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Meta-Entrepreneurship

An Analysis Theory on Integrating Generative AI, Agentic AI, and Metaverse for Entrepreneurship

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Published in:

Journal of Global Information Management

Published: 01/01/2024

Document Version:

Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

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Publication record in CityU Scholars:

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Published version (DOI):

[10.4018/JGIM.364094](https://doi.org/10.4018/JGIM.364094)

Publication details:

Zhang, Y., & Siau, K. (2024). Meta-Entrepreneurship: An Analysis Theory on Integrating Generative AI, Agentic AI, and Metaverse for Entrepreneurship. *Journal of Global Information Management*, 32(1).
<https://doi.org/10.4018/JGIM.364094>

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Meta-Entrepreneurship: An Analysis Theory on Integrating Generative AI, Agentic AI, and Metaverse for Entrepreneurship

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ABSTRACT

Metaverse entrepreneurship has emerged as an innovative topic alongside the development of generative AI, agentic AI and metaverse. This study conceptualizes meta-entrepreneurship as a novel form of entrepreneurial activity that enables value creation within virtual and physical realms and proposes an analytical theoretical framework based on a systematic literature review, observations, and focus group study. Our framework is structured around three layers (infrastructure, content, and experience) and two domains (metaverse-based operational domain and AI-based production domain), aims to conceptualize “what is meta-entrepreneurship” and identify new possibilities. The research highlights the multifaceted impact of meta-entrepreneurship on individuals, corporations, industries, societies, and countries. Further, we delineate three pathways to achieve meta-entrepreneurship, analyze nine critical challenges, and propose potential future research directions to contribute to the theoretical foundation of this emerging field.

KEYWORDS

Metaverse, Entrepreneurship, Metaverse Entrepreneurship, Generative AI, Agentic AI, Business Innovation

INTRODUCTION

The metaverse, which integrates both virtual and physical worlds, has been described as a “comprehensive ecosystem” (Wang et al., 2024) and is often referred to as the next evolution of the internet, sometimes known as the next stage of the internet (George et al., 2021). Artificial Intelligence (AI) serves as a fundamental component and key enabler of the metaverse. The emergence of Generative AI (GenAI), exemplified by ChatGPT and Sora, alongside advancements in agentic AI, has propelled the metaverse and virtual worlds to unprecedented heights, unlocking a myriad of new possibilities and creative entrepreneurship activities. Unlike traditional information systems that merely reflect or augment real-world phenomena or game environments that offer limited interaction, the metaverse facilitates immersive social experiences that transcend physical limitations (Seidel et al., 2022). This paradigm shift significantly impacts various social and economic activities, representing the integration and application of next-generation AI technologies. It serves as a dynamic platform where technologies can interact with human creativity and social dynamics, fostering a new era of

DOI: 10.4018/JGIM.364094

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innovation, interaction, and business innovation opportunities – *Metaverse-Entrepreneurship or Meta-Entrepreneurship*.

The importance of meta-entrepreneurship cannot be underestimated or ignored, as it is poised to transform various aspects of society and the economy. Nations and organizations must not only understand and research business opportunities enabled by the metaverse, but also proactively prepare for the challenges and digital transformation in the metaverse era. Around the globe, numerous government agencies are launching initiatives to equip businesses, citizens, and students with the necessary skills and knowledge to thrive in this new digital frontier. These efforts emphasize becoming adept in the metaverse as well as in generative AI and agentic AI technologies, which are expected to play a pivotal role in shaping the future. The metaverse is anticipated to revolutionize entrepreneurship by fostering new opportunities and experiences seamlessly integrating the virtual and physical worlds (Weking et al., 2023; Yemenici, 2022). However, despite these promising developments and the increasing momentum behind governmental and organizational programs, there remains a significant gap in systematic and scientific studies on meta-entrepreneurship. Our study aims to contribute to the emerging field by proposing an analytical framework for meta-entrepreneurship, studying its potential impacts and identifying possible pathways.

In this paper, we begin with an introduction to metaverse entrepreneurship, setting the context for our study. We then review relevant perspectives and propose a definition of meta-entrepreneurship, examining the role of generative AI and agentic AI in this domain. Building on this foundation, we draw on emergence theory to provide an explanation of meta-entrepreneurship phenomenon. The core of our study introduces an innovative theoretical framework analyzing the convergence of virtual and physical spaces, along with human-technology-space interactions, revealing opportunities in meta-entrepreneurship. Subsequently, we research the potential impacts of this new entrepreneurial form on individuals, corporations, industries, societies and countries. We then outline three distinct pathways for implementing meta-entrepreneurship, identify nine critical challenges, and propose potential future research directions. Finally, we summarize our theoretical and practical contributions.

LITERATURE REVIEW

Definition of Meta-Entrepreneurship

The metaverse can potentially reshape social interactions through advanced technological systems (Schiller et al., 2024; Jaung, 2022). As an immersive, persistent, and shared digital space, it promises to redefine how individuals and organizations engage in various domains, including commerce, education, and entertainment (Yang et al., 2022). Entrepreneurship in the metaverse has emerged as a focal topic within the discourse on business innovation. However, its definition remains contested, with scholars and practitioners debating the extent to which traditional entrepreneurial theories apply within this virtual context.

Based on the current body of research, we propose three distinct perspectives related to meta-entrepreneurship. The first research perspective focuses on technological integration and innovation. Entrepreneurship in the metaverse can be conceptualized as the convergence and advancement of various cutting-edge technologies. This perspective emphasizes the development and integration of augmented reality (AR), virtual reality (VR), AI, and advanced communication technologies such as 5G and 6G (Wang et al., 2024). From this perspective, entrepreneurs may focus on creating seamless, immersive digital environments that blur the boundaries between physical and virtual realities. The second human-centric research perspective focuses on user experience and design. Metaverse entrepreneurship revolves around the creation and optimization of user experiences within virtual spaces. This approach prioritizes interface design, interaction modalities, and the cultivation of immersion and engagement (Kim, 2021). Entrepreneurs adopting this perspective seek to develop intuitive, compelling, and psychologically satisfying metaverse experiences that resonate with users on a profound level. The third perspective conceptualizes entrepreneurship in the metaverse as an

Table 1. Differences between traditional entrepreneurship and meta-entrepreneurship

Aspect	Traditional entrepreneurship	Meta-entrepreneurship
Entrepreneurial Subjects	Primarily entrepreneurs	Includes entrepreneurs, virtual avatars, and AI agents
Entrepreneurial Objects	Tangible goods or services	Virtual assets, digital products, and immersive experiences
Entrepreneurial Process	Conventional business practices	Online, decentralized, and collaborative models supported by technologies
Entrepreneurial Outcomes	Primarily economic value	Economic value plus shaping digital culture, social interaction modes, and virtual ecosystems

imagination-driven innovation process. The immersive nature of metaverse experiences significantly stimulates human creativity, allowing the form and content of metaverse ventures to be shaped not only by technological capabilities but also by the bounds of human imagination (Dionisio et al., 2013). From this perspective, young people will leverage their active imagination to generate new ideas, resources, and markets, creating more entrepreneurial opportunities (Park & Kim, 2022). Synthesizing these three perspectives, we use an integrated view, defining meta-entrepreneurship as a novel form of entrepreneurial activity that enables value creation within the virtual and physical realms. This phenomenon represents a convergence of technology and creativity, not only relying on the support of advanced technologies, but also driven by human imagination and innovative capacity.

