Metaverse meets digital entrepreneurship: a practitioner-based qualitative synthesis

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Abstract

Purpose – Considering the pervasiveness of technology, this article offers an understanding of how the metaverse can impact digital entrepreneurship. The objective will be to gather professional evidence on how the revival of this new technology can bring entrepreneurial development.

Design/methodology/approach - Through a qualitative study approach based on applying the metaverse in digital business contexts and analyzing 533 practitioner sources from the NexisUni database, it will be possible to identify the concepts and application techniques of this emerging technology. The research adopts a qualitative methodology based on a mixed thematic and content review using tools such as ATLAS.ti and Leximancer.

Findings – Our study finds three relevant macro-topics for metaverse and digital entrepreneurship (Technology, Immersive and Design) and eight concepts (Private Solutions, Digital Twins, Gamification, Public Solutions, New Business Worlds, Co-design, Collaborative Spaces and Stakeholders' participation). The uncovered elements demonstrate professionals' interest in a new mode of digital entrepreneurship using the metaverse. This interest highlights the commitment of companies and entrepreneurs toward discovering new services delivered in virtual and parallel worlds that find the creation of digital twins as their essence. Therefore, the study explores ongoing relationships for developing increasingly technically complex metaverse platforms and customer service offerings.

Research limitations/implications – The study has some limitations as the selection of the database and the way the cases are focused on, which may be a stimulus for future studies. The analysis has innumerable theoretical and practical implications. In the first case, our research will shed light on an empirical case concerning the conceptual difference between innovation or greater transformation of business models through the metaverse. This work will directly contribute to the global discussion by identifying a model for applying emerging technology to digital entrepreneurs. Finally, from a practical point of view, we will provide new insights to digital entrepreneurs by showing them applications, best practices, and platforms they can use for their businesses.

Practical implications - On a practical level, we show practical opportunities coming from the metaverse for digital entrepreneurs. This study may inspire CEOs, managers, and future entrepreneurs to use the metaverse to expand their businesses by diversifying their services into numerous sectors.

Originality/value - To the best of our knowledge, this study represents one of the first efforts to study the metaverse by framing it from theoretical and practical perspectives of digital entrepreneurship. Additionally, future research implications may guide researchers in this brilliant research field.

Keywords: *Metaverse, digital entrepreneurship, co-design- digital twins, public value, qualitative study*

1. Introduction

In recent years, we have witnessed the spread of new digital technologies as drivers for novel business ideas (Kraus et al., 2019a). A large part of the world's entrepreneurship progress depends on technological changes. Numerous studies stress the role of technology as an entrepreneurial enabler. For instance, according to Schiuma et al. (2021), entrepreneurs have increasingly employed new technological ways to promote competitiveness. Moreover, Troise et al. (2022) confirm that new technical environments enable entrepreneurs to navigate turbulent and uncertain environments. Therefore, numerous scholars indicate that cutting-edge technologies can promote winning entrepreneurial opportunities (Dong, 2019; Nambisan, 2017; Upadhyay et al., 2021). While one stream of the literature invokes positivist and constructivist ideas, other authors question the business issues such changes might promote. For instance, according to Oyemomi et al. (2016), adopting emerging technologies only sometimes represents light and successful choices from a business perspective.

Nonetheless, as most often recalled, it is first necessary to study and evaluate the theoretical significance of technology adoption and provide practical implications for entrepreneurs (Garousi Mokhtarzadeh et al., 2020). The need to rely on external knowledge and evaluate application capabilities is emerging, especially regarding dynamic platforms (Biancone et al., 2021), such as the advent of the metaverse. Despite considerable interest in professionals from leading international consulting firms (Accenture, 2022; KPMG, 2022; Ward, 2022) and other sectors such as marketing, supply chain, gaming, and health (Cross, 2022; Marr, 2022), science is currently questioning technology's impacts. The metaverse refers to a virtual reality shared

through the Internet, where each human being is represented in three dimensions through an avatar (Neal Stephenson, 1992; Sparkes, 2021). The term metaverse was first used by Neal Stephenson in 1992, and it is described as a virtual environment that originates in a computer and is based on various concepts (Alvarez-Risco *et al.*, 2022). What seemed futuristic a short time ago opens the door to new forms of digital entrepreneurship today (Gursoy *et al.*, 2022). The metaverse offers an immersive experience based on augmented reality technology, creates a mirror image of the real world based on digital twin technology and builds an economic system based on blockchain technology (Ning, Wang, Lin, Wang, *et al.*, 2021). For instance, Kraus et al. (2022) provide an entrepreneurial and rebranding perspective through the metaverse, denoting a radical change in the Facebook business model. Other research experiences are ongoing in conferences and book chapters (Inder, 2023; Sarkar and Kedas, 2022), highlighting the literature's shortcomings. Therefore, there is a need to glimpse a contribution that offers state-of-the-art attempts by companies and entrepreneurs to foster their businesses through the metaverse.

That said, the contribution of this research seeks to address two primary objectives. First, this paper strives to provide the concepts, theoretical tools, and advanced techniques related to the metaverse. Second, we aim to link theory to empirical practice by showing how the metaverse can be an enabling technology for entrepreneurship. As the literature shows, several studies need to understand how the metaverse can enable digital entrepreneurship tools and techniques (Dong, 2019; Kraus *et al.*, 2019a; Oyemomi *et al.*, 2016). Hence, this paper is set to address the following research question:

RQ1: How can the metaverse enable digital entrepreneurship tools and techniques?

This study highlights three relevant macro-topics (Technology, Immersive and Design) and eight concepts (Private Solutions, Digital Twins, Gamification, Public Solutions, New Business Worlds, Co-design, Collaborative Spaces and Stakeholders' participation). Furthermore, the data will demonstrate how it can increase management efficiency and extend the entrepreneurial business model using frontier technologies. Therefore, this research will also provide a theoretical framework for all digital entrepreneurs looking at new and emerging technologies. As such, the study's findings will provide several theoretical and practical implications. Regarding the theoretical contributions, this research builds on the study of Kraus et al. (2022). It sheds light on an empirical case concerning the conceptual difference between innovation and the increased transformation of business models through the metaverse. This

work will directly contribute to the global discussion by identifying a model for applying emerging technology to digital entrepreneurs. In particular, the metaverse enables the implementation of theoretical concepts such as gamification, co-design and digital twins. On the other hand, the practical implications of this paper provide new insights for digital entrepreneurs. Starting from the selected best practices, the objective will be to extract and contribute knowledge applicable to countless contexts and share practical entrepreneurial ideas. Some concrete cases explored within the study include LG, DP World, Siemens and Intel Corporation. These practical cases can inspire other managers and future entrepreneurs to use the metaverse to expand their activities and services.

Our reminder of the paper is organized as follows. The next section identifies the theoretical background focusing on digital entrepreneurship theories and experiences and analyses metaverse opportunities in theory. Then, section three will discuss the methodological flow employed to address the asserted research question. This part is followed by discussing of the results and considering the literature flow. Finally, the last section concludes the paper by addressing theoretical and practical implications, limitations, and future research avenues.

2. Literature review

2.1. Digital entrepreneurship

The pervasiveness of digitization has paved the way for countless entrepreneurial opportunities and a timely research line (Mir *et al.*, 2022). As indicated in the literature (Kraus *et al.*, 2019b), studying digital entrepreneurship means identifying new digital business models, understanding new processes, implementing new platform strategies, creating, and facilitating new digital ecosystems, providing entrepreneurship education, and facilitating digital social entrepreneurship (Table 1). Creating new digital businesses means designing, launching, and managing new companies as much as possible in the digital world (Hsieh and Wu, 2019a). These characteristics then clash with the reality of businesses and entrepreneurs. While digital pervasiveness is highest in large companies, this is more limited for small-to-medium-sized companies or single-entrepreneurship entities. For example, Jiao et al. (2022) highlight how digital entrepreneurship is more difficult in single-entrepreneurship cases and is positively influenced by exposure to digital networks and innovative culture, even according to the gender of the entrepreneur himself. Other studies point out that being a digital entrepreneur depends on variables such as business innovativeness, intentionality, convenience, culture, flexible design, entrepreneurship orientation, generality, openness, network, and technology orientation

(Dutot and van Horne, 2015; Upadhyay *et al.*, 2022). Therefore, while exposure to the digital environment can play an essential role for entrepreneurs, the presence of digital skills enables the start of new initiatives to understand new technologies (Mir *et al.*, 2022).

