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Metaverse-based Korean Digital Citizenship NFT: A Strategy for Strengthening National Competitiveness and Attracting Global Talent Through K-Culture and ICT Infrastructure

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Abstract

This study explores an innovative solution to address South Korea's declining population and rapid aging: the "Metaverse-based Korean Digital Citizenship NFT" model. Current population policies in South Korea fail to fully reflect the changing values and needs of the younger generation. This research proposes a model that leverages metaverse and NFT technologies to capitalize on Korea’s two key strengths—K-Culture and advanced ICT infrastructure—by issuing digital citizenship as NFTs that bridge metaverse spaces with reality. This model aims to attract global fanbases, enabling users to engage in diverse content consumption and production within the metaverse, while simultaneously offering tangible benefits during their visits to Korea. The feasibility of the proposed "Metaverse-based Korean Digital Citizenship NFT" model is assessed by examining successful projects such as Estonia’s e-Residency program, Decentraland, and The Sandbox. Through this, the study estimates how digital citizenship in the metaverse and NFT-based economic activities could enhance Korea's cultural influence and economic gains, contributing to national competitiveness. A mixed-method research

approach, including literature reviews and case studies, is adopted to analyze the model's feasibility, societal potential, and associated challenges. The findings suggest that the "Korean Digital Citizenship NFT Model" holds potential to attract domestic and international talent by activating global fandoms and a startup ecosystem centered on K-Culture. This model could contribute to the stabilization of national finances, the growth of digital asset transactions, and overall fiscal improvements, offering concrete economic benefits. Future research should address the legal and policy support structures, along with the technical challenges of the model, while assessing its long-term economic and social impact.

Keywords : Digital Citizenship NFT, Digital Citizenship, Citizenship, NFT, Metaverse

Metaverse-based Korean Digital Citizenship NFT: A Strategy for Strengthening National Competitiveness and Attracting Global Talent Through K-Culture and ICT Infrastructure

1. Introduction

1.1 Research Necessity and Problem Statement

South Korea faces significant social and economic challenges due to a declining population and rapid aging. Despite the government's efforts to increase birth rates through various population policies, the fertility rate has remained the lowest among OECD countries for 11 consecutive years, from 2013 to 2023, with a total fertility rate of just 0.72. Existing policies are primarily focused on questions such as, "How can we encourage young people to marry and have children?" As a result, the emphasis has been placed on improving inadequate child-rearing environments as a primary solution to population decline. However, this approach does not adequately reflect the shifting values and diverse needs of younger generations in modern society.[1] Despite the various birth promotion policies that have been implemented, the economic burden on younger generations and the rise of individualistic values have further driven birth rates. Traditional approaches fail to address the actual needs of the youth, thereby limiting the effectiveness of the policies. In a rapidly advancing society, focusing solely on increasing

[1] Social Survey on Changes in Young Adults' Views on Marriage, Childbirth, and Labor(Statistics Korea, 2023), In 2022, the percentage of young adults who viewed marriage positively dropped by 20.1% compared to 10 years ago (from 56.5% to 36.4%), with younger individuals showing a sharper decline. Reasons for not marrying include a lack of financial resources for marriage (33.7%), no perceived necessity for marriage (17.3%), and burdens of childbirth and childrearing (11%). Among single women, 23.7% expressed that they did not feel marriage was necessary, a notably higher rate than for men.

population numbers cannot ensure the fundamental goal of maintaining and enhancing national competitiveness. As technological innovation accelerates, there is a need for new economic and demographic responses.

Thus, the question must change. The issue is not simply about increasing the population. More crucially, the focus should be on how to attract and retain a "productive population" — that is, "competent and competitive talent" that can make a substantial contribution to the national economy. Additionally, how can the country expand to high-quality jobs in the domestic market?