Unlike traditional entrepreneurship, meta-entrepreneurship exhibits significant differences (Table 1). The differences can be discussed from the perspectives of entrepreneurial subjects, entrepreneurial objects, entrepreneurial processes, and entrepreneurial outcomes. For entrepreneurial subjects, meta-entrepreneurship encompasses not only entrepreneurs but also novel entities such as virtual avatars and AI agents (e.g., AI-powered characters). These subjects transcend the physical limitations of the natural world in terms of identity and role. For entrepreneurial objects, meta-entrepreneurship revolves around virtual assets, digital products, and immersive experiences. These objects are characterized by high levels of virtualization, programmability, and scalability, fundamentally differing from traditional tangible goods or services. For entrepreneurial processes, meta-entrepreneurship leverages technology to achieve fully online, decentralized, and collaborative models. These processes rely more heavily on digital tools and virtual platforms for support. For entrepreneurial outcomes, meta-entrepreneurship extends beyond economic value, encompassing influences on digital culture, social interaction modes, and the shaping of virtual ecosystems. These distinctions establish metaverse entrepreneurship as a novel entrepreneurial paradigm.

Components of Meta-Entrepreneurship

Existing research on the related components of metaverse entrepreneurship offers varied emphases (see Table 2). From a technological perspective, key enablers such as AI, Blockchain, VR, AR, Network and computing technologies, Internet of Things (IoT), which form the foundational infrastructure that underpins entrepreneurial activity in the metaverse (Lee et al., 2021; Imoize et al., 2024; Ometov et al., 2022; Urrea & Matteoda, 2020; Wang et al., 2023). In terms of structure, several studies emphasize the role of spatial computing, robots, human-computer interaction (HCI), and the underlying digital infrastructure that supports metaverse ecosystems (Zhu et al., 2021). These structural elements provide the underlying framework that supports the dynamic, persistent, and interconnected nature of the metaverse. The content components highlight the new forms of value creation and consumption unique to the metaverse, as well as the novel ways in which entrepreneurs can engage users. This content perspective emphasizes the importance of digital identity, business innovation, creation of virtual products and services, and value exchange, such as NFTs, which drive entrepreneurial activities in virtual spaces (Far & Rad, 2022; Chalmers et al., 2022).

Table 2. Related components of meta-entrepreneurship

Components	Key description	Reference
Technology	Artificial intelligence (AI), Blockchain, Virtual Reality (VR), Augmented Reality (AR), Network and computing technologies, Internet of Things (IoT), 6G	Lee et al., 2021; Imoize et al., 2024; Ometov et al., 2022; Urrea & Matteoda, 2020; Wang et al., 2023
Structure	Spatial computing, Robots, Human-computer interaction (HCI), Digital infrastructure	Zhu et al., 2021; Fui-Hoon Nah et al., 2023
Content	Digital identity, Business innovation, Virtual products and services, Value exchange (NFTs)	Far & Rad, 2022; Chalmers et al., 2022
Characteristic	Immersive experiences, Openness, Innovation, Virtual-physical interaction	Weking et al., 2023; Inder 2023

The characteristic components delineate the distinct attributes of meta-entrepreneurship, including immersive experiences, openness, innovation, and the blending of virtual and physical realities (Weking et al., 2023; Inder, 2023). While these components provide a valuable approach to understanding the composition of meta-entrepreneurship, it is essential to acknowledge that other dimensions and classifications may further refine this conceptualization. Nonetheless, metaverse entrepreneurship is undeniably a complex system characterized by integrating multiple components and dissolving spatial and temporal boundaries, allowing for pervasive and innovative entrepreneurial opportunities.

As digital and physical realities continue to converge, the study of meta-entrepreneurship offers unprecedented opportunities to develop new theoretical frameworks. The unique composition and characteristics of meta-entrepreneurship not only differentiate it from traditional entrepreneurship but also render it an exceptionally worthy subject of academic investigation. As we stand on the brink of a new digital frontier, research into metaverse entrepreneurship promises to yield invaluable insights that could shape the future of business, technology, and society.

AI's Role in Meta-Entrepreneurship

AI is revolutionizing and transforming the world (Siau & Wang, 2020; Stephanidis, 2019; Hyder et al., 2019; Wang & Siau, 2019; Siau, 2018). The emergence of Generative AI, such as ChatGPT and Sora, Agentic AI (i.e., autonomous AI agents), and the expected arrival of Artificial General Intelligence (AGI) in the near future are creating shock waves around the globe for all industries and disciplines (Qian et al., 2024; Fui-Hoon Nah et al., 2023). Entrepreneurship is no exception. AI plays a transformative role in entrepreneurship by optimizing resource use, introducing novel organizational processes, and broadening the networks necessary for venture development (Schiafone et al., 2022). The transformative impact of AI on entrepreneurship is further amplified in the metaverse, where users can generate and execute programs through simple instructions, effectively democratizing the entrepreneurial process. By integrating AI with cutting-edge technologies, secure, scalable, and immersive virtual environments are created, unlocking unprecedented opportunities for innovation and business growth (Huynh-The et al., 2023). Further, AI plays a critical role in promoting sustainable entrepreneurship by fostering environmental development and advancing sustainability within the entrepreneurial sector, as emphasized by Gupta (2023). This demonstrates AI's potential to reshape entrepreneurship across both virtual and real-world domains.

As AI systems evolve to support users through task customization and decision-making, they increasingly exhibit characteristics of agentic AI, capable of exercising independent agency (Sundar, 2020). This shift in AI's capabilities not only enhances their functionality but also redefines their role in human-AI interactions, challenging traditional assumptions about their subordinate status. As Baird and Maruping (2021) argue that agentic AI challenges the primacy of human agency, as these systems are no longer passive tools but can independently handle ambiguous tasks and seek optimal outcomes under uncertainty. In the context of meta-entrepreneurship, this evolution of agentic AI has profound

implications. It can autonomously design and manage virtual businesses, generate and market digital assets such as NFTs, and optimize user experiences by analyzing real-time data. Moreover, agentic AI facilitates collaboration by connecting diverse stakeholders in virtual environments, streamlining communication, and ensuring efficient decision-making, which empowers entrepreneurs to innovate and scale their ventures with unprecedented efficiency and creativity.