Back in 2007, it was predicted that leading technology companies would have the opportunity to mix the scenarios of augmented reality, lifelogging, virtual worlds, and mirror worlds by creating a world beyond the real one, the metaverse (Kim, 2021). As Biancone, Secinaro, Iannaci, et al. (2021) and Jafari-Sadeghi et al. (2021) suggested, digital transformation and new technologies can create value in the company through new expenditures in research and development as well as the registration of brands or patents. This increase in value is happening thanks to technologies that were previously not considered and are now revealing their potentials, such as the metaverse and the massive investments of large entrepreneurs like Mark Zuckerberg for Meta (Kraus *et al.*, 2022). It is already witnessing the formation of an ecosystem of meta-verses composed of several actors helping each other to create a second world simulating the real one (Kim, 2021).

However, when using new technologies, people, companies, and organisations leave traced digital footprints that can detect information such as identity, location, and strategies adopted (Falchuk *et al.*, 2018).

In addition, privacy infringement is also a problem that needs to be considered in the metaverse, where various information not generated in real-world interactions is collected and processed in real-time (Kye *et al.*, 2021). At the same time, the metaverse's severe privacy invasions and security breaches (inherited from underlying technologies or emerged in the new digital ecology) can impede its wide deployment (Wang *et al.*, 2023).

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2.2. Entrepreneurship through the metaverse

Metaverse is a virtual world that empowers users to interact socially, using digital avatars, to generate value and co-create experiences (Buhalis *et al.*, 2023; Hirsch, 2022). Advances in new computing powers, hardware-software blending, and efficient Internet speeds enable the creation of dedicated applications in virtual worlds (Arpaci *et al.*, 2022). Metaverse integrates the most advanced technologies, such as cloud computing, blockchain, artificial intelligence, 5G, and computer vision, and has applications in numerous fields, such as video games, business and art (Ning, Wang, Lin, Wang Wenxi, *et al.*, 2021). Advancements are progressively

leading people to use virtual, interactive, collaborative, and immersive environments (Dwivedi *et al.*, 2022). Therefore, the metaverse now turns out to be a parallel virtual world where people can perform, play, socialize, discover new realities, and act themselves (Duan *et al.*, 2021). In recent years, the metaverse has attracted enormous attention from around the world, where it seems that not a day goes by without a company or celebrity announcing that they are building a presence in a virtual universe (Vidal-Tomás, 2023).

Movement (albeit virtual) into new digital worlds creates unique individual needs, progressively stimulating entrepreneurs to provide new products and services that match real needs. In other cases, the metaverse is seen as an opportunity for entrepreneurs to offer new activities to individuals and manually bring them into a virtual and digital world. This is the case for vehicle manufacturers creating sales spaces for new electric vehicles (Glenday, 2022; Stellantis, 2022), for social media creating a range of dedicated services for consumers to test and try products digitally (Kraus et al., 2022; Meta, 2023) or for transforming the concept of telemedicine and raising the level of doctor-patient interaction (Biancone, Secinaro, Marseglia, et al., 2021; Walcott, 2022). Opportunities for entrepreneurs arise from the fast evolution and increase in the use of VR headsets, Augmented Reality (AR), Extended Reality (XR), and haptic gloves, which allow users to experience high levels of interaction and immersive experience fully (Dwivedi *et al.*, 2022). Although being explored, the metaverse represents both a risk and an excellent opportunity for entrepreneurs (Kang, 2021) who will be able to use digital services as a lever for development. Indeed, organisations are beginning to evaluate the potential of the metaverse and how it can be integrated into their existing business model (Dwivedi *et al.*, 2022). For instance, hospitality and tourism organisations need to use the metaverse strategically to customise and co-create hybrid virtual and physical experiences, allowing consumers to engage with them and other customers before, during and after their visit (Buhalis *et al.*, 2023).

Making our own the inherent riskiness of a constantly updating research topic, the continuation of the article will aim to shed light on best practices and case studies of digital entrepreneurs and companies that see the metaverse as a future source of development.

3. Methodology

The following sub-sections will illustrate the research methodology adopted. The first section will investigate the qualitative reasons and opportunities, the research context, and the data selection process. The second section will explore the data analysis and the tools used.

3.1. Motivations, research contexts, and data selection

The research adopts a qualitative methodology based on a hybrid thematic and content survey. Numerous authors confirm this research approach through countless scientific publications. For example, in their theoretical contribution, Massaro et al. (2019) state that this approach allows researchers to discover new variables and complex processes within a social and corporate context. In addition, for Gummesson (2006), qualitative research in managerial fields allows researchers to capture countless intangible factors that create value for the literature. Furthermore, the opportunity to bring in practical evidence and success stories allows, in retrospect, to make cross-comparisons between different realities, answering research questions that question the "*How*" and "*Why*" of a phenomenon (Yin, 2017). Therefore, considering that the metaverse is progressively introducing new ways of doing business and entrepreneurial opportunities potentially changing social contexts, the qualitative methodology is suitable for investigating application modes and challenges (Dal Mas *et al.*, 2020).

In addition, as stated by Scott et al. (2013), the qualitative methodology may include the analysis of multiple sources and the comprehensive development of 'leading case studies, i.e., best practices that can advance scarce practical knowledge in each field. Again, the practical explanation of the metaverse as an enabler of digital entrepreneurship leads us to assert that the multiple case study methodology will be able to provide more knowledge in this ongoing field. The present research is grounded in the theory of digital entrepreneurship and aims to discover how the metaverse can be a positive enabler of entrepreneurship experiences. Therefore, from these premises, the first step taken by the researchers was to research and subsequently select all the current and available sources.

As suggested by Massaro et al. (2019), rhetoric and insufficient transparency in qualitative sources and case studies are two of the most evident problems in the literature. Additionally, recent research topics may require more work to find relevant academic sources. As indicated by Romme et al. (2015) and explored by Secinaro et al. (2021), practitioners' sources can help find results where one is in growing research topics with nascent debate. It could be even more interesting in entrepreneurship (Jack and Anderson, 1999). Therefore, researchers use the NexisUni database to select and map entrepreneurship experiences in the metaverse. This database is widely used to conduct literature reviews and extract practical sources such as business opportunities, web articles, blogs, news releases, and case studies (Biancone *et al.*, 2022; Boudlaie *et al.*, 2022; Calandra *et al.*, 2022). Considering the research question, the filter

"*Business Opportunities*" seems adequate for looking forward to new entrepreneurial opportunities using the metaverse (Nandi *et al.*, 2022; Weiss and Nemeczek, 2021).

As for the selection criteria, we limited the search to the last two years (i.e., the period of greatest momentum to select sources that adopt the metaverse as a possible development for their business) and to English sources. After an initial selection of reports and news items, we validate the sample by triangulating the information available through web pages, press interviews, and audio/video interviews where possible to verify the existence of sources (Secinaro *et al.*, 2020; Yin, 2017). Furthermore, to refine the technique of company selection, the researchers used the technique of snowball sampling, as indicated by allowing access to information through direct contacts and field interviews (Noy, 2008). Numerous studies in the literature have used this snowball sampling technique within qualitative studies (Khurana *et al.*, 2022). Therefore, the technique was used to gather new entrepreneurship experiences through the metaverse.

3.2. Data analysis and tools

Using the search criteria, 533 articles for business opportunity sources were selected. Data analysis thus began by sorting through all sources and downloading the PDF of each article. Then, all data were analyzed by researchers using two software programs, ATLAS.ti and Leximancer. The former is a data analysis tool that can classify and create nodes between topics covered in documents (Hwang, 2008). The software allowed researchers to develop a holistic analysis environment by including codes for sectors and countries first investing in entrepreneurial opportunities in the metaverse. Adopting different algorithms can extract co-occurrence, semantic, and relational information from qualitative sources (Smith and Humphreys, 2006). Mainly, Leximancer extracts Thesaurus-based concepts from text data using automated content analysis. As confirmed by Massaro et al. (2021), it can enhance data analysis by avoiding biases by manual procedures. The methodological flow is summarized in Figure 1.

