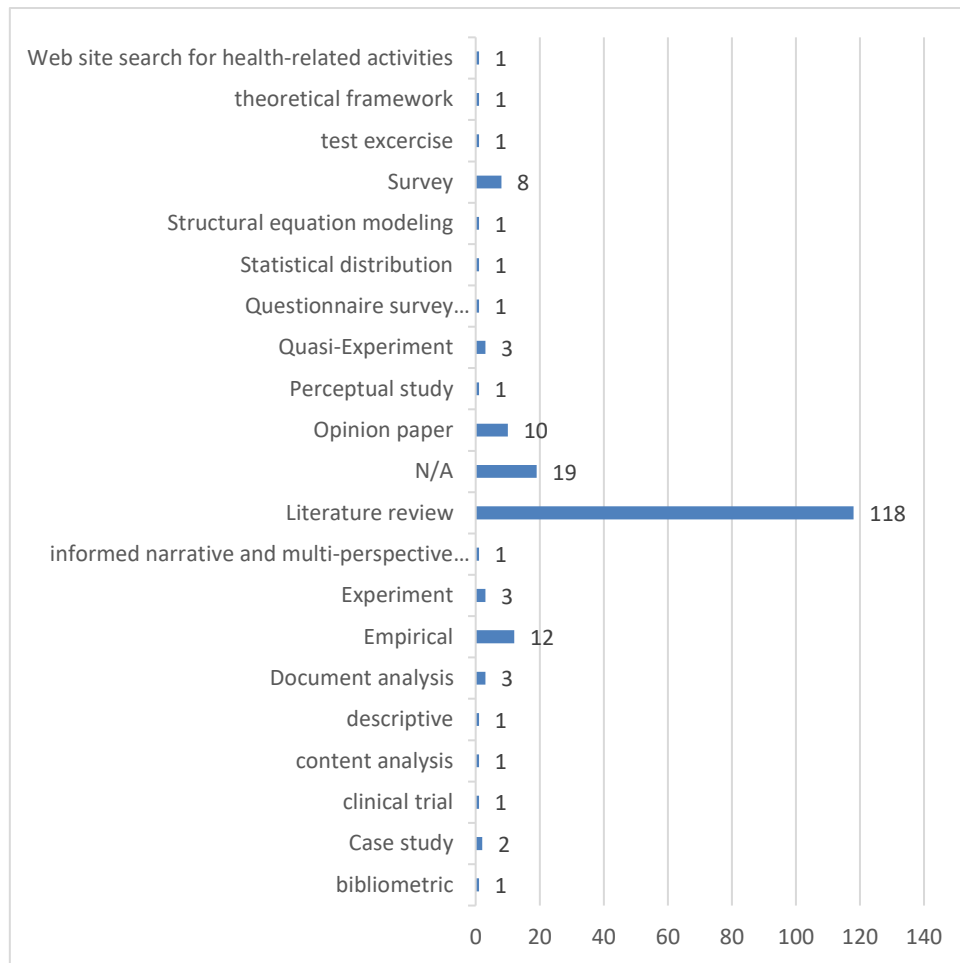
Figure 5: methodology

Actual and Hypothetical Applications

In the analysis, we also distinguished between articles that reported actual applications, articles that discussed hypothetical applications, and articles that included both actual and hypothetical points of view (as in the case of some literature reviews).