THEORETICAL FOUNDATION

Emergence theory, a fundamental concept in complex systems research, hypothesizes that complex phenomena originate from the interactions of more superficial elements, where the resulting complexity cannot be adequately predicted by merely aggregating the individual components (Holland, 2001). This theoretical framework has gained significant traction in various fields, including organizational studies (Anderson, 1999) and entrepreneurship research (McKelvey, 2004), and is particularly valuable for understanding entrepreneurship within the metaverse. Nambisan and Baron (2013) use emergence theory to explore the concept of entrepreneurship in digital ecosystems and argue that the unique characteristics of digital environments necessitate a reconsideration of traditional entrepreneurial processes and outcomes. Yoo et al. (2012) introduced the concept of “generativity” in digital innovation and posited that digital technologies enable novel forms of innovation that are unpredictable and often arise from the recombination of existing elements. This notion is particularly relevant to metaverse entrepreneurship, as it creates a fertile ground for emergent business models and value propositions.

Further, the phenomena of emergence within this context progress through numerous iterations and evolutionary phases, allowing for the optimization and enhancement of entrepreneurial ventures over time. This iterative process resonates with the concept of “effectuation” in business (Sarvasathy, 2001). Effectuation posits that entrepreneurs create opportunities through a process of experimentation and learning rather than following a predetermined plan. In the metaverse, this process is accelerated and amplified by the virtual nature of interactions and the rapid feedback loops enabled by digital technologies. This ongoing evolution facilitates the development of innovative solutions and competitive advantages within the digital economy. As noted by Nambisan (2017), digital technologies are not just enablers of entrepreneurship but are increasingly becoming an integral part of the entrepreneurial process and outcome. In the metaverse, this integration is even more pronounced, with virtual environments serving as both the medium and the marketplace for entrepreneurial activities.

AI serves as a crucial catalyst for metaverse entrepreneurship, significantly enhancing the scope of entrepreneurial exploration and discovery. By synthesizing diverse inputs into unique outputs, AI aligns with the tenets of emergence theory, introducing additional layers of complexity and interaction. Further, agentic AI makes metaverse entrepreneurship more tangible and actionable by bridging the gap between complex virtual environments and practical implementation. It enables entrepreneurs to translate innovative ideas into immersive, functional, and scalable ventures within the metaverse, fostering a seamless integration of creativity and execution. As noted by Nambisan et al. (2019), digital technologies can act as both enablers and constraints in entrepreneurial processes, shaping the nature of opportunities and the methods by which they are pursued. Such emergent phenomena allow entrepreneurs to tap into novel market dynamics and explore previously unimagined business possibilities, thereby driving the continuous expansion and sophistication of the metaverse. Thus, the integration of AI into metaverse entrepreneurship exemplifies the multi-layered nature of emergent phenomena in complex adaptive systems.

Meta-entrepreneurship, as an emerging and transformative phenomenon, demands comprehensive theoretical exploration to understand its unique dynamics and implications. Gregor (2006) defines analysis theory as a “description of the phenomena of interest” within which these observations hold. In this study, we focus on meta-entrepreneurship as a novel area for theoretical inquiry. By integrating

generative AI, agentic AI, and metaverse for entrepreneurship, we propose a novel analysis theory and provide a deeper understanding of “what is meta-entrepreneurship”. This theoretical framework not only elucidates the fundamental constructs and relationships underpinning metaverse entrepreneurship but also delineates the role of emerging technologies in shaping entrepreneurial practices.

META-ENTREPRENEURSHIP ANALYSIS THEORETICAL FRAMEWORK

Research Methodology and Procedure

The construction of our analytical framework for meta-entrepreneurship is grounded in a comprehensive and systematic review of relevant literature, coupled with observational research and insights from focus groups. Drawing from Grant and Booth's (2009) influential typology of 14 review types, we adopted the Systematic Review approach for this study. This method emphasizes a structured and rigorous process to identify, evaluate, and synthesize research evidence in alignment with clearly defined objectives. In our research, the primary objective is to develop an analytical theoretical framework for meta-entrepreneurship, which involves systematically exploring, appraising, and synthesizing academic literature on the metaverse and entrepreneurship to uncover critical linkages and new possibilities for business value creation.

Observation research is a way of gathering data by watching behavior, events, or noting physical characteristics in their natural setting (Ciesielska & Jemielniak, 2018). There are a few types of observation research -- participant or non-participant, and structured or unstructured. In this research, we followed the non-participant and unstructured observation. We observed metaverse platforms and entrepreneurial activities to provide a preliminary foundation for our research. This approach allowed us to capture nuanced interactions between entrepreneurs, users, and the virtual infrastructure. Coupled with the systematic review findings, these observations enriched the contextual depth and empirical relevance of our framework, ensuring that it is both grounded in theory and informed by real-world practice.

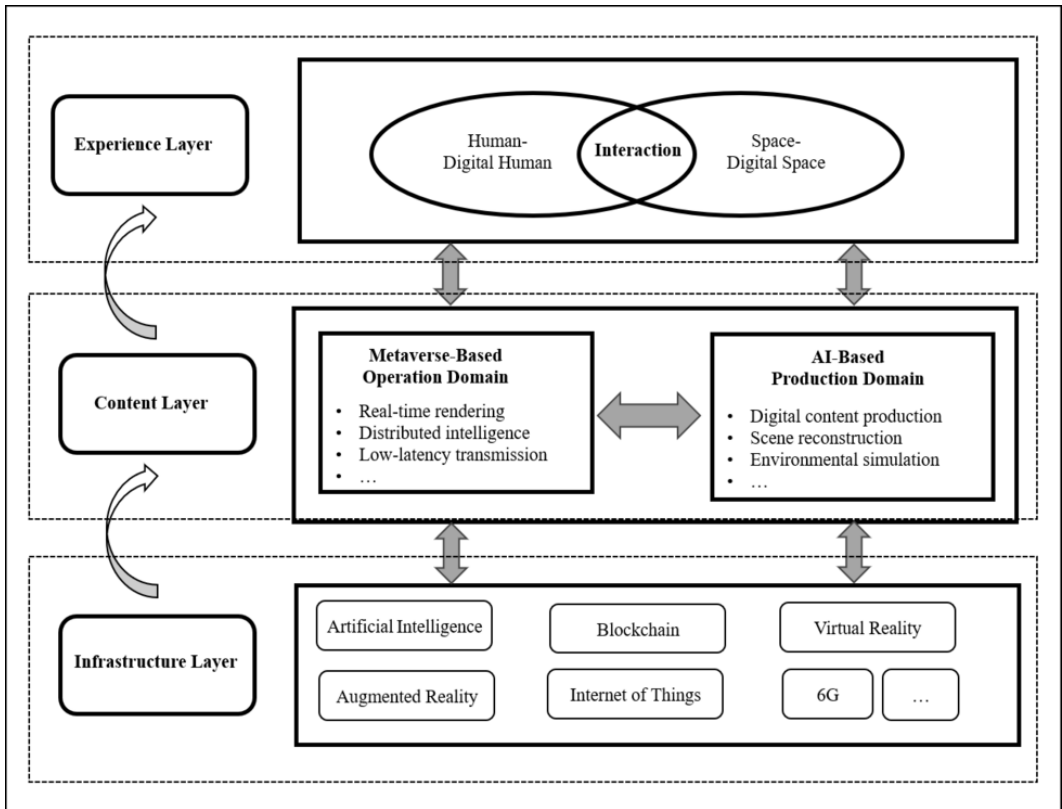
Focus group study is also used. Focus group approach allows participants to freely express their ideas without the need to reach a consensus, leaving room for insights into previously unexplored issues (Hollis et al., 2002). In addition, focus groups enable researchers to quickly gather participants' perceptions, ideas, and viewpoints on specific topics (Krueger & Casey, 2000). In this study, we followed the focus group procedures outlined by Nili (2017) to study and evaluate participants' perspectives and experiences regarding the conceptual framework of meta-entrepreneurship. Specifically, we invited six participants with knowledge or related experience in metaverse entrepreneurship. All participants held at least a master's degree and voluntarily agreed to participate in our research. The focus group discussions were conducted in a structured yet flexible manner to encourage open dialogue. Data collected from these sessions were analyzed using conversational analysis, which enabled us to identify key insights and critical interactions.