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4. Results

The following sub-sections explain the link between the metaverse and entrepreneurship as a research stream giving the content and thematic analysis.

4.1. Descriptive elements and content analysis

To give context to the extracted data, Table 2 shows the trend of publication countries. The total number of results is obtained by checking the extracted articles and indicating the countries of news launches as countries. This check allowed the authors to avoid overlaps, especially in the case of corporate groups and with locations in multiple countries. This study will enable us to understand which countries and companies are investing in metaverse technology while incentivizing entrepreneurial initiatives (Secundo *et al.*, 2021). As visible, the top countries in terms of the number of publications were the United States (136), Korean Republic (97), United Arab Emirates (78), China (38), and India (28).

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Finally, Table 3 below allows us to link the publications extracted from NexisUni and the sectors to which they refer. This link indirectly allows us to verify in which direction public and private investments are oriented in the study context (Machado *et al.,* 2021). As visible, among the most dynamic sectors, we discover Electronics (96), Computing & Information Technology (86), and Media & Telecommunication (80). The first three are directly connected to the creation of advanced virtual spaces. In addition, we also discover that the manufacturing, energy, and public administration sectors are initiating projects in the metaverse creating favourable environments for companies and entrepreneurs.

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4.2. Thematic analysis

As shown in Figure 2, the subject of metaverse feeds practitioners' debates creating connections with different concepts such as "technology", "digital", "platform", “business”, “immersive”, “developers”, “design”, and “solutions”. The first research topic considers practical elements of emerging technologies used by companies. Then, the content analysis directly links new businesses and spin-offs. Finally, design and solutions conclude by providing a new matter of expert collaboration.

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The first topic practitioners address concerns the opportunities that the metaverse as an emerging technology offers traditional businesses and entrepreneurs (Table 4). For example, through a virtual world, it is possible to increase the number of services and solutions offered to consumers in countless areas. Through a virtual world, it is possible to increase the number of customers, which positively impacts margins and revenue (LG, 2022a). This is the case with

companies offering control services for e-mobility and virtual health care. Another application by LG denotes how: "*The Metaverse will bring greater capabilities that will change how we engage across the digital space in the future. LG is looking to broaden its role and explore new services and applications for enterprises that leverage the capabilities of the Metaverse. iQ3 Connect provides immersive 3D workspace technology to enable distributed teams to cost-effectively work, collaborate and train from anywhere, on any Augmented Reality, Virtual Reality, or 2D device*" (LG, 2022b). In addition, the same is happening for Siemens with the launch of the industrial metaverse that can democratize the use of virtual worlds for manufacturing and production service employing the digital twins' concept (Dubai Future Foundation, 2022; Siemens, 2022). Also, along the same lines is DP World, which has launched simulations of warehouse and terminal operations for the logistics sector, following the logic of the digital twin, i.e., 3D virtual versions of physical assets and inspections of containers and ships (Dubai Future Foundation, 2022). Therefore, such applications make it possible to extend corporate businesses, bring more and more consumers closer and diversify the activities of entrepreneurs.

In addition, as demonstrated by Metascale (i.e., a startup active in corporate communications), the metaverse enables new forms of financial and non-financial communication. At the same time, thanks to interactivity, it is possible to convey messages of various kinds according to business needs and induces dynamic behaviour on the part of customers (e.g., using avatars) (Metascale, 2022).

The technology also opens up questions about the role of governments. For example, findings show that public companies consider the metaverse significantly. Such is the case with the United Arab Emirates, which clarifies through Minister of Health Al Olama: "*Metaverse technology addresses customers' needs in the three-dimensional digital spaces easily while enjoying a digital and interactive sensory experience. He explained that the ministry intends to expand the range of services it provides through the virtual environment offered by this innovative technology to continue its pioneering journey towards improving the community's quality of life*" (Khaleej Times, 2022). Alternatively, France considers investment in the sector so strategic that it adopted and launched a dedicated tax credit on the European continent. Finally, still in the context of public utility contexts, the role of multi-service companies also emerges (France 2030, 2022). The Dubai Electricity and Water Authority (DEWA) sees the

metaverse as a source of advanced innovation by launching an entirely dedicated hackathon (Dubai Electricity & Water Authority, 2022).

Practitioners' consideration of the potential of the metaverse continues beyond there. Digital reality enables the creation of virtual worlds and enables the creation of immersive businesses. The challenge is well understood by Intel, which has begun production of next-generation hardware capable of expanding the boundaries of current data connections (e.g., 5G) by enabling companies and entrepreneurs to create new services and business models (Koduri, 2021). These include the opportunity to create online art exhibitions. For example, Forkast (2022) has launched a new business that allows people to arrange a viewing of up to 52 works of art by offering a sense of scale and immersion. In addition, exhibitions can also be enjoyed offline (e.g., this is the case in areas lacking data connections). Finally, Walmart (2022), the world's leading large retail retailer, has unveiled one of the largest metaverse platforms to offer its customers immersive experiences that include games and additional services compared to physical stores.

The third and final macro-theme that emerges from the thematic analysis is designed. Launching immersive experiences requires personalized, immersive features with high-profile interactive 3D content. For Adobe (2022), a leader in software for creative marketing and document management solutions, the metaverse will require the co-design and design of even more sophisticated marketing and e-commerce products and resources. It will also require new collaboration spaces that will allow designers, engineers, entrepreneurs and business figures to work together to scale new businesses and accelerate research and development of solutions in the metaverse (Microsoft, 2022; NVIDIA, 2022).

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5. Discussion

Starting with the *"RQ How can the metaverse enable digital entrepreneurship tools and techniques?"* the analysis of 533 results allowed researchers to highlight some new implications for theory and practice. The results of this study bring out three relevant macro-topics (Technology, Immersive and Design) and eight concepts (Private Solutions, Digital Twins, Gamification, Public Solutions, New Business Worlds, Co-design, Collaborative Spaces and Stakeholders' participation). The uncovered elements demonstrate professionals' interest in a new mode of digital entrepreneurship using the metaverse. This interest highlights

the commitment of companies and entrepreneurs toward discovering new services delivered in virtual and parallel worlds that find the creation of digital twins as their essence. Therefore, the study explores ongoing relationships for developing increasingly technically complex metaverse platforms and customer service offerings.

In this study, the authors argue that the metaverse represents an opportunity for numerous business and entrepreneurial stakeholders and the entire supply chain, including the need to upgrade Internet networks and data infrastructure. Furthermore, we denote how adopting a new technology to explore new virtual worlds capable of increasing customers requires several vital elements. First, as Jafari-Sadeghi et al. (2021) indicated, value creation through technology needs favourable conditions such as investment and knowledge translation regarding brands and patents. This was observed in our results in the case of Adobe or NVIDIA through the market launch of new enabling platforms towards entrepreneurs. Second, for the metaverse to be explored by more and more entrepreneurs, it is necessary to create collaborative, flexible environments aimed at the market launch of new services (Upadhyay *et al.*, 2022). Third, although the difficulty for individual entrepreneurs to implement significant investments (Jiao *et al.*, 2022), we discover how even in the case of the metaverse, support from public companies (e.g., central governments) can be vital, for example, through tax credits (France 2030, 2022) and finalized participation in hackathons (Dubai Electricity & Water Authority, 2022; Koduri, 2021).

Moreover, any decision to act at the level of digital entrepreneurship can be explored through the framework of Kraus et al. (2019b). Table 5 and the following subsections connect the results with some theoretical implications, allowing a better understanding of the topic and opening opportunities for future research.

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5.1. Digital business model

According to Kraus et al. (2019b) and Toniolo et al. (2020), a digital business model concerns shifting business activities to fully digital environments. This shift coincides with the emergence of new businesses arising from digitisation and offering products and services for the digital world. Digitisation aligns with the metaverse, even more so than other technologies, which aim to shift from the real to the virtual environment (Dwivedi *et al.*, 2022). We discover how LG is increasingly increasing its digital strategy through source observation.

Alternatively, Ifland Gallery is gradually diversifying its business by offering virtual art exhibitions using the metaverse. Finally, unlike physical stores, Walmart offers new virtual worlds for customers to experience different games and services. Therefore, the analysis of practical results confirms what is present in theory, although we are at an early stage of exploration by entrepreneurs.