For example, Estonia's e-Residency program successfully attracted global talent and startups, granting digital residency to 117,000 individuals from 185 countries as of the first half of 2024. More than one-third of Estonia's new companies are now connected to e-residents, and the direct economic impact on the country exceeded 31 million euros in the first half of 2024 alone(Estonia World, 2024). Unlike traditional population growth support policies, digital technology-based approaches open up possibilities that go beyond physical limitations, allowing countries to attract global talent aligned with the growing digital nomad trend[2] and supporting a variety of economic activities. For instance, blockchain-based NFTs can securely guarantee a person's digital identity and ownership while providing a foundation for offering various benefits through digital citizenship within the metaverse. This approach not only addresses the issue of low birth rates but also revitalizes the economy by attracting

[2] Digital Nomad is technically savvy, Skills-Oriented, and Well Educated, 15.5 million American workers currently describe themselves as digital nomads, increasing 42% from 2020 and 112% from the pre-pandemic year 2019(MBO Partners, 2021).

globally competitive talent.

In 2023, the metaverse market grew to approximately $82 billion and is projected to grow at a compound annual growth rate (CAGR) of over 43.9% by 2030(Grand view Research, 2023). The metaverse is a space where physical reality and the digital world converge, enabling new forms of social interaction and economic activity. By leveraging Korea's strengths in "K-Culture" and "advanced ICT infrastructure," a metaverse that links physical and digital spaces could be developed, including a "Metaverse-based Korean Digital Citizenship NFT" model. This model could attract skilled and tech-savvy digital nomads from around the world, inject vitality into the economy, and offer a new approach to addressing the issues of population decline and ensuring the sustainability of national systems.

1.2 Research Purpose and Scope

This study aims to explore the Korean Digital Citizenship NFT model and analyze its potential impact on South Korea's population and economic issues. The specific research objectives are as follows:

- To examine the concept of Digital Citizenship NFTs and the feasibility of implementing this model
- To evaluate the potential contribution of this model to addressing South Korea's population decline and fostering economic growth

The study is guided by the following research questions:

- What are the key features of the Korean Digital Citizenship NFT model, and how can it position South Korea as an attractive destination for digital nomads?

- How can Digital Citizenship NFTs play a complementary role in solving South Korea's population decline problem, and what are the economic and social implications of this model?

This research aims to provide valuable insights for policymakers, businesses, and relevant stakeholders by expanding the understanding of digital citizenship, NFTs, and the metaverse. It seeks to propose new policies and economic strategies that can be adopted in this emerging landscape.

1.3 Research Methodology and Data Collection

This study adopts a qualitative research methodology focused on literature reviews and case studies to explore the feasibility and potential impact of the Korean Digital Citizenship NFT model. A systematic analysis of various academic papers, government reports, technical documents, and previous studies related to the metaverse, NFTs, and digital citizenship will be conducted to assess the implementation potential of a digital citizenship model tailored to South Korea's unique circumstances. In particular, a comparative analysis of similar initiatives, such as Estonia's e-Residency program, will be undertaken to identify the distinct features of the Korean model and to extract applicable insights. This approach aims to analyze the potential economic and social impacts of the Korean Digital Citizenship NFT model comprehensively and systematically.

The data for this study will primarily be collected from existing literature and reports, while concrete empirical data will be gathered through comparative case analysis. Specific data collection methods include:

- Literature Review: A comprehensive review of academic papers, books, technical reports, and industry research materials related to digital citizenship,

the metaverse, and NFTs will be conducted. This will establish the theoretical foundation for the Digital Citizenship NFT model and explore ways to adapt it to the Korean context. The review will also focus on analyzing the development trends of metaverse and blockchain technologies to theoretically support the feasibility of digital citizenship.