First, we found that most applications of the Metaverse are hypothetical rather than actual. In fact, in 53% (n=101) of the studies, just hypothetical applications are reported. 20% (n=38) are about actual applications, and 13% (n=25) of the studies report both actual and hypothetical applications. The reported cases of actual use of the Metaverse are almost exclusively related to the healthcare and education sectors. We also found 14% (n=26) of the cases that did not report this aspect. This will answer our first research question: "What are the existing and hypothetical Metaverse applications for delivering public services reported in the literature?".
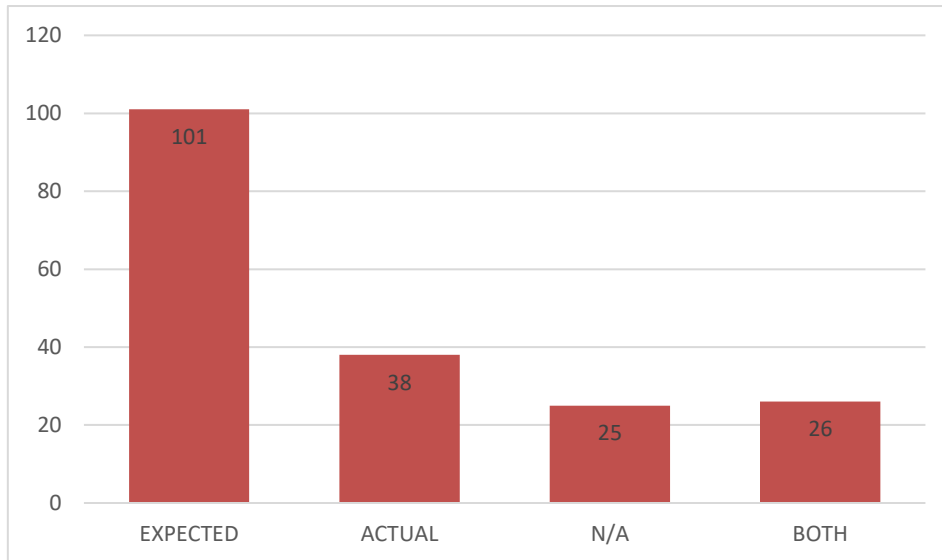
Figure 6: expected vs. actual applications

We found most applications in the healthcare sector, with over 40% of the overall applications (table 1), both expected and actual. Among the health services, we found rehabilitation, mental healthcare, telemedicine in general, diagnosis, cardio-vascular treatment, virtual counselling, long covid treatment, mental health and personality disorders, palliative care to improve the psychological well-being of patients and even analgesia.

Field	N	percentage
Health	**82**	**43%**
Education and training	43	23%
Urban planning	8	4%
Multiple fields	6	3%
Smart Cities	3	2%
Public transport in the Metaverse	2	1%
Social services	2	1%
Other	5	3%
Not reported	39	21%
	190	100%

Table 1: fields of application of the studies

The second most frequently cited field is Education and training, with 20% of the cases. Here we found many different applications in several subjects and areas, mainly related to the delivery of training courses to teach both students and train teachers. Other fields are reported with a

lower frequency, such as smart cities, social services and a few more cases with one reference only. The rest applies to generally expected applications (not specific to any field).

Risks of Using the Metaverse

The RQ2 asked, "What are the potential **risks** that can arise from using the Metaverse?". We found several, potential risks reported in the articles. Some articles expressed the risks in using the technology, which appears to be not ready yet to support all the activities that people in the Metaverse are expected to perform (Tan et al., 2022). For example, interoperability among different virtual worlds in the Metaverse, graphic resolution, hardware capacity and processing speeds can pose severe problems to the correct functioning of the Metaverse and its capacity to deliver services (Radford et al., 2011). Also, technophobia, the fear of using technology, can be increased by the immersive features of the Metaverse (Yuan, 2022).

Some articles reported concerns about the possibility that crimes can happen in the Metaverse, also due to the virtual environment and anonymity (Ocak et al., 2022). In addition, security and privacy concerns are frequently reported as significant aspects to be dealt with (T.-C. Wu & Ho, 2022), and the theft of personal information (Pamucar, D., Deveci, M., Gokasar, I., Tavana, M., Köppen, M., 2022). Reduced social relations and loneliness are also reported (Oh et al., 2023; Pamucar et al., 2022).

Another reported risk regards harmful products. For example, companies may use the Metaverse to foster increased alcohol or drogue consumption by facilitating the integration of virtual and real-life experiences (Huckle & Casswell, 2022).