5.2. Digital entrepreneurship model

Digital entrepreneurship models differ from traditional ones in the greater need for networking (Dutot and van Horne, 2015). The revival of the metaverse as a tool for entrepreneurship demonstrates this claim. The resurgence of the metaverse as a tool for entrepreneurship demonstrates this claim. Entrepreneurship has been observed mainly from the Metascale case, which enables different technology-based communication tools and focuses on the participation of potential customers through gamification (Rodrigues *et al.,* 2019). Moreover, such elements are also present in the Walmart case. Improving entrepreneurship models use the metaverse to centre the customer through avatars, enabling virtual games and simulating virtual shopping experiences that are matched in the real world (Figures 3 and 4).

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5.3. Platform strategies

Early entrepreneurial ventures in the metaverse use digital platforms and, through avatars, allow users immersive experiences in virtual worlds. Our results, in line with Hsieh and Wu, 2019b) and Kraus et al. (2019b), show that digital platforms can be used in three ways. First, through pure innovation initiatives that aspire to share new digital tools and develop entrepreneurial ventures, such as for Adobe, Intel Corporation, NVIDIA, and Microsoft. Second, through transaction platforms for business promotion by leveraging third-party technology to create additional lines of business and services (e.g., Ifland, Walmart, Metascale and DP World). Finally, integration platforms where entrepreneurs can develop new consumer projects (e.g., Siemens).

5.4. Digital ecosystem

As recalled, digital entrepreneurship is based on an ecosystem, i.e., a complex mechanism of interactions between different entities and with multiple utilities (Kraus *et al.*, 2019b; Mir *et*

al., 2022). Our results are in line with this view by extending its validity. The selected sources demonstrate elements of governance innovativeness by companies and public institutions. For example, the digital ecosystem is promoted by the Dubai Electricity and Water Authority (DEWA) through forms of collaboration with schools and universities. Alternatively, considering immersive experiences require solid digital skills and investments, tools such as tax credits can facilitate the ecosystem of stakeholders interested in developing business in the metaverse (e.g., Minister of Economy, Finance, and Industrial and Digital Sovereignty - France).

5.5. Entrepreneurship education

Being a digital entrepreneur also means having the tools and notions that can make people create innovative business ideas. The theoretical evidence of Kraus et al. (2019b) has been both a light and a confirmation for us. The observation also confirms and extends the concepts for the case of the metaverse as a living laboratory for digital applications (le Dinh *et al.*, 2018). Education initiatives are put in place by Adobe and Walmart towards developers and their customers to co-create novel business solutions. However, this assumption is also confirmed through hackathons that inherently have prominent educational connotations.

5.6. Social digital entrepreneurship

Being digital also invokes social elements. As defined by Smith et al. (2017), new digital business models require studies, among others, on the benefits of using digital profiles on social capital. In addition, Sussan and Acs (2017) further extend the vision by specifying how some digital activities could be equally traditional, creating an inevitable intertwining with routines (Sussan and Acs, 2017). In the metaverse, the "social" need of entrepreneurs and then customers mean using avatars to simulate digital worlds while maintaining the characteristics that best suit the individual. Being social, therefore, is innate in entrepreneurs and is reflected in the theoretical concept of digital twins repeatedly referred to by Siemens and DP World.

6. Conclusions, limitations, and further research opportunities

To conclude our study, starting from the premises that inspired it is necessary. Our research explored the concepts, theoretical tools, and advanced techniques that digital entrepreneurs can apply to the metaverse. Since this is a burgeoning area of research, we adopted a qualitative research methodology using only professional sources. Therefore, our research focused on available sources by identifying real case studies that can serve academics and entrepreneurs to strengthen business ideas using the metaverse. Analyzing 533 sources, we discovered three

relevant macro-topics (Technology, Immersive and Design) and eight concepts (Private Solutions, Digital Twins, Gamification, Public Solutions, New Business Worlds, Co-design, Collaborative Spaces and Stakeholders' participation). In addition, we confirmed and extended the theoretical implications of digital entrepreneurship by applying it to real metaverse cases. Finally, our study reiterates how digitization can distribute value and diversify business activities.

As reported in the discussion, the research allowed us to outline some implications of both a theoretical and practical nature. Theoretically, we extend the debate on digital entrepreneurship using the lens of Kraus et al. 2019b. In particular, the metaverse fosters new entrepreneurial ventures based on theoretical concepts such as gamification, co-design and digital twins. At the same time, developing of new business models through technology can also enable new opportunities for entrepreneurship. On a practical level, we have demonstrated with established cases the opportunities that the metaverse can provide digital entrepreneurs by reaffirming the value of technology as a lever for creating new business models. In addition, the cases recounted here can inspire CEOs, managers, and future entrepreneurs to use the metaverse to expand their businesses by diversifying their services into numerous sectors. The metaverse can enable digital entrepreneurs to move into sectors other than their core business by exploiting new opportunities. Finally, to our knowledge, this study represents one of the first attempts to study the metaverse by framing it from theoretical and practical perspectives.

As is the case with all research, the study has some limitations. First, using a single database and selecting some of the most globally cited cases may have limited our research. This will prompt new frontier studies by integrating more databases as time and knowledge of the topic progress. Second, not using scholarly sources from traditional databases such as Scopus or Web of Science stems from the timeliness of our study and a constantly evolving stream of knowledge. This limitation can stimulate future researchers to conduct holistic literature reviews that encapsulate academics' thinking on the metaverse and its implications for entrepreneurship. Third, the desire to explore the metaverse generically may have caused researchers to miss some typical case study elements and concepts. Therefore, in the future, colleagues may adopt multiple methodologies to explore one or more case studies in this area.

References

Accenture. (2022), “Enterprise Metaverse Services & Solutions”, available at: https://www.accenture.com/us-en/services/metaverse-index (accessed 12 May 2022).

Adobe. (2022), “Adobe Empowers Brands to Succeed in the Metaverse”, *Adobe News*, available at: https://news.adobe.com/news/news-details/2022/Adobe-Empowers-Brands-to-Succeed-in-the-Metaverse/default.aspx (accessed 4 January 2023).

Alvarez-Risco, A., Del-Aguila-Arcentales, S., Rosen, M.A. and Yáñez, J.A. (2022), “Social Cognitive Theory to Assess the Intention to Participate in the Facebook Metaverse by Citizens in Peru during the COVID-19 Pandemic”, *Journal of Open Innovation: Technology, Market, and Complexity 2022, Vol. 8, Page 142*, Multidisciplinary Digital Publishing Institute, Vol. 8 No. 3, p. 142, doi: 10.3390/JOITMC8030142.

Arpaci, I., Karatas, K., Kusci, I. and Al-Emran, M. (2022), “Understanding the social sustainability of the Metaverse by integrating UTAUT2 and big five personality traits: A hybrid SEM-ANN approach”, *Technology in Society*, Pergamon, Vol. 71, p. 102120, doi: 10.1016/J.TECHSOC.2022.102120.

Biancone, P. pietro, Secinaro, S., Iannaci, D. and Calandra, D. (2021), “International Entrepreneurship and Technology: A Structured Literature Review”, *Contributions to Management Science*, Springer, Cham, pp. 137–159, doi: 10.1007/978-3-030-68972-8_8.

Biancone, P., Secinaro, S., Calandra, D. and Chmet, F. (2022), “COVID-19 and Islamic Finance: A Practitioners’ View and Financial Accounting Investigation”, *Towards a Post-Covid Global Financial System*, Emerald Publishing Limited, pp. 51–69, doi: 10.1108/978-1-80071-625-420210003.

Boudlaie, H., Mahdiraji, H.A., Jirandeh, M.S. and Jafari-Sadeghi, V. (2022), “The Role of Human Resource Management in the Growth of Startups: A Multiple Case Study from the Perspective of Entrepreneurs and Employees”, *World Review of Entrepreneurship, Management and Sustainable Development*, Inderscience, Vol. 18 No. 3, pp. 307–324, doi: 10.1504/WREMSD.2022.122540.

Buhalis, D., Lin, M.S. and Leung, D. (2023), “Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing”, *International Journal of Contemporary Hospitality Management*, Emerald Publishing, Vol. 35 No. 2, pp. 701–716, doi: 10.1108/IJCHM-05-2022-0631/FULL/XML.