- Government and International Reports: Reports from the Korean government and major international organizations will be analyzed to gather data on current digital policies, forecasts for the development of the metaverse and blockchain technology, and Korea's digital infrastructure. These reports will help evaluate the feasibility of the Korean Digital Citizenship NFT model and provide policy insights for its successful implementation.
- Comparative Case Analysis: In-depth analysis of similar digital citizenship programs implemented in other countries, such as Estonia's e-Residency program, will be conducted to explore the insights and applicability of those cases to the Korean model. This comparative analysis will provide crucial insights into the design and introduction strategies of the Korean Digital Citizenship NFT model. Additionally, successful metaverse-based NFT projects, such as Decentraland (which enables virtual real estate ownership and transactions) and The Sandbox (which allows users to create content based on virtual real estate and generate revenue), will be analyzed to offer important perspectives on global economic activities. These examples will serve as key references for assessing the technical feasibility and economic potential of the "Metaverse-based Korean Digital Citizenship NFT" model.

Through these diverse data collection methods, the study will evaluate whether

the Korean Digital Citizenship NFT model can serve as an innovative solution to South Korea's population and economic challenges and analyze its potential economic and social effects from various angles.

2. Key Concepts and Case Analysis

2.1 Metaverse: The Revolution of Everything

The term "metaverse" is a combination of "meta" and "universe," referring to a digital world that transcends mere virtual space, aiming to provide immersive experiences that overcome the limitations of time and space. Matthew Ball(2022), in his book The Metaverse: And How It Will Revolutionize Everything, defines the metaverse as a "real-time, interoperable virtual world with a sense of realism"[3] and describes it as the future development of the internet. Similarly, Katsuaki Sato, often referred to as the Mark Zuckerberg of Japan, emphasizes in his book World 2.0: How to Build the New Metaverse that the metaverse represents a key turning point in the evolution of the internet, one that will redefine future social and economic interactions.

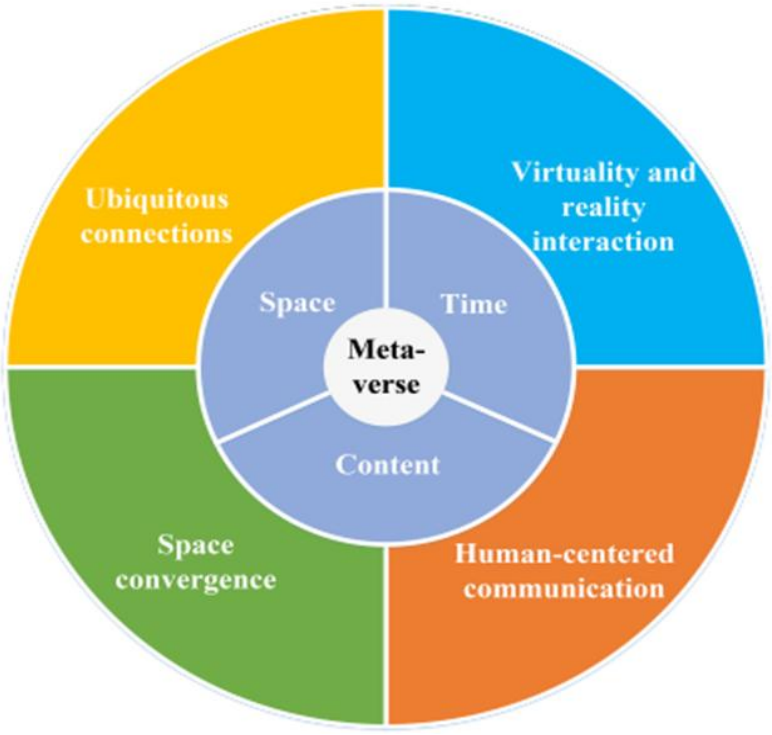
In essence, the metaverse is an ecosystem where the physical and digital worlds converge, enabling immersive experiences and economic activities. It has the potential to drive innovation across various domains, including business, social participation, and personal identity. Users in the metaverse can transcend physical and temporal constraints, realizing their full potential and achieving self-actualization—at the pinnacle of Maslow's hierarchy of needs. Therefore, the metaverse holds revolutionary potential,

[3] He defines the metaverse as a network composed of real-time rendered 3D virtual worlds, capable of massive scalability and interoperability. He describes it as a world where an effectively infinite number of users can simultaneously and continuously experience various aspects of identity, history, ownership, objects, communication, and transactions, all with a sense of continuity and individual presence.

not only as a technological advancement but also as a platform that satisfies fundamental human needs and enables self-fulfillment.