Concerning the healthcare sector, a substantial risk is the lack of personal contact with doctors, and the inability to perform a physical examination (Skalidis et al., 2022). The already mentioned data privacy risk is even more exacerbated in the healthcare sector, due to patients' data specificity and sensitivity (T.-C. Wu & Ho, 2022; Y. Wu et al., 2022).

Cyberchondria is another risk that is well-known on the Internet, and the Metaverse can augment that. It is a neology that indicates the unfounded concerns of patients, derived from searches, toward common symptoms (Yuan, 2022). In addition, some studies report cybersickness, simulator sickness, motion sickness, dizziness, and physical discomfort (Sunardi et al., 2022). Finally, for individuals suffering from mental health disorders, the Metaverse can exacerbate their problems (Benrimoh et al., 2022).

Several risks have been explicitly reported in the education and training sector. For example, getting lost if the technology is poor or a has limited graphic resolution (Radford et al., 2011). Still linked to technological problems, students may face limited system accessibility and difficulty using AR/VR systems (Tan et al., 2022). Students may also suffer from a detachment from reality; for example, they may face problems in adjusting to real-world situations; or they can forget about their own self and face cultural degeneration (Sunardi et al., 2022). Zhong & Zheng (2022) report the risk of creating public opinion, technological concerns and safety ethics.

The Metaverse's main benefits

The third research question is: "What are the perceived **benefits** that can arise from the use of the Metaverse for both citizens and public organisations?". Several benefits emerged from the review. The primary reported benefits regard the healthcare and the education and training sectors.

Regarding healthcare, Situmorang (2022) reports the possibility of a more rapid tele-psychotherapy and T.-C. Wu & Ho (2022) talk about improved triage skills training and interpersonal relationships. Also, supportive intervention in rehabilitation programs may promote engagement in physical activity, especially for older adults (Shah et al., 2022).

The Metaverse may also allow having a personal doctor for emergencies (Y. Wu et al., 2022) and personalised medicine (Singh et al., 2022).

The Metaverse may also have applications in several health specialities, for example, in dentistry, as patients can receive oral health monitoring from their home and book a physical appointment only when needed (Sailer, 2022).

Health communication will also benefit from the Metaverse, as it will be more experience-based, rather than information-based (Plechatá et al., 2022). Other possible benefits are better dissemination of health information, enabling patient education and patients being more engaged in various health-related activities (Beard et al., 2009). Not only patients benefit from the Metaverse, but also doctors and other healthcare workers can enhance their healthcare education toolkit, simulating health protection protocols (Kerdvibulvech, 2022).

Additional reported benefits are the reduction of mental health stigma (Rodríguez-Rivas et al., 2022), easier access to care and lower costs (Wiederhold & Riva, 2022).

Anwer et al. (2022) also report that informed decisions and overcoming the language barrier with no physical presence are important benefits.

The Metaverse, or its archetypes, are widely used in healthcare education and training. It was found that its use may increase social skills and decrease student anxiety (Miranda et al., 2022). Students also appear to be able to develop increased soft skills and character. The Metaverse will also foster first-hand experience, experiential learning, improved practical alignment in training and education programs and more engagement (Asad et al., 2021; Yilmaz et al., 2023). Still related to the education and training sector, the Metaverse is believed to improve data management and ease of access to course materials and new ways to visualise data (Radford et al., 2011). The same authors suggest that students will enjoy more freedom to express themselves and take risks and develop collaborative learning. Similarly, Campo Ocak et al. (2022) highlight that the Metaverse can develop a strong sense of social presence and socialisation and improve learning through realistic games.

According to Yue (2022), the Metaverse provides better equality regarding opportunities for the best possible education. It also removes time limits in learning, as students can learn in their own time and pace.

Finally, the Metaverse can foster soft skills development and increase accessibility for students with special needs (Bakhri & Sofyan, 2022).

Concluding Remarks

The Metaverse is a new and emerging field that has, up to now, received little attention from public management scholars. We believe that the Metaverse offers important opportunities for public sector organisations to change how they deliver public services and even to offer entirely new ones. For this reason, we believe it is a promising form of innovation. The growing attention towards this topic is testified by the recent increase in scientific publications, which started in 2021 and sharply increased since 2022.