Calandra, D., Secinaro, S., Massaro, M., Mas, F.D. and Bagnoli, C. (2022), “The link between sustainable business models and Blockchain: A multiple case study approach”, *Business Strategy and the Environment*, John Wiley & Sons, Ltd, doi: 10.1002/BSE.3195.

Cross, T. (2022), “A reality check for the metaverse is coming | The Economist”, *The Economist*.

Dal Mas, F., Dicuonzo, G., Massaro, M. and Dell’Atti, V. (2020), “Smart contracts to enable sustainable business models. A case study”, *Management Decision*, Vol. 58 No. 8, pp. 1601–1619, doi: 10.1108/MD-09-2019-1266.

le Dinh, T., Chien Vu, M. and Ayayi, A. (2018), “TOWARDS A LIVING LAB FOR PROMOTING THE DIGITAL ENTREPRENEURSHIP PROCESS”, *International Journal of Entrepreneurship*, Vol. 22 No. 1, pp. 1939–4675.

Dong, J.Q. (2019), “Moving a mountain with a teaspoon: Toward a theory of digital entrepreneurship in the regulatory environment”, *Technological Forecasting and Social Change*, North-Holland, Vol. 146, pp. 923–930, doi: 10.1016/J.TECHFORE.2018.07.050.

Duan, H., Li, J., Fan, S., Lin, Z., Wu, X. and Cai, W. (2021), “Metaverse for Social Good: A University Campus Prototype”, *MM 2021 - Proceedings of the 29th ACM International*

Conference on Multimedia, Association for Computing Machinery, Inc, pp. 153–161, doi: 10.1145/3474085.3479238.

Dubai Electricity & Water Authority. (2022), "DEWA launches the Metaverse and Digital Twin Hackathon in collaboration with the Higher Colleges of Technology", *Government of Dubai*, available at: https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2022/11/dewa-launches-the-metaverse (accessed 4 January 2023).

Dubai Future Foundation. (2022), "DP World Embraces Metaverse to Solve Real World Supply Chain Challenges", *Dubai Future Foundation*, available at: https://www.dubaifuture.ae/latest-news/dp-world-embraces-metaverse-to-solve-real-world-supply-chain-challenges/ (accessed 4 January 2023).

Dutot, V. and van Horne, C. (2015), "Digital Entrepreneurship Intention in a Developed vs. Emerging Country: An Exploratory Study in France and the UAE", *Https://Doi.Org/10.5148/Tncr.2015.7105*, Taylor & Francis, Vol. 7 No. 1, pp. 79–96, doi: 10.5148/TNCR.2015.7105.

Dwivedi, Y.K., Hughes, L., Baabdullah, A.M., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M.M., Dennehy, D., *et al.* (2022), "Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy", *International Journal of Information Management*, Pergamon, Vol. 66, p. 102542, doi: 10.1016/J.IJINFOMGT.2022.102542.

Falchuk, B., Loeb, S. and Neff, R. (2018), "The Social Metaverse: Battle for Privacy", *IEEE Technology and Society Magazine*, Institute of Electrical and Electronics Engineers Inc., Vol. 37 No. 2, pp. 52–61, doi: 10.1109/MTS.2018.2826060.

Forkast. (2022), "South Korea's Ifland metaverse dives into play-to-earn", *Forkast*, available at: https://forkast.news/headlines/south-korea-ifland-metaverse-play-to-earn/ (accessed 4 January 2023).

France 2030. (2022), "Video games in France: the video game tax credit will be modernized and extended until 2028", *The Latest News*, available at: https://gettotext.com/video-games-in-france-the-video-game-tax-credit-will-be-modernized-and-extended-until-2028/ (accessed 4 January 2023).

Garousi Mokhtarzadeh, N., Amoozad Mahdiraji, H., Jafarpanah, I., Jafari-Sadeghi, V. and Cardinali, S. (2020), "Investigating the impact of networking capability on firm innovation performance: using the resource-action-performance framework", *Journal of Intellectual Capital*, Emerald Group Holdings Ltd., Vol. 21 No. 6, pp. 1009–1034, doi: 10.1108/JIC-01-2020-0005/FULL/XML.

Gummesson, E. (2006), "Qualitative research in management: addressing complexity, context and persona", edited by Cassell, C.*Management Decision*, Vol. 44 No. 2, pp. 167–179, doi: 10.1108/00251740610650175.

Gursoy, D., Malodia, S. and Dhir, A. (2022), "The metaverse in the hospitality and tourism industry: An overview of current trends and future research directions", *Https://Doi.Org/10.1080/19368623.2022.2072504*, Routledge, pp. 1–8, doi: 10.1080/19368623.2022.2072504.

Hirsch, P.B. (2022), "Adventures in the metaverse", *Journal of Business Strategy*, Emerald Group Holdings Ltd., Vol. 43 No. 5, pp. 332–336, doi: 10.1108/JBS-06-2022-0101/FULL/XML.

Hsieh, Y.J. and Wu, Y.J. (2019a), "Entrepreneurship through the platform strategy in the digital era: Insights and research opportunities", *Computers in Human Behavior*, Pergamon, Vol. 95, pp. 315–323, doi: 10.1016/J.CHB.2018.03.033.

Hsieh, Y.J. and Wu, Y.J. (2019b), "Entrepreneurship through the platform strategy in the digital era: Insights and research opportunities", *Computers in Human Behavior*, Pergamon, Vol. 95, pp. 315–323, doi: 10.1016/J.CHB.2018.03.033.

Hwang, S. (2008), "Utilizing Qualitative Data Analysis Software: A Review of Atlas.ti", *Social Science Computer Review*, Vol. 26 No. 4, pp. 519–527, doi: 10.1177/0894439307312485.

Inder, S. (2023), "Entrepreneurial Opportunities in Metaverse", *Promoting Consumer Engagement Through Emotional Branding and Sensory Marketing*, IGI Global, pp. 52–62, doi: 10.4018/978-1-6684-5897-6.CH006.

Jack, S.L. and Anderson, A.R. (1999), "Entrepreneurship education within the enterprise culture: Producing reflective practitioners", *International Journal of Entrepreneurial Behaviour & Research*, MCB UP Ltd, Vol. 5 No. 3, pp. 110–125, doi: 10.1108/13552559910284074/FULL/XML.

Jafari-Sadeghi, V., Garcia-Perez, A., Candelo, E. and Couturier, J. (2021), "Exploring the impact of digital transformation on technology entrepreneurship and technological market expansion: The role of technology readiness, exploration and exploitation", *Journal of Business Research*, Elsevier, Vol. 124, pp. 100–111, doi: 10.1016/J.JBUSRES.2020.11.020.

Jiao, H., Wang, L. and Shi, Y. (2022), "How does institutional environment in the digital context affect technology entrepreneurship? The moderating roles of government digitalization and gender", *Journal of Organizational Change Management*, Emerald Group Holdings Ltd., Vol. 35 No. 7, pp. 1089–1112, doi: 10.1108/JOCM-10-2021-0321/FULL/XML.

Khaleej Times. (2022), "Dubai: World's first Metaverse customer service centre to offer health services virtually", *Khaleej Times*, available at: https://www.khaleejtimes.com/health/dubai-worlds-first-metaverse-customer-service-centre-to-offer-health-services-virtually (accessed 4 January 2023).

Khurana, I., Dutta, D.K. and Singh Ghura, A. (2022), "SMEs and digital transformation during a crisis: The emergence of resilience as a second-order dynamic capability in an entrepreneurial ecosystem", *Journal of Business Research*, Elsevier, Vol. 150, pp. 623–641, doi: 10.1016/J.JBUSRES.2022.06.048.

Kim, J. (2021), "Advertising in the Metaverse: Research Agenda", *Journal of Interactive Advertising*, Routledge, Vol. 21 No. 3, pp. 141–144, doi: 10.1080/15252019.2021.2001273.

Koduri, R. (2021), "Powering the Metaverse", *Intel*, available at: https://www.intel.com/content/www/us/en/newsroom/opinion/powering-metaverse.html#gs.mhzbhc (accessed 4 January 2023).

KPMG. (2022), "The future of the metaverse and Extended Reality -", available at: https://home.kpmg/xx/en/home/insights/2022/04/the-future-of-the-metaverse.html (accessed 12 May 2022).