Through systematic review of the literature, observation method, and focus group study, we developed a theoretical analysis framework. Within our framework, we integrate generative AI and agentic AI under the unified concept of AI, positioning it as a central driver of innovation and value creation in the metaverse. The framework is structured into three progressive layers, which are interdependent and sequential, with each layer building upon the foundation laid by the preceding one. In the following sections, we will provide a detailed analysis of this theoretical framework, focusing on the content layer's potential to foster novel applications, creative possibilities, and drive business opportunities.

Theoretical Framework of Meta-Entrepreneurship

The theoretical framework for meta-entrepreneurship that we propose (Figure 1) is structured into three interconnected layers: the infrastructure layer, the content layer, and the experience

Figure 1. Theoretical framework of meta-entrepreneurship



layer. At the foundation lies the infrastructure layer, which underscores the critical role of enabling technologies such as AI, blockchain, VR/AR, IoT, and 6G. These technologies serve as the backbone of the meta-entrepreneurship, providing the technical foundation for all higher-level activities. As established in our literature review, existing research has extensively validated the significance of these foundational technologies in shaping the metaverse ecosystem.

Content Layer is supported by these technologies and focuses on the creation, distribution, and management of digital content. In the core activities layer of meta-entrepreneurship, we categorize the infrastructure into two primary domains: the Operation Domain (OD) based on metaverse and the Production Domain (PD) based on GenAI. The OD encompasses critical technological aspects that enable real-time engagement within the metaverse, including real-time rendering, distributed intelligence, and low-latency transmission. These components are crucial for creating immersive and responsive user experiences. Simultaneously, the PD focuses on creating and simulating metaverse content and environments using AI technologies. This includes digital content production and service, scene reconstruction, and environmental simulation, often utilizing advanced techniques such as light field rendering. A vital feature of this layer is the bidirectional relationship between these domains, allowing for dynamic interchangeability and even simultaneous operation, thus fostering a highly adaptive and innovative entrepreneurial environment.

Experience Layer highlights immersive engagement, social connection, and interactive experiences that connect users to the metaverse. In this layer, we identify two essential sets: the entity set and the spatial set. The entity set, which includes both human and digital actors. The spatial set, representing both physical and virtual space. The intersection of these sets encapsulates

the essence of metaverse interactions, highlighting the dynamic interplay that defines entrepreneurial activities in the metaverse. Specifically, the “Human-Digital human” set embodies the duality of real-world individuals and their virtual counterparts, potentially representing diverse global citizens unrestricted by physical limitations. The “Space-Digital Space” set signifies the convergence of our tangible, physical environments with the boundless digital realms of the metaverse. The intersection of these sets underscores the crux of meta-entrepreneurship – facilitating meaningful exchanges and experiences that can be purely virtual, entirely real, or a hybrid of both. It delineates the critical juncture where digital representations of individuals engage with virtualized spaces, fostering novel forms of communication, commerce, and creativity.

Based on our theoretical analytical framework, meta-entrepreneurship can be understood as a phenomenon emerging from the interaction of humans, technology, and spatial dimensions. These activities are characterized by a distinctive fusion of virtual and physical elements, creating novel business models and value propositions that transcend traditional boundaries. Our framework highlights the dynamic interplay between technological capabilities, content creation, and user interaction.

Possibility Identification of Meta-Entrepreneurship

Possibility of Metaverse-Based Operation Domain

Metaverse is a platform for entrepreneurial opportunities. The metaverse holds the potential to transform the mechanisms of value creation and capture (Latino et al., 2024). The expanding metaverse offers novel opportunities in the domain of entrepreneurial operations and customer relations by creating a “phygital” environment where the realities of both the physical and digital worlds are integrated to enhance user immersion (Mancuso et al., 2023). Metaverse provides entrepreneurship opportunities through features such as real-time rendering, distributed intelligence, and low latency, which can drive innovation and efficiency in business operations.

First, real-time rendering. Real-time rendering technology is crucial for providing immersive experiences in metaverse-based entrepreneurial activities. Advancements in Graphics Processing Units (GPUs) and cloud computing have enabled metaverse platforms to render complex 3D scenes, offering users fluid and realistic visual experiences. This technology facilitates unprecedented virtual events such as conferences, exhibitions, concerts, and games. Real-time rendering enhances social interaction authenticity by allowing participants to observe each other's movements and expressions in virtual environments. Further, it supports the creation of dynamic environments with weather changes and lighting effects, enriching the contextual backdrop for entrepreneurial activities within the metaverse.

Second, distributed intelligence. Distributed intelligence emerges as a critical pillar in metaverse entrepreneurship, facilitating decentralized operations and collaborations. It enables the integration of individual and local nodes, fostering a decentralized ecosystem (Cao, 2022). The implementation of distributed intelligence supports the provision of personalized services and content while maintaining operational efficiency. This technology empowers metaverse platforms to process and analyze vast amounts of user data concurrently, enabling large-scale user engagement without compromising system performance. For metaverse entrepreneurs, distributed intelligence offers invaluable tools for real-time user behavior analysis, which provides deep market insights, facilitates customer need identification, and unveils new business opportunities.