According to Feifei Shi and Huansheng Ning's paper, A New Technology Perspective of the Metaverse: Its Essence, Framework, and Challenges (November 2022), the development of the metaverse is based on four pillars in Metaverse. As shown in Figure 1 the core elements of the metaverse are time, space, and content. These elements define the user experience within the metaverse, allowing users to explore and interact with a digital world that transcends reality.

Figure 1. *Four Pillars in Metaverse*



Source: A new technology perspective of the Metaverse: its essence, framework and challenges, Feifei Shi, Huansheng Ning etc Nov. 2022

These core components are realized through four technological pillars[4]; ubiquitous connections, space convergence, virtuality and reality interaction, and human-centered communication. These technological elements form the essential foundation that allows the metaverse to overcome physical boundaries and temporal limitations, providing users with immersive experience.

The early iterations of the metaverse began with 2D-based online communities, but today, 3D rendering, 5G, virtual reality (VR), and augmented reality (AR) technologies have converged to offer far more immersive experiences. Platforms like VRChat, where users interact through 3D avatars and explore diverse virtual environments, are pioneering social VR platforms that exemplify the actualization of the metaverse concept.

While the initial hype around the metaverse has subsided, this does not signify regression. The number of virtual worlds and their users continues to increase yearly,[5]

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[4] Ubiquitous Connections: This technology ensures seamless activities within the metaverse by connecting objects, people, and entities. With advancements in network technologies like the Internet of Things (IoT), the metaverse bridges physical and virtual spaces, enabling a wide range of activities. Users can interact in real time, regardless of physical distance.
Space Convergence: This refers to the merging of physical, social, and cyber spaces to facilitate interaction between reality and virtual worlds within the metaverse. By strengthening the connection between physical and cyber spaces and integrating social spaces, users can engage in social interactions in the virtual world just as they would in reality.
Interaction: This pillar focuses on connecting virtual spaces with reality through various interfaces and devices, enabling users to immerse themselves in the metaverse. Technologies such as VR, AR, and mixed reality (MR) allow users to easily access virtual worlds and have immersive experiences, moving freely between virtual and real spaces.
Human-centered Communication: This pillar includes technologies that make user interaction within the metaverse more immersive and efficient. It encompasses advanced real-time communication, 3D simulation, and emotion recognition technologies, allowing smooth communication and collaboration between users, thereby enhancing social and economic activities within the metaverse.

[5] According to the Statista Metaverse Market Report(https://www.statista.com/study/132822/metaverse-market-report/), global metaverse revenue reached $44.1 billion in 2022 and is projected to grow to $484.8 billion by 2030. This growth is reflected in key markets such as the U.S., China, and Europe, with each showing

and the rapid development of large-scale language models, generative image and video platforms, and humanoids are all promising indicators of the sustained growth of the metaverse.

2.2 Digital Citizenship, NFT, and Their Integration with Metaverse

2.2.1 Digital Citizenship and Korea's Potential

Digital citizenship can be defined as "responsible online behavior based on the legal and ethical use of information and communication technologies(Öztürk, 2021)". It is a comprehensive concept that encompasses legal rights, social responsibilities, and roles in the digital space, providing individuals with guidelines and norms for acting responsibly and ethically within the digital society.

A person with digital citizenship has the right to access information online and protect their data, while also having the obligation to respect the rights of others and act responsibly. These rights and responsibilities are central elements of digital citizenship, contributing to enhanced participation and a sense of belonging in the digital society(Manzuoli, 2019).