Kraus, S., Kanbach, D.K., Krysta, P.M., Steinhoff, M.M. and Tomini, N. (2022), "Facebook and the creation of the metaverse: radical business model innovation or incremental transformation?", *International Journal of Entrepreneurial Behavior & Research*, Emerald, Vol. 28 No. 9, pp. 52–77, doi: 10.1108/IJEBR-12-2021-0984/FULL/PDF.

Kraus, S., Palmer, C., Kailer, N., Kallinger, F.L. and Spitzer, J. (2019a), "Digital entrepreneurship: A research agenda on new business models for the twenty-first century", *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. 25 No. 2, pp. 353–375, doi: 10.1108/IJEBR-06-2018-0425/FULL/XML.

Kraus, S., Palmer, C., Kailer, N., Kallinger, F.L. and Spitzer, J. (2019b), "Digital entrepreneurship: A research agenda on new business models for the twenty-first century", *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. 25 No. 2, pp. 353–375, doi: 10.1108/IJEBR-06-2018-0425/FULL/XML.

Kye, B., Han, N., Kim, E., Park, Y. and Jo, S. (2021), "Educational applications of metaverse: possibilities and limitations", *Journal of Educational Evaluation for Health Professions*, J Educ Eval Health Prof, Vol. 18, doi: 10.3352/JEEHP.2021.18.32.

LG. (2022a), "LG Grows New Business Ventures with Selection of Finalists in First 'Mission For The Future' Challenge", *LG Newsroom*, available at: https://www.lgnewsroom.com/2022/09/lg-grows-new-business-ventures-with-selection-of-finalists-in-first-mission-for-the-future-challenge/ (accessed 4 January 2023).

LG. (2022b), "LG Electronics Advances COMMITMENT TO SOCIALLY IMPACTFUL STARTUP AND ENTREPRENEUR COMMUNITY", *Press Release*, available at: https://www.lg.com/us/press-release/lg-electronics-advances-commitment-to-socially-impactful-startup-and-entrepreneur-community (accessed 4 January 2023).

Machado, A. de B., Secinaro, S., Calandra, D. and Lanzalonga, F. (2021), "Knowledge management and digital transformation for Industry 4.0: a structured literature review", *Knowledge Management Research & Practice*, Taylor & Francis, Vol. 20 No. 2, pp. 320–338, doi: 10.1080/14778238.2021.2015261.

Marr, B. (2022), "What Is The Business Impact Of The Metaverse?", *Forbes*, available at: https://www.forbes.com/sites/bernardmarr/2022/10/12/what-is-the-business-impact-of-the-metaverse/?sh=3f9a061c26d3 (accessed 30 December 2022).

Massaro, M., Dumay, J. and Bagnoli, C. (2019), "Transparency and the rhetorical use of citations to Robert Yin in case study research", *Meditari Accountancy Research*, Vol. 27 No. 1, pp. 44–71, doi: 10.1108/MEDAR-08-2017-0202.

Massaro, M., Secinaro, S., Dal Mas, F., Brescia, V. and Calandra, D. (2021), "Industry 4.0 and circular economy: An exploratory analysis of academic and practitioners' perspectives", *Business Strategy and the Environment*, John Wiley & Sons, Ltd, Vol. 30 No. 2, pp. 1213–1231, doi: 10.1002/BSE.2680.

Metascale. (2022), "Rescale your universe", *Press Release*, available at: https://metascalecorp.com/ (accessed 4 January 2023).

Microsoft. (2022), "SCG joins forces with Microsoft to drive complete digital transformation, delivering customer experiences with intelligence, agility and beyond through innovations for the future", *Microsoft*, available at: https://news.microsoft.com/th-th/2022/06/07/microsoft-scg-partnership-en/ (accessed 4 January 2023).

Mir, A.A., Hassan, S. and Khan, S.J. (2022), "Understanding digital entrepreneurial intentions: A capital theory perspective", *International Journal of Emerging Markets*, Emerald Group Holdings Ltd., Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/IJOEM-05-2021-0687/FULL/XML.

Nambisan, S. (2017), "Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship":, *Https://Doi.Org/10.1111/Etap.12254*, SAGE PublicationsSage CA: Los Angeles, CA, Vol. 41 No. 6, pp. 1029–1055, doi: 10.1111/ETAP.12254.

Nandi, S., Nandi, M.L. and Sindhi, S. (2022), "Does the concept of 'creating shared value' make sense for multinational firms?", *Society and Business Review*, Emerald Publishing, Vol. 17 No. 4, pp. 664–690, doi: 10.1108/SBR-02-2022-0049/FULL/XML.

Neal Stephenson. (1992), *Snow Crash*.

Ning, H., Wang, H., Lin, Y., Wang, W., Dhelim, S., Farha, F., Ding, J., *et al.* (2021), "A Survey on Metaverse: the State-of-the-art, Technologies, Applications, and Challenges", *ArXiv*.

Ning, H., Wang, H., Lin, Y., Wang Wenxi, Dhelim, S., Farha, F., Ding, J., *et al.* (2021), *A Survey on Metaverse: The State-of-the-Art, Technologies, Applications, and Challenges*.

NVIDIA. (2022), "NVIDIA's New Ada Lovelace RTX GPU Arrives for Designers and Creators", *NVIDIA Newsroom*, available at: https://nvidianews.nvidia.com/news/nvidias-new-ada-lovelace-rtx-gpu-arrives-for-designers-and-creators (accessed 4 January 2023).

Oyemomi, O., Liu, S., Neaga, I. and Alkhuraiji, A. (2016), "How knowledge sharing and business process contribute to organizational performance: Using the fsQCA approach", *Journal of Business Research*, Elsevier, Vol. 69 No. 11, pp. 5222–5227, doi: 10.1016/J.JBUSRES.2016.04.116.

Rodrigues, L.F., Oliveira, A. and Rodrigues, H. (2019), "Main gamification concepts: A systematic mapping study", *Heliyon*, Elsevier, Vol. 5 No. 7, p. e01993, doi: 10.1016/J.HELIYON.2019.E01993.

Romme, A.G.L., Avenier, M.J., Denyer, D., Hodgkinson, G.P., Pandza, K., Starkey, K. and Worren, N. (2015), "Towards Common Ground and Trading Zones in Management Research and Practice", *British Journal of Management*, John Wiley & Sons, Ltd, Vol. 26 No. 3, pp. 544–559, doi: 10.1111/1467-8551.12110.

Sarkar, S. and Kedas, S. (2022), "The Cryptogameur: A New Approach to Entrepreneurial Design", *Https://Doi.Org/10.5465/AMBPP.2022.12921abstract*, Academy of Management Briarcliff Manor, NY 10510, Vol. 2022 No. 1, doi: 10.5465/AMBPP.2022.12921ABSTRACT.

Schiuma, G., Schettini, E., Santarsiero, F. and Carlucci, D. (2021), "The transformative leadership compass: six competencies for digital transformation entrepreneurship", *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/IJEBR-01-2021-0087/FULL/XML.

Scott, N., Laws, E. and Boksberger, P. (2013), "Agenda for Co-Creation Tourism Experience Research", Routledge, pp. 219–235, doi: 10.4324/9781315875293-16.

Secinaro, S., Calandra, D., Cappa, C. and Bignamini, E. (2020), "La qualità dei dati all'interno dell'evoluzione dei servizi territoriali: il caso del Servizio Dipendenze", *MECOSAN*, doi: 10.3280/MESA2020-116003.

Secinaro, S., Dal Mas, F., Massaro, M. and Calandra, D. (2021), "Exploring agricultural entrepreneurship and new technologies: academic and practitioners' views", *British Food Journal*, Emerald Publishing Limited, Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/BFJ-08-2021-0905.

Secundo, G., del Vecchio, P. and Mele, G. (2021), "Social media for entrepreneurship: myth or reality? A structured literature review and a future research agenda", *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. 27 No. 1, pp. 149–177, doi: https://doi.org/10.1108/IJEBR-07-2020-0453.

Siemens. (2022), "Siemens shows path to industrial metaverse at Web Summit 2022", *Siemens Press Release*, available at: https://press.siemens.com/global/en/pressrelease/siemens-shows-path-industrial-metaverse-web-summit-2022 (accessed 4 January 2023).