Third, low-latency transmission. Low-latency transmission is vital for metaverse entrepreneurial activities. The application of low-latency transmission technologies enables real-time interaction and communication within the metaverse, whether for virtual events or social interactions. For example, it ensures seamless real-time communication between speakers and audiences in virtual conferences, reducing communication barriers. It also enhances online gaming responsiveness, improving player experiences. In addition, low-latency transmission supports real-time transactions and payments in the metaverse, providing entrepreneurs with convenient commercial services.

These represent only a glimpse of the entrepreneurial opportunities that metaverse platforms can offer. In reality, the metaverse's broader characteristics and capabilities hold even greater potential to stimulate innovation, enabling entrepreneurs to explore uncharted territories, leverage immersive technologies, and reimagine value creation in ways that transcend traditional boundaries.

Possibility of AI-Based Production Domain

The integration of AI in the metaverse accelerates innovation in virtual products and services, opening new avenues for entrepreneurship. We explore AI's potential in meta-entrepreneurship through three illustrative applications: digital content production, scene recreation, and environment simulation.

First, digital content production. AI's capacity to emulate human creative processes through extensive data analysis facilitates the generation of original text, images, music, and video content with unprecedented efficiency and scalability. Natural Language Processing (NLP) enables AI to compose news reports, poetry, and even computer code. In the realm of image generation, Generative Adversarial Networks (GANs) produce photorealistic faces, landscapes, and artwork (Goodfellow et al., 2014). These technological advancements not only equip content creators with powerful tools but also provide a rich repository of assets for constructing virtual worlds within the metaverse.

Second, scene recreation. Scene recreation represents another critical application of AI in metaverse entrepreneurship. Leveraging 3D modelling and computer vision technologies, AI accurately captures and digitally reconstructs real-world environments. This seamless integration of physical and digital spaces offers users immersive experiences. In educational contexts, historical event recreations provide vivid learning experiences, while in real estate, virtual property tours revolutionize buyer engagement. The evolution of scene recreation technology significantly expands the metaverse's application scope, fostering new entrepreneurial opportunities.

Third, environment simulation. Environment simulation emerges as a critical domain for AI application in metaverse entrepreneurship. AI's capability to simulate complex environmental systems, including weather patterns, ecosystems, and social dynamics, infuses the metaverse with dynamic and interactive environments. These simulations not only enhance the complexity and verisimilitude of virtual worlds but also engender novel user interaction paradigms and experiences. For instance, AI can model traffic flows in virtual cities to inform urban planning or simulate species interactions in virtual ecosystems to provide new perspectives for environmental research. The advancement of environment simulation technology presents limitless possibilities for entrepreneurial activities within the metaverse, enabling entrepreneurs to test and optimize business models in controlled, predictable environments.

Further, the new agentic AI can facilitate automatic collaboration across different metaverse platforms, promote resource sharing and interoperability, and assist entrepreneurs in scaling their businesses. The above analysis demonstrates that AI not only serves as an efficient, intelligent, and scalable tool in metaverse entrepreneurial activities but also acts as a catalyst for innovation, a bridge connecting virtual and real economies, and a force reshaping the boundaries of digital interaction, ultimately enriching the diversity of scenarios and possibilities.

IMPACT OF META-ENTREPRENEURSHIP

Meta-entrepreneurship represents a significant nexus between virtual and real-world interactions, offering solutions to the complex challenge of integrating virtual and real value in digital entrepreneurship. As a transformative force, the impact of metaverse entrepreneurship extends across various levels, including individuals, corporations, industries, societies and countries.

Meta-Entrepreneurship for Individuals

The immersive and interactive nature of metaverse environments provides novel platforms for individual social interaction and community building. Przybylski and Weinstein (2013) argue

that virtual environments can foster social connectedness, particularly when they facilitate shared experiences. For example, metaverse environments can play a crucial role in sparking individual creativity and imagination during interactions with others. The ability to navigate and manipulate three-dimensional spaces, coupled with real-time communication tools, allows users to experiment with new ideas and engage in collaborative endeavors. The metaverse also serves as a fertile ground for the cultivation of intellectual and spiritual wealth. Through the creation and exchange of digital assets, including art, music, and literature, individuals can express themselves creatively and contribute to a growing body of digital cultural artifacts. This phenomenon, which Belk (2013) terms the “extended self in a digital world”, allows for new forms of self-expression and identity construction.

Moreover, meta-entrepreneurship offers unprecedented opportunities for personal growth and skill development. The virtual nature of these environments provides safe spaces for experimentation and learning, allowing individuals to develop entrepreneurial competencies with reduced real-world risks. This unique setting promotes both personal development and an entrepreneurial mindset, equipping individuals to navigate and excel in the evolving digital economy.

Meta-Entrepreneurship for Corporations

The immersive and interconnected nature of metaverse environments facilitates work and collaboration while enhancing corporate operational efficiency. In the metaverse context, this manifests through advanced collaboration tools and virtual workspaces that transcend geographical boundaries. Virtual and augmented reality technologies are revolutionizing product design, prototyping, and manufacturing, enabling real-time collaboration across geographically dispersed teams.

Traditional corporate boundaries are being redefined as entrepreneurs develop new value propositions that bridge both virtual and physical realms. A significant manifestation of this shift is the emergence of blockchain-enabled supply chains within the metaverse, which enhance transparency, traceability, and efficiency. These advancements effectively address longstanding challenges, such as counterfeit products and ethical sourcing (Saber et al., 2019). In addition to these developments, the decentralized architecture of blockchain technology serves as a foundational framework for various metaverse platforms, facilitating the creation of novel organizational structures, particularly decentralized autonomous organizations (DAOs). By their nature, these DAOs fundamentally challenge traditional conceptions of corporate governance and stakeholder engagement (Wang et al., 2019), thereby further transforming the landscape of contemporary business practices.

Metaverse also enables rapid prototyping and testing of business ideas in virtual environments, potentially accelerating the entrepreneurial process. One example is the rise of virtual real estate and property development within the metaverse, where digital land and assets are bought, sold, and monetized much like their physical counterparts. Entrepreneurs are creating entire digital economies that encompass gaming, entertainment, and social networking, all seamlessly integrated into the metaverse infrastructure. This shift has given rise to new revenue streams through the sale of virtual goods, advertising space, and customized experiences tailored to individual users.

Meta-Entrepreneurship for Industries

Digital twins (DT) technology has opened up vast prospects for the development of the industrial metaverse. It enables the creation of complex systems (e.g., factories, airports, cities), facilitating unprecedented large-scale and complex simulations and optimizations. A noted example is the collaboration between Nokia Bell Labs and AeroFarms, which integrates AI-driven drone control, machine learning, and vision tools to track millions of plants in real-time. This comprehensive farm-wide DT system not only monitors crop growth but also predicts yield, optimizes resource utilization, and autonomously adjusts growth environments. The potential applications of DT technology extend to various sectors, including manufacturing, logistics, and energy, providing a powerful impetus for digital transformation across diverse industries.