The components of digital citizenship include nine key elements: digital access, digital commerce, digital communication, digital literacy, digital etiquette, digital law, digital rights and responsibilities, digital health and wellness, and digital security. These elements provide essential guidelines for users to act ethically in the digital space while protecting their own rights and those of others. The detailed descriptions of these

a compound annual growth rate (CAGR) exceeding 30%. In the U.S. alone, the metaverse market generated $14.13 billion in 2022 and is expected to exceed $158.09 billion by 2030.

elements are outlined in Table 1.

The components of digital citizenship include nine key elements: digital access, digital commerce, digital communication, digital literacy, digital etiquette, digital law, digital rights and responsibilities, digital health and wellness, and digital security. These elements provide essential guidelines for users to act ethically in the digital space while protecting their own rights and those of others. The detailed descriptions of these elements are outlined in Table 1.

South Korea ranks globally among the top in several of these elements, particularly in digital access, digital communication, digital literacy, and digital security,

Table 1. *The 9 Key Elements in Digital Citizenship*

Key Elements	Description
Digital Access	The right for all individuals to have equal access to digital technologies.
Digital Commerce	Acting responsibly during the process of electronically buying and selling goods and services.
Digital Communication	The way information is exchanged electronically through email, social media, text messages, etc.
Digital Literacy	Understanding digital technologies and using them effectively and appropriately.
Digital Etiquette	Following proper behavioral guidelines within the digital space
Digital Law	Legal responsibilities and rights related to behavior in the digital environment.
Digital Rights and Responsibilities	Enjoying freedom and rights in the digital space while also taking responsibility for those actions
Digital Health and Wellness	Maintaining physical and mental health when using digital technologies.
Digital Security	Taking preventative measures to protect personal information and data in the digital environment.

Source: Mike Ribble, Digital Citizenship in Schools, Second Edition, ISTE, 2011

positioning it well for further advancement in other areas of digital citizenship.

South Korea boasts one of the world's most advanced internet infrastructures, providing easy access to high-speed internet nationwide. This widespread accessibility allows most of the population to easily utilize digital technologies, facilitating active digital communication. The extensive use of mobile messaging apps, such as KakaoTalk, has become an essential aspect of digital communication in Korean society. Additionally, topics related to IT and digital literacy are well integrated into the national education curriculum, equipping many Koreans with the skills to effectively utilize digital technologies.

In terms of digital security, strong security protocols are implemented in critical online activities, such as financial transactions, ensuring a safe digital environment. South Korea maintains a high level of cybersecurity infrastructure and emphasizes data protection through relevant legislation. These strengths position South Korea as a leader in the global digital society.

2.2.2 FTs Suitable for Digital Citizenship

Digital citizenship can be more concretely implemented within the metaverse through the use of NFTs(Non-Fungible Tokens). NFTs are unique digital assets based on blockchain technology, characterized by their ability to clearly establish ownership and their inability to be replicated or replaced. NFTs can represent various forms of assets, including digital content, artworks, music, and virtual real estate. Each NFT is assigned a unique ID recorded on the blockchain, ensuring its ownership and authenticity. Due to these characteristics, NFTs are considered a new method for securely managing digital identity and ownership.

In particular, NFTs are highly suited for a digital citizenship model. A Digital Citizenship NFT issued within the metaverse not only protects an individual's digital identity and assets but also serves as a medium for providing various benefits within the metaverse. With NFTs, individuals can be granted unique digital citizenship, which is securely protected through a decentralized system based on blockchain technology. NFTs act as a powerful tool for formalizing the legal and social rights and responsibilities of digital citizenship on the blockchain. For instance, a Digital Citizenship NFT issued by a particular country can function as proof of the rights and benefits guaranteed on that country's digital platform, granting the holder special privileges within the platform. Additionally, NFTs can be transferred or inherited, ensuring that ownership of digital citizenship can be managed transparently and securely.