Smith, A.E. and Humphreys, M.S. (2006), “Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping”, *Behavior Research Methods 2006 38:2*, Springer, Vol. 38 No. 2, pp. 262–279, doi: 10.3758/BF03192778.

Smith, C., Smith, J.B. and Shaw, E. (2017), “Embracing digital networks: Entrepreneurs’ social capital online”, *Journal of Business Venturing*, Elsevier, Vol. 32 No. 1, pp. 18–34, doi: 10.1016/J.JBUSVENT.2016.10.003.

Sparkes, M. (2021), “What is a metaverse”, *New Scientist*, Reed Business Information, Vol. 251 No. 3348, p. 18, doi: 10.1016/S0262-4079(21)01450-0.

Sussan, F. and Acs, Z.J. (2017), “The digital entrepreneurial ecosystem”, *Small Business Economics*, Springer, Vol. 49 No. 1, pp. 55–73, doi: 10.1007/S11187-017-9867-5.

Toniolo, K., Masiero, E., Massaro, M. and Bagnoli, C. (2020), “Sustainable Business Models and Artificial Intelligence: Opportunities and Challenges”, *Contributions to Management Science*, Springer, Cham, pp. 103–117, doi: 10.1007/978-3-030-40390-4_8.

Troise, C., Corvello, V., Ghobadian, A. and O’Regan, N. (2022), “How can SMEs successfully navigate VUCA environment: The role of agility in the digital transformation era”, *Technological Forecasting and Social Change*, North-Holland, Vol. 174, p. 121227, doi: 10.1016/J.TECHFORE.2021.121227.

Upadhyay, N., Upadhyay, S., Al-Debei, M.M., Baabdullah, A.M. and Dwivedi, Y.K. (2022), “The influence of digital entrepreneurship and entrepreneurial orientation on intention of family businesses to adopt artificial intelligence: examining the mediating role of business innovativeness”, *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/IJEBR-02-2022-0154/FULL/XML.

Upadhyay, N., Upadhyay, S. and Dwivedi, Y.K. (2021), “Theorizing artificial intelligence acceptance and digital entrepreneurship model”, *International Journal of Entrepreneurial Behaviour and Research*, Emerald Group Holdings Ltd., Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/IJEBR-01-2021-0052/FULL/XML.

Vidal-Tomás, D. (2023), “The illusion of the metaverse and meta-economy”, *International Review of Financial Analysis*, North-Holland, Vol. 86, p. 102560, doi: 10.1016/J.IRFA.2023.102560.

Walmart. (2022), “Walmart Jumps Into Roblox With Launch of Walmart Land and Walmart’s Universe of Play”, *Walmart News*, available at: https://corporate.walmart.com/newsroom/2022/09/26/walmart-jumps-into-roblox-with-launch-of-walmart-land-and-walmarts-universe-of-play (accessed 4 January 2023).

Wang, Y., Su, Z., Zhang, N., Xing, R., Liu, D., Luan, T.H. and Shen, X. (2023), “A Survey on Metaverse: Fundamentals, Security, and Privacy”, *IEEE Communications Surveys and Tutorials*, Institute of Electrical and Electronics Engineers Inc., Vol. 25 No. 1, pp. 319–352, doi: 10.1109/COMST.2022.3202047.

Ward, J. (2022), “How to navigate the uncharted territory of the metaverse | EY Ireland”, available at: https://www.ey.com/en_ie/consulting/how-metaverse-can-help-humans-glide-into-new-experience-zones (accessed 12 May 2022).

Weiss, D. and Nemeczek, F. (2021), “A text-based monitoring tool for the legitimacy and guidance of technological innovation systems”, *Technology in Society*, Pergamon, Vol. 66, p. 101686, doi: 10.1016/J.TECHSOC.2021.101686.

Yin, R.K. (2017), *Case Study Research and Applications: Design and Methods*, Sage publications.

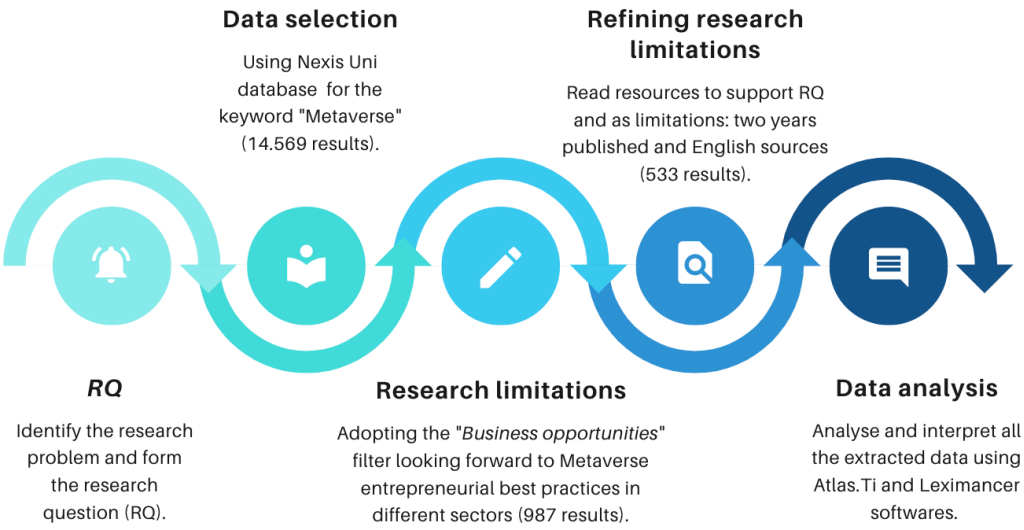

Figure 1. Methodological flow in brief
Source: Authors' elaboration

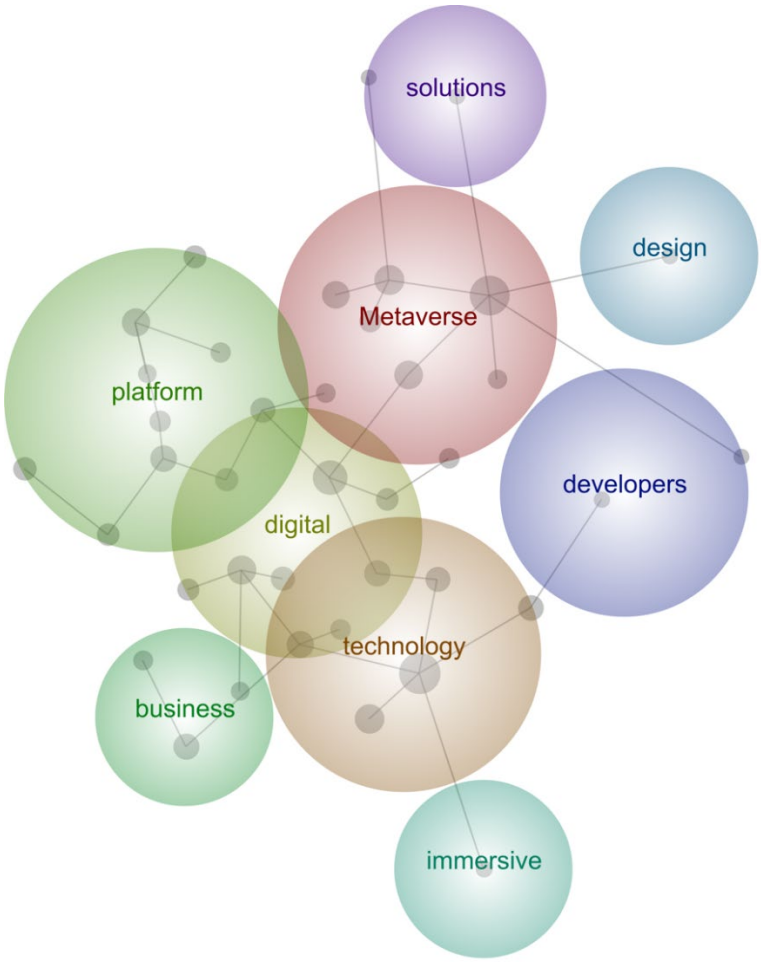

Figure 2. The metaverse and entrepreneurial opportunities
Source: Authors' elaboration

Figure 3. Walmart Land and Walmart's Universe of Play
Source: (Walmart, 2022)

Figure 4. How Walmart envisions shopping in the metaverse
Source: (Walmart, 2022)