As the metaverse is anticipated to drive industries toward Industry 5.0 (Guo et al., 2024), meta-entrepreneurship is poised to accelerate this transformation. Meta-entrepreneurship facilitates seamless collaboration between stakeholders by leveraging virtual platforms. For example, in the consumer goods sector, meta-entrepreneurship facilitates the alignment of product designs and manufacturing systems at a granular level. By leveraging AI models, it minimizes communication misunderstandings that often arise during the customization process for personalized consumer demands. Further, Makridakis (2017) suggests that AI and virtual technologies could play a crucial role in addressing global challenges such as climate change and resource scarcity. Meta-entrepreneurship supports sustainability goals by reducing resource waste, promoting circular economy models, and enabling the development of eco-friendly production methods. By integrating these advancements, meta-entrepreneurship not only enhances operational precision and flexibility but also aligns with the broader goals of Industry 5.0, fostering innovation, efficiency, and sustainability across industrial ecosystems.

Meta-Entrepreneurship for Societies

For societies, meta-entrepreneurship is fundamentally restructuring social and economic interactions, reinforcing the foundations of societal operations. This transformation is now materializing through metaverse platforms, where entrepreneurs are creating new forms of value exchange, social interaction, and economic activity. These virtual ecosystems are not merely paralleling physical economies but are increasingly intertwining with and augmenting them, creating a new paradigm of “phygital” experiences (Belk, 2013).

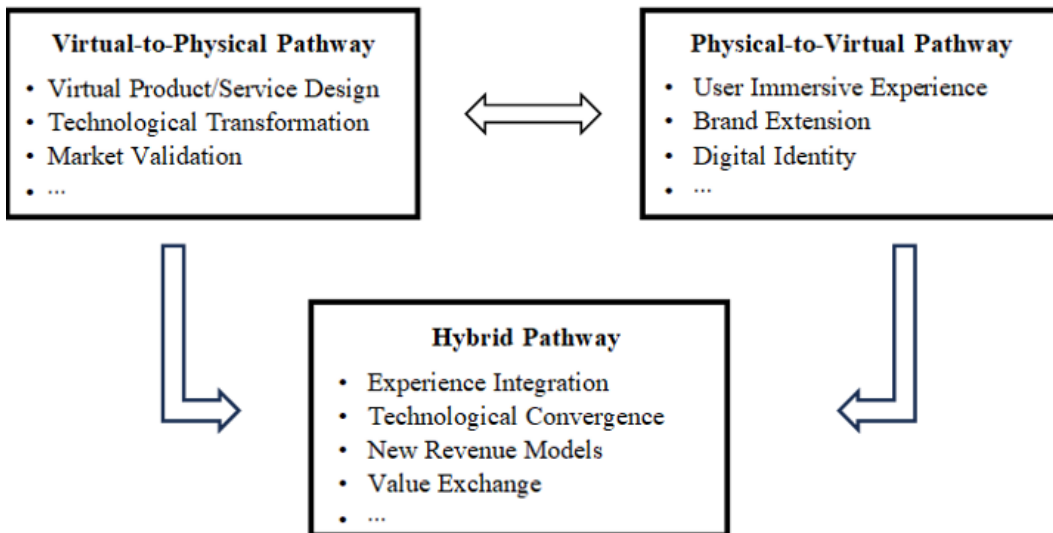
Further, meta-entrepreneurship has the potential to democratize access to entrepreneurial opportunities, thereby fostering more significant social equity across global communities. By lowering traditional barriers to entry, such as geographical constraints and the need for substantial capital investment, the metaverse enables a more diverse range of individuals to participate in entrepreneurial activities. By decentralizing and distributing economic opportunities, meta-entrepreneurship has the potential to reduce socioeconomic disparities and empower underrepresented groups, enabling them to actively participate in and benefit from the global digital economy. In addition to promoting inclusivity, meta-entrepreneurship can help reduce social conflicts and tensions by addressing economic inequalities and fostering equitable access to resources and opportunities. The decentralized nature of meta-entrepreneurial ecosystems allows for localized decision-making and resource allocation, aligning with the specific needs of different communities. These dynamics contribute to building a more harmonious society where shared economic prosperity and mutual understanding reduce the root causes of social friction.

Meta-Entrepreneurship for Countries

The emergence of meta-entrepreneurship has profound implications for nations worldwide, reshaping economic landscapes and cultural preservation strategies. A prime example is the small island nation of Tuvalu, which is pioneering the concept of “Digital Tuvalu” (Rothe et al., 2024). This initiative is driven by the urgent need to safeguard the nation's heritage against the existential threats posed by climate change and rising sea levels. By establishing a digital twin of its environment, Tuvalu not only seeks to preserve its cultural artifacts but also to enhance global awareness regarding the vulnerabilities faced by small island nations. Similarly, Singapore has positioned itself at the forefront of this digital revolution, emerging as the most prominent digital twin country. By digitizing its urban landscapes, from iconic buildings to intricate street layouts, Singapore is leveraging advanced technologies to enhance urban planning, improve resource management, and foster innovation in real estate development. This comprehensive digital representation facilitates data-driven decision-making and enables stakeholders to simulate and analyze the impacts of various urban policies in real-time.

These developments underscore how meta-entrepreneurship enables countries to transcend physical limitations, preserve cultural identities, and reimagine governance in the digital age. By

Figure 2. Pathways of meta-entrepreneurship



embracing digital representations of their cultures and urban environments, nations are not only bolstering their resilience against environmental challenges but are also generating new economic opportunities. As more nations explore similar strategies, the metaverse is poised to become a new frontier for national development, offering novel solutions to longstanding challenges and creating unprecedented opportunities for global interaction and collaboration.

PATHWAYS TO DEVELOP META-ENTREPRENEURSHIP

Based on our definition and conceptualization of meta-entrepreneurship, we identify three primary pathways to realizing entrepreneurial endeavors within the metaverse: the Virtual-to-Physical Pathway, the Physical-to-Virtual Pathway, and the Hybrid Pathway (Figure 2). The following sections will explore each pathway in detail.

Virtual-to-Physical Pathway

The Virtual-to-Physical Pathway represents a unique entrepreneurial trend. It delineates a process wherein entrepreneurs initially conceive their core products or services within virtual spaces, subsequently materializing these concepts into tangible products in the physical realm. This path highlights the fusion of metaverse technology and real-world economics, revealing the permeation and impact of virtual innovations on tangible industries. For example, RTFKT, which introduced unique virtual sneakers in the metaverse before successfully launching physical versions in the market, thereby establishing brand influence across both virtual and physical realms.