In the metaverse, digital citizenship and NFTs are key concepts for shaping a new economic and social order in the digital age. These concepts are tightly interconnected with the metaverse, establishing a new form of legal and social status that defines users' rights and responsibilities. Thus, by engaging in economic activities, social exchanges, and cultural experiences within the metaverse, users actively form and express their digital identities.

In other words, within the metaverse, users can securely own and trade digital assets such as virtual real estate, avatars, or digital items through blockchain technology using NFTs. This method allows individuals who hold a specific Digital Citizenship NFT to connect with others who share the same citizenship, enabling them to pursue common goals or participate in community activities. As a result, distributed talent and communities from around the world can be brought together, promoting social

integration. In this way, the metaverse, digital citizenship, and NFTs work complementarily, playing a crucial role in creating new economic opportunities and fostering social cohesion within the digital space.

Katsuaki Sato, in his book World 2.0, emphasizes that digital assets will be the key assets of the future economy, with technologies like NFTs supporting this transformation. This suggests that NFTs will act as major components of the digital economy, breaking down the boundaries between physical and digital assets, and creating new forms of economic value. An NFT-based digital citizenship model can play a critical role in strengthening a nation's digital sovereignty, attracting global talent, and revitalizing the digital economy.

South Korea has the unique advantage of developing most of its internet technology and service devices domestically, and it has led the way in real-time service games and social worlds. This is an exceptional case on the global stage(Ball, 2022, 19). Building on this experience, South Korea is well-positioned to take a leadership role in the emerging metaverse field. The Korean Digital Citizenship NFT model has the potential to leverage world-class digital technologies, attracting a global fanbase centered around K-Culture and top talent in ICT-based startups, ultimately expanding Korea's cultural and economic influence.

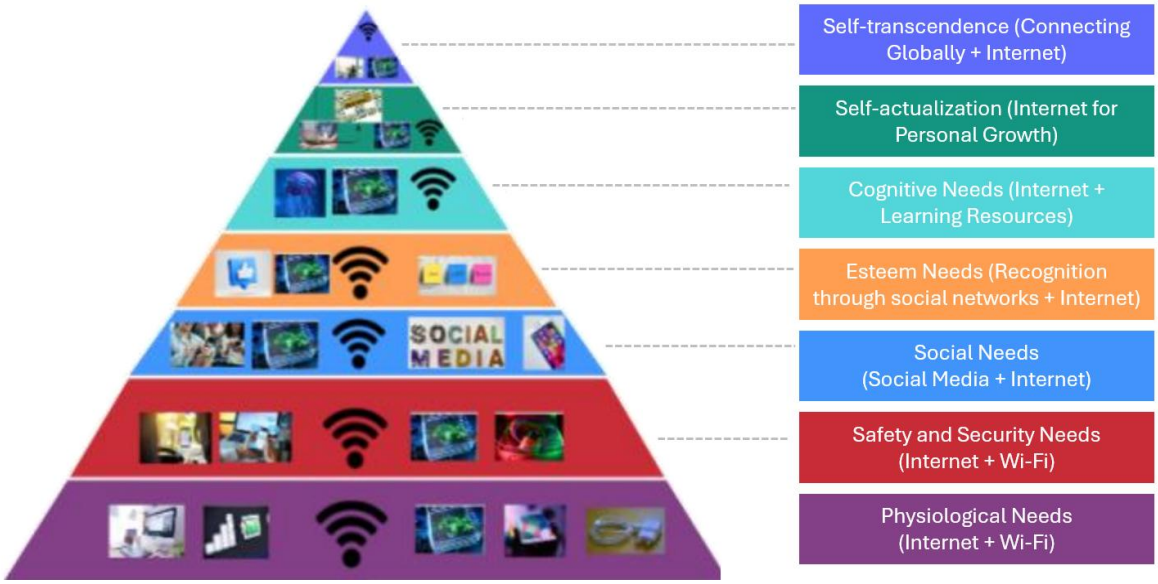
2.2.3 Shared Value of Digital Nomads and the Metaverse

A Digital Nomad refers to individuals who utilize the internet and digital technologies to work from anywhere in the world, unrestricted by a specific physical location. Digital nomads often prefer remote work settings, favoring environments such as cafes, co-working spaces, or travel destinations over traditional office spaces. The rise

of high-speed internet, cloud computing, and collaboration tools, coupled with the normalization of remote work following the COVID-19 pandemic, has made the digital nomad lifestyle more accessible to a wider audience.