Despite this growing attention toward the Metaverse in general, our research has highlighted a relatively short number of publications on delivering public services in the Metaverse. We know that other works could be found in the so-called grey literature, composed of works other than scientific papers. Even though, in some cases, grey literature can reveal a new research field in advance, we decided to focus on scientific content (peer-reviewed articles, books and book chapters, and conference proceedings).

Although most papers report experimental projects or broad hypotheses of using the Metaverse, the preliminary results show that the Metaverse may particularly impact some

specific segments in the public sector. The most cited segment in the literature that we reviewed is healthcare; in light of the rise of telemedicine during the Covid-19 emergency, this sector appears to be able to benefit from the Metaverse by potentially allowing immersive health practices at a fraction of the cost of in-person delivery (Wiederhold & Riva, 2022).

The second most cited segment is education which is expected to be profoundly transformed by the Metaverse by allowing a more intense online interaction compared to the current distance learning tools.

The fact that 60% of the overall studies focus on these two sectors may be interpreted that there is a search for an understanding of how the Metaverse can help provide public services that directly impact an individual's life. Among the many services public organisations provide, healthcare and education appear to be the first candidates to be delivered in the Metaverse. The healthcare sector, in particular, is developing quasi-experiments and clinical trials using metaverse-based environments to address several tasks, including but not limited to training, mental health treatment, and physical rehabilitation. For example, the Metaverse is believed to offer important opportunities for treating individuals with specific psychological disorders (Cerasa et Al., 2022).

In general, we conclude from this literature review that most studies are hypothetical and provide an overview of the expected applications, implications, risks and benefits of the Metaverse. In the few cases of application of the Metaverse, we see it in its archetypic forms through AR and VR. Technical and cultural limitations still exist that can hinder the diffusion of the Metaverse, but we believe these limitations will be overcome soon. Those public organisations that start studying and working in this field will enjoy a competitive advantage compared to more conservative organisations.

Our literature review is timely because this new methodology and its technical environment are growing very fast. We believe public sector organisations and public sector scholars must study and investigate new development capable of disrupting existing practices. For this reason, we believe it is essential that public organisations and public management scholars gather an in-depth knowledge of the Metaverse, its potential benefits and risks.

This is even more true as we believe the Metaverse will have managerial, policy, and theoretical implications for public sector organisations in a few areas. First, concerning the interaction between public organisations and citizens as the Metaverse will be a new ground to foster citizens' participation and engagement, particularly among young individuals. Second, the

theoretical foundations of public management theory need to be revisited, as this new form of interaction will require new ways to design public services and new forms of coproduction that consider the users' new expectations. Third, from a political point of view, legislators will need to regulate what can be and cannot be and how it can be done in the Metaverse. Eventually, the paper aims to raise awareness among politicians and policy-makers so that they start thinking ahead about how the Metaverse can be regulated.

Future research might focus on several streams. One is to look for actual use cases of Metaverse applications to deliver public services, especially in healthcare. In this stream, case study exploration is particularly instrumental to investigate the actual implication of delivering health services in the Metaverse; from these case studies, new knowledge on how to build and improve Metaverse-related experiences can be derived.

Secondly, understanding for what services, under what conditions and to what extent the Metaverse can be helpful. For example, it is essential to understand if the Metaverse is beneficial for all health services or for some of them only and, in this latter case, for which ones; and if its use can improve clinicians' and patients' experience. A third stream could be to investigate the preconditions and the antecedents that can foster the use of the Metaverse in a public sector setting. For example, what technical issues can influence the Metaverses' performance? Are today's technologies sufficient to support the computing power required to operate all the functions the Metaverse needs? Finally, research might focus on the economic, psychological, sociological and juridical implications deriving from using the Metaverse to deliver public services, especially in fields sensitive to privacy and ethical issues such as healthcare. Analysing why the Metaverse is used or experimented mainly in a few sectors (healthcare and education) may help understand the future possible developments of this promising field.

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