The key to the Virtual-to-Physical Pathway lies in synthesizing technological innovations from the metaverse with market demands in the physical world. The metaverse serves not only as a canvas for creative expression but also as a sophisticated experimental platform, where designers can iterate and refine their offerings through immersive experience design, technological integration, and the incorporation of user feedback. This iterative process is crucial, as it allows for the collection of invaluable market data and user insights, which are instrumental in the optimization of product/service designs. Further, the metaverse acts as a dynamic training platform, providing simulation-based training that is both realistic and safe, facilitating employee's (or student's) skill development, and offering

immediate feedback mechanisms that are essential for continuous improvement. Another possibility is market validation, where user engagement is maximized to gather insights on product appeal and usability. Through A/B testing and data collection, entrepreneurs can discern consumer preferences and interactions, which are then used to fine-tune the product or service before its physical manifestation. This virtual-to-physical transmutation is facilitated by insights gained from the metaverse, which inform manufacturing processes, supply chain optimization, and physical distribution strategies.

Physical-to-Virtual Pathway

The Physical-to-Virtual Pathway delineates the entrepreneurial process of extending tangible products and services from the physical world into the metaverse. This process transcends mere technological application, involving the reconceptualization of market strategies, brand identity, and user interaction paradigms. Through this pathway, entrepreneurs can explore novel market opportunities, establish connections with global consumers, and harness the immersive characteristics of the metaverse to create unique user experiences. For example, the luxury brand BULGARI expanded its digital footprint and innovated consumer interaction by showcasing “virtual twins” of its new products in the metaverse.

In this pathway, the reimagination of user experiences is paramount. The metaverse provides a space for users to construct and express their digital identities. Entrepreneurs can utilize data analytics to comprehend the preferences and needs of metaverse residents, designing corresponding virtual experiences to meet these needs. This may encompass creating virtual try-on experiences, online virtual events, or interactive product displays. Through these experiences, entrepreneurs can not only captivate the attention of metaverse residents and enhance brand loyalty but also gather valuable user feedback for further product and service refinement. Moreover, by leveraging virtual worlds in the metaverse, entrepreneurs can design highly stylized and realistic environments that reflect or transcend real-world limitations, creating interactive experiences.

Meta-Entrepreneurship Hybrid Pathway

The Hybrid Pathway represents a strategic convergence of virtual and actual experiences, creating a seamless and immersive user interaction. This integration transcends the traditional boundaries between the digital and physical worlds, offering users a multi-sensory experience that is both engaging and transformative. By merging the capabilities of virtual environments with the tangibility of real-world settings, the Hybrid Pathway paves the way for innovative applications across various industries, from education and healthcare to entertainment and retail.

The core of the hybrid pathway is the technological convergence of AI with other advanced technologies across diverse entrepreneurial activities, encompassing both virtual and physical realms. This approach leverages the capabilities of AI to transcend traditional entrepreneurship boundaries, fostering advancements in both digital and tangible business. For example, Anwar et al. (2023) reveal how integrating AI with IoT can optimize supply chain operations in physical commerce, thereby improving resource allocation and enhancing business performance.

The emergence of the hybrid pathway also signals the development of novel business models that capitalize on AI's advantages. These models often prioritize user-centric design, personalized experiences, and data-driven decision-making. This customized approach extends beyond basic customization, aiming to create meaningful and engaging experiences that resonate more deeply with consumers. For example, by analyzing both physical and virtual purchasing behaviors, businesses can more accurately grasp market demands, facilitating entrepreneurs in aligning opportunities between the metaverse's virtual space and the physical world.

Moreover, this pathway introduces innovative mechanisms for value exchange, redefining traditional economic transactions. In this context, value extends beyond monetary currency to encompass intangible assets such as data, intellectual property, and social capital. Value exchange is facilitated by decentralized platforms and smart contracts, ensuring transparency, efficiency, and

Table 3. Challenges and future research directions of meta-entrepreneurship

Challenges	Research directions description
Interaction Challenges	Enhance intuitiveness, responsiveness, and ergonomics of HCI technologies for seamless user interaction.
Computational Power Challenges	Distributed computing, edge computing, and quantum computing approaches.
Compatibility and Standardization Challenges	Develop open standards and protocols for metaverse interoperability.
Business Value Conversion Challenges	Innovative metaverse business models. Value transfer mechanism. Assess and tax virtual goods and services.
Data Security and Privacy Challenges	Data security solutions. Privacy-enhancing technologies and methods.
Legal and Regulatory Challenges	Develop meta-entrepreneurship laws and more “meta-rules”.
Content Creation and Intellectual Property Challenges	Blockchain-based systems for tracking and enforcing digital rights.
Social and Cultural Challenges	Sociocultural implications of metaverse adoption. Metaverse addiction.
Environmental Impact and Sustainability Challenges	Sustainable practices for metaverse infrastructure and meta-entrepreneurship.

fairness in transactions. Therefore, meta-entrepreneurs must consider establishing value exchange mechanisms between virtual and physical products and optimizing operational efficiency through data analytics and insights.

FUTURE RESEARCH DIRECTIONS

While meta-entrepreneurship presents immense commercial and economic potential, it is accompanied by a range of challenges that need to be addressed. In this section, we explore these challenges by organizing them into nine distinct categories. By identifying these obstacles, we highlight the complexities of operating within the metaverse and propose future research directions to pave the way for sustainable growth and innovation (see Table 3).

Interaction Challenges. Current interactive technologies are yet to achieve the desired levels of sophistication and effectiveness, which significantly impairs the immersive experiences that users expect within the metaverse. For example, although products such as Apple's Vision Pro exemplify advances in augmented reality, they still fall short in terms of user comfort and sensory engagement. The discomfort caused by prolonged use of such devices can detract from the immersive experience that the metaverse purports to offer. Therefore, future research is imperative to enhance the intuitiveness, responsiveness, and ergonomics of HCI technologies to foster a more seamless and enjoyable interaction between users and digital environments.

Computational Power Challenges. Meta-entrepreneurship is an innovative endeavor based on the metaverse, necessitating substantial processing capabilities and high computational power. Current computing capabilities may be insufficient to support large-scale user bases and complex 3D scene rendering simultaneously. Future research should explore novel approaches to distributed computing, edge computing, and quantum computing to address these challenges. Moreover, investigating energy-efficient rendering techniques and optimized data transmission protocols could contribute to more sustainable metaverse infrastructures.

Compatibility and Standardization Challenges. Ensuring interoperability between different companies' metaverse platforms is crucial for effective communication and collaboration among

various components and systems. As Cheng et al. (2022) note, the lack of standardization could lead to fragmented user experiences and hinder the growth of the metaverse ecosystem. Future research should focus on developing open standards and protocols for metaverse interoperability, similar to the development of internet protocols.