Digital nomads, by frequently crossing national borders while conducting economic activities, place great importance on legal protection, the security of asset ownership, and the freedom to engage in economic activities. The needs of digital nomads, alongside the potential of the metaverse, highlight the necessity of reinterpreting and expanding Maslow's hierarchy of needs. It has been argued that Maslow's five-tier structure (physiological needs, safety needs, love and belonging, esteem, and self-actualization) should be revised into a seven-tier model (physiological needs, safety needs, love and belonging, esteem, cognitive needs, self-actualization, and transcendence) to better align with the internet age(Datrika & David, 2022).

Figure 2. *Refined Model of Maslow's Needs Theory in Internet Era*



Source: Venkata Madhusdan Rao Datrika, Arokiaraj David, Refined Model of Maslow's Needs Theory in Internet Era, Organization and Human Capital Development, April, 2022

Figure 2 presents a modified version of Maslow's hierarchy of needs for the digital era, reflecting new demands. Notably, the inclusion of the internet and Wi-Fi as part of the basic physiological needs directly correlates with the lifestyle of digital nomads. The specific needs of digital nomads align with various levels of this revised theory. They seek self-actualization through a flexible and autonomous work environment, while also valuing safety needs such as legal security and stable living conditions. Additionally, their desire for belonging and esteem is met through interactions within online communities, and they pursue cognitive needs through continuous learning and personal growth.

The "Metaverse-based Korean Digital Citizenship NFT" has the potential to meet the diverse needs of digital nomads by offering opportunities for self-actualization and global collaboration(shi et al., 2022). The legal protections and economic freedoms provided through NFTs fulfill the need for safety, while participation in metaverse communities satisfies social and esteem needs. Additionally, creative activities and global collaboration within the metaverse can offer opportunities for self-actualization and even self-transcendence.

In this context, the Metaverse-based Digital Citizenship NFT can evolve into an innovative platform that goes beyond mere technological advancement, integrating the various needs of digital nomads. This platform could redefine the traditional concepts of nationhood and citizenship, contributing to the formation of a new social and economic structure that aligns with the global digital economy era.

The "Metaverse-based Korean Digital Citizenship NFT" can offer digital nomads an improved work and living environment, as well as opportunities for self-actualization.

South Korea, with its world-class internet infrastructure and safe environment, is well-positioned to provide an optimal work environment and a higher quality of life. Furthermore, Korea's strength lies in its ability to develop the cultural appeal of K-Culture into metaverse content. If the "Metaverse-based Korean Digital Citizenship NFT" is systematized to offer various benefits to digital nomads, South Korea could position itself as an attractive and ideal destination for them. Specifically, by providing benefits such as discounts on accommodation, transportation, and business facilities, the country could facilitate the physical influx of global talent, thereby enhancing economic vitality.

2.3 Success Case of Digital Citizenship, NFT, and Metaverse Integration

2.3.1 Estonia's e-Residency and the Korean Digital Citizenship NFT

The Estonian e-Residency program is the world's first digital citizenship initiative, allowing anyone to access Estonia's digital infrastructure and public services, regardless of geographical borders. Launched in 2014, the program enables people from around the globe to establish and operate companies online within Estonia, while also offering services such as electronic signatures, e-commerce, and e-tax filings. By the first half of 2024, the program had granted e-residency to 117,000 individuals from 185 countries, successfully attracting global talent and startups. Currently, over one-third of Estonian startups are connected to e-residents, with the program generating over €31 million in direct economic impact in the first half of 2024 alone(Estonia World, 2024).