Table 1. Digital entrepreneurship: theoretical framework

Theoretical framework
Digital business model
Digital entrepreneurship process
Platform strategies
Digital ecosystem
Entrepreneurship education
Social digital entrepreneurship

Source: (Kraus *et al.*, 2019b)

Table 2. Countries' analysis

Countries	Number of results
United States	136
Korean Republic	97
United Arab Emirates	78
China	38
India	28
United Kingdom	20
Japan	11
Singapore	11
France	9
Brazil	9
Australia	8
Germany	6
Turkey	6
Switzerland	5
Canada	5
Sweden	5
Indonesia	4
Finland	4
Thailand	4
Malaysia	4
Russia	4
Andorra	3
Philippines	3
Slovenia	3
Uruguay	3
Spain	3
Italy	3
Israel	2
Netherlands	2
Peru	2
Hong Kong	2
Nigeria	2
Saudi Arabia	2
Malta	1
Poland	1
Austria	1
Cote D'Ivoire	1

Azerbaijan	1
Pakistan	1
Argentina	1
Portugal	1
Qatar	1
New Zealand	1
Egypt	1
Total	**533**

Source: Authors' elaboration

Table 3. Sectors' analysis

Sectors	**Number of results**
Electronics	96
Computing & Information Technology	86
Media & Telecommunications	80
Other	66
Manufacturing	57
Energy & Utilities	31
Banking & Finance	30
Environmental Industry	27
Public administrations	24
Health	16
Arts	13
Fashion	7
Total	**533**

Source: Authors' elaboration

Table 4. Metaverse opportunities within the entrepreneurship field

Macro-Topics	Concepts	Case study (if applicable)	Original quotes
Technology	Private solutions and new environments	LG Electronics North American Innovation Center	LG NOVA will build new businesses in Digital Health, Electric Mobility, and the Metaverse and pursue multiple paths to deliver new services and solutions that will help us move forward faster into the future (LG, 2022a).
		LG	The Metaverse will bring greater capabilities that will change how we engage across the digital space in the future. LG is looking to broaden its role and explore new services and applications for enterprises that leverage the capabilities of the Metaverse. iQ3 Connect provides immersive 3D workspace technology to enable distributed teams to cost-effectively work, collaborate and train from anywhere, on any AR, VR, or 2D device (LG, 2022b).
	Digital Twins	DP World	DP World will explore metaverse applications for its services, including simulations of warehousing and terminal operations, in so-called digital twin's 3D virtual versions of physical assets, and container and vessel inspections.
		Siemens	From Digital Twins to the industrial Metaverse The interoperability and openness of Siemens Xcelerator with its curated portfolio, where everything works seamlessly with each other in the future, is the perfect basis for the Industrial Metaverse, where players meet to democratize technology by making immersive experiences accessible to everyone. The digital twin is the critical technology for this digital transformation in this decade (Siemens, 2022).
	Network and gamification	Metascale	Metascale is preparing a new type of metaverse service, intending to introduce the concept of Metaverse early next year. This three-dimensional virtual world enables story-based communication. It plans to provide a unique experience to users worldwide by utilizing Gamification, a device that enhances human-to-human interaction, which has recently been attracting attention (Metascale, 2022).

Immersive	Public solutions	Ministry of Health – United Arab Emirates	Al Olama pointed out that the field of customer service, which the ministry is reinventing within a sustainable virtual environment, is the best convenient and safe model for receiving customers in the ministry and completing their transactions in a decentralized digital platform. He added: "Arab Health 2022 is a platform for innovations in the health field, and we are pleased to announce the launch of the world's first virtual health licensing service center through this global event. "Metaverse" technology easily addresses customers' needs in the three-dimensional digital spaces while enjoying a digital and interactive sensory experience." Al Olama explained that the ministry intends to expand its services through the virtual environment offered by this innovative technology to continue its pioneering journey towards improving the community's quality of life (Khaleej Times, 2022).
		Minister of Economy, Finance, and Industrial and Digital Sovereignty - France	In France, we are fortunate to benefit from one of the richest video game ecosystems in the world. Adjusting the tax credit dedicated to it will allow us to support innovative projects better and maintain our lead in this area. At a time when new technologies such as the metaverse and virtual reality are developing, this tax credit is one of the pledges of French digital sovereignty. says Bruno Le Maire, Minister of Economy, Finance and Industrial and Digital Sovereignty (France 2030, 2022).
		Dubai Electricity and Water Authority (DEWA)	Dubai Electricity and Water Authority (DEWA) has organized a Metaverse and Digital Twin Hackathon, collaborating with the Higher Colleges of Technology in Dubai and Sharjah. This is in line with its continuous efforts to strengthen Dubai's position as an incubator for creativity and a beacon of innovation; to ensure Dubai remains at the forefront of cities that anticipate and shape the future. Twenty-four students participated in the Hackathon. The Hackathon included workshops on DEWA and Metaverse and DEWA and Digital Twin to motivate and inspire participants to create advanced technology solutions through designs and prototypes (Dubai Electricity & Water Authority, 2022).
	New business worlds	Intel Corporation	This technology that enables immersive virtual worlds to augment the real world opens up many possibilities and keeps me excited to work every day. We believe that the dream of providing a petaflop of computing power and a petabyte of data within a millisecond of every human on the planet is within our reach (Koduri, 2021). Regarding boundary expansion, 5G-Advanced has expanded from the current industrial digitization trend to more new services and business models. For example, XR's immersive experiences allow the users to reach out to the metaverse; the internet of vehicles makes the automotive industry smarter; with the integration of communication and perception, 5G can superimpose a perception of "radar" on communication functions (Koduri, 2021).

Design		Ifland Gallery	You can appreciate 52 works Various offline-scale metaverse exhibitions are held Ifland Gallery Land can display up to 52 works of art and provides a sense of scale and immersion at the level of offline exhibitions. In addition, various events, such as artist invitation lectures, can be operated through the main lobby screen (Forkast, 2022).
		Walmart	Were showing up in a big way, creating community, content, entertainment, and games through the launch of Walmart Land and Walmarts Universe of Play, said William White, chief marketing officer, Walmart U.S. Roblox is one of the fastest growing and largest platforms in the metaverse. We know our customers are spending loads of time there. So, were focusing on creating new and innovative experiences that excite them, something were already doing in the communities where they live and now, the virtual worlds where they play (Walmart, 2022).
	Co-Design	Adobe	The metaverse and other immersive experiences will only succeed if they are feature-rich, personalized, engaging, and have interactive content, said Scott Belsky, chief product officer and executive vice president of Adobe Creative Cloud. To lead in the metaverse, brands should start creating 3D and immersive content now it will not only prepare them for the future but make their product design and creation of marketing and e-commerce assets better, faster and cheaper (Adobe, 2022).
	Collaborative spaces	NVIDIA	The new NVIDIA Ada Lovelace architecture will enable designers and engineers to continue pushing the boundaries of engineering simulations, said Dipankar Choudhury, Ansys Fellow and HPC Center of Excellence lead. The RTX 6000 GPUs larger L2 cache, a significant increase in the number and performance of next-gen cores, and increased memory bandwidth will result in impressive performance gains for the broad Ansys application portfolio (NVIDIA, 2022).
	Stakeholders' participation	Microsoft	Building for the Beyond is how the partnership will anticipate and develop for the future's needs, accelerate the innovation process, and create more significant degrees of participation for various stakeholders. This may include joint creation and design opportunities in the metaverse or accelerating research and development through quantum computing (Microsoft, 2022).

Source: Authors' elaboration

Table 5. Digital entrepreneurship meets Metaverse

Theoretical framework	**Theoretical implications**	**Examples**
Digital business model	Solutions and new environments	LG, Ifland Gallery and Walmart
Digital entrepreneurship process	Network and gamification	Metascale and Walmart
Platform strategies	Collaborative spaces and stakeholders' participation	NVIDIA and Microsoft
Digital ecosystem	Immersive	Dubai Electricity and Water Authority (DEWA), Minister of Economy, Finance, and Industrial and Digital Sovereignty – France, Intel Corporation
Entrepreneurship education	Co-design	Adobe, Walmart
Social digital entrepreneurship	Digital twins	Siemens and DP World

Source: Authors' elaboration