Business Value Conversion Challenges. The conversion of value generated within the metaverse to real-world profits presents a significant challenge for meta-entrepreneurship. Because the metaverse economy operates on different principles than traditional economies, often utilizing unique digital currencies or tokens. The question of how to monetize products and services traded in the metaverse and convert metaverse profits into real-world value remains a critical issue. Future research should explore innovative business models that bridge virtual and physical economies. This could include studies on the integration of blockchain technologies and cryptocurrencies to facilitate seamless value transfer between metaverse and real-world economies. Further, research into the economic implications of virtual goods and services, including their valuation and taxation, would provide valuable insights for both entrepreneurs and policymakers.

Data Security and Privacy Challenges. The operation of the metaverse relies heavily on extensive user data, encompassing personal information, behavioral patterns, and potentially even biometric details. Ensuring the security and privacy of this data presents a significant challenge. Future research directions may include developing robust privacy-preserving technologies specifically designed for immersive virtual environments. This could include advanced encryption methods, decentralized data storage solutions, and privacy-enhancing technologies that allow users to control their data (Bernabe et al., 2022). In addition, laws surrounding data protection, such as the General Data Protection Regulation (GDPR), need to adapt to the unique attributes of the metaverse. Collaborative efforts among researchers, legal experts, and technologists are essential to create adaptable guidelines that protect users' rights without stifling innovation.

Legal and Regulatory Challenges. An emerging concern is the legal and regulatory implications of meta-entrepreneurship. As the metaverse blurs the lines between the digital and physical realms, existing laws must be reevaluated to address issues such as virtual harassment, digital asset ownership disputes, and liability for virtual actions. The development of “meta-rules”, including both technical and social norms, requires the participation of various stakeholders, including governments, tech giants, and individual users. Future research should focus on developing comprehensive legal frameworks that address the unique challenges of the metaverse. For example, the applicability of existing laws to virtual environments, the development of new legal concepts for digital assets and identities, and the exploration of governance models for decentralized virtual worlds.

Content Creation and Intellectual Property Challenges. Rich and varied content is the lifeblood of the metaverse. Protecting the intellectual property rights of content creators while simultaneously fostering innovation and creativity is a crucial challenge in metaverse development. Future research should explore novel approaches to intellectual property rights in virtual environments. For example, studies on blockchain-based systems for tracking and enforcing digital rights, the development of smart contracts for automated royalty distribution, and the exploration of new licensing models suitable for user-generated content in immersive environments.

Social and Cultural Challenges. The metaverse has the potential to fundamentally alter social interaction patterns and cultural consumption habits. As metaverse entrepreneurs navigate this new landscape, they face the challenge of adapting to and guiding these changes while fostering a positive sociocultural environment within virtual spaces. Future research should explore the sociocultural implications of metaverse adoption on a broader scale. This could include longitudinal studies on the impact of prolonged metaverse engagement on social skills, cultural norms, and community formation. Further, research into the psychological effects of immersive virtual experiences, including issues of addiction, dissociation, and the blurring of virtual and physical realities, would be essential for developing responsible metaverse platforms and services.

Environmental Impact and Sustainability Challenges. The servers and data centers powering metaverse services consume substantial amounts of energy, potentially leading to increased carbon emissions and environmental degradation. Moreover, the iterative of meta-entrepreneurship, involving extensive experimentation and potential failures, could result in various forms of waste, including electronic waste from discarded hardware (Nleya and Velepini, 2024). Future research should focus on developing sustainable practices for metaverse infrastructure and entrepreneurship. For example, studies on energy-efficient algorithms for rendering complex virtual environments, the use of renewable energy sources for powering metaverse infrastructure, and the development of circular economy models for hardware used in metaverse applications.

CONCLUSION AND CONTRIBUTIONS

Meta-entrepreneurship is not merely introducing alternative ways of conducting business but is pioneering a transformative shift in how value is created, exchanged, and perceived in the digital age. This evolution is poised to challenge conventional economic paradigms and inspire new thinking about the very nature of entrepreneurship in a hyper-connected society. In this research, we study how generative AI, agentic AI and the metaverse converge to enable novel forms of entrepreneurial innovations. Our investigation into this emerging technological intersection reveals significant implications for the future of entrepreneurship in the metaverse.

This study has several theoretical contributions. First, this research systematically reviewed and synthesized the relevant perspectives surrounding metaverse entrepreneurship, providing a definition of meta-entrepreneurship, which is “a novel form of entrepreneurial activity that enables value creation within the virtual and physical realms”. Second, using systematic review, observation method, and focus group study, we developed a novel analysis framework for conceptualizing meta-entrepreneurship. This framework elucidates the complex interactions between technologies, human and digital entities, physical and digital spaces, PD and OD and the pivotal role of their intersections in fostering entrepreneurial opportunities. It not only provides a structured approach to conceptualizing meta-entrepreneurship but also serves as a heuristic tool for identifying emergent opportunities for future entrepreneurial ventures. Third, we have delineated three distinct yet interconnected pathways for meta-entrepreneurship: the virtual-to-physical pathway, the physical-to-virtual pathway, and the hybrid pathway. Fourth, our study provides a comprehensive analysis of the multifaceted impacts of meta-entrepreneurship across various levels, encompassing individuals, corporations, industries, societies, and national countries, offering a deep understanding of its far-reaching implications and potential transformative effects. Last but not least, we identify and analyze nine critical challenges facing meta-entrepreneurship — encompassing interaction, computational power, compatibility and standardization, business value conversion, data security and privacy, legal and regulatory issues, content creation and intellectual property, social and cultural impacts, and environmental sustainability—while proposing potential future research directions for each domain.

Practically, our study offers valuable insights for entrepreneurs seeking to navigate and capitalize on opportunities within the metaverse. It highlights potential business opportunities, identifies anticipated challenges, and outlines possible pathways for success, thereby facilitating their understanding of how AI and the metaverse can enhance entrepreneurial activities. For individuals, the study highlights how meta-entrepreneurship democratizes opportunities, potentially enabling them to become metaverse entrepreneurs. The identified opportunities and pathways aim to raise public awareness of this emerging form of entrepreneurship. For policymakers, these novel phenomena provide valuable insights, encouraging them to proactively consider and prepare for regulatory and governance frameworks. These efforts aim to strike a balance between fostering innovation and ensuring societal well-being, creating an environment where technological advancements can thrive responsibly. At the national level, our research underscores the critical importance of meta-entrepreneurship in preserving national historical and cultural heritage, reshaping governance structures, safeguarding cultural assets, and

formulating economic strategies. By delineating both the opportunities and challenges associated with meta-entrepreneurship, this study serves as a valuable resource for stakeholders, contributing to the responsible and sustainable development of entrepreneurship in the metaverse ecosystems while emphasizing its potential to transform various aspects of national identity and operations.

COMPETING INTERESTS

The authors declare there are no conflicts of interest.

FUNDING

This research was conducted independently and with no external funding.

PROCESS DATES

Received: October 28, 2024, Revision: November 28, 2024, Accepted: November 28, 2024

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