Estonia's e-Residency program has thrived due to the integration of various technological, legal, and policy elements. Key features of the program include the borderless nature of digital identities, the ease of business operations, and strong legal protections. Participants of the e-Residency program acquire a digital identity, allowing

them to establish and run businesses under Estonian legal protection, utilizing the country's digital infrastructure. They can manage their business transactions and sign contracts electronically from anywhere in the world. The incorporation of blockchain technology, particularly for electronic signatures and data protection since 2012, has further enhanced the program's reliability.

Estonia’s example highlights the potential for South Korea to enhance its global competitiveness through digital citizenship, offering valuable insights into how the Korean Digital Citizenship NFT model could evolve. While inspired by Estonia’s e-Residency program, the Korean Digital Citizenship NFT model would incorporate distinct elements.

Firstly, South Korea’s Digital Citizenship NFTs would be connected to the metaverse, providing cross-border economic activities and cultural experiences. For instance, NFT holders based on K-Culture could attend virtual concerts or exhibitions within the metaverse, fostering interaction with a global fanbase.

Secondly, the Korean model would not be limited to business operations but would also offer automated benefits through smart contracts. NFT holders visiting South Korea could receive automatic discounts on accommodations, transportation, and shopping. These benefits would be securely managed on the blockchain, ensuring transparency and trust.

Lastly, South Korea’s advanced ICT infrastructure and globally renowned K-Culture position the country as having immense potential to attract international talent and startups. By maximizing these national strengths, the "Metaverse-based Korean Digital Citizenship NFT" could combine cultural content with technological infrastructure,

offering even broader economic opportunities. Specifically, the metaverse and NFTs linked to industries with active global fandoms—such as K-pop, dramas, and films—could significantly amplify economic impact.

2.3.2 Decentraland: Creating Economic Opportunities Through Virtual Real Estate

Decentraland is a virtual reality metaverse platform built on the Ethereum blockchain, offering users a unique environment where they can purchase virtual real estate and use it to create commercial or creative content. A key feature of Decentraland is its use of NFT technology to clearly define asset ownership, creating economic opportunities by enabling the trading of virtual assets.

In 2021, Decentraland's virtual real estate transactions amounted to $500 million, with one piece of virtual land fetching $2.43 million (approximately 2.9 billion Korean won), drawing significant attention. This case highlights the fact that assets within virtual spaces can carry economic value comparable to those in the real world. Decentraland's DAO (Decentralized Autonomous Organization) governance model allows users to autonomously determine the direction of the project, enhancing the platform's transparency and user engagement.

Decentraland's success stems from the revenue structures generated by virtual assets and the blockchain technology that guarantees transparent ownership. These features align with the potential of the "Metaverse-based Korean Digital Citizenship NFT, which also aims to facilitate digital asset transactions and economic opportunities.

The "Korean Digital Citizenship NFT" is likely to operate under a centralized governance model, led by the government or a designated government-affiliated agency. Therefore, during the design phase, particular attention must be paid to strengthening

transparency, user participation, and trust. Even with a central authority at the helm, it is essential that the issuance and trading of all digital citizenship NFTs are managed transparently through a blockchain-based management system. To maximize user participation, an active feedback system should be implemented to regularly incorporate user input and ensure transparent management of digital citizenship-related policies. By maintaining autonomy while simultaneously enhancing the legal infrastructure, users will be provided with the legal protection necessary to safely own and trade citizenship NFTs. This approach will establish a solid foundation for ensuring transparency and trust in the digital economy, while also solidifying state-led digital sovereignty.

2.3.3 The Sandbox: A User-Generated Content-Based Metaverse Ecosystem

The Sandbox, along with Decentraland, is one of the most successful examples of integrating the metaverse with NFTs. The Sandbox is a blockchain-based platform that provides a user-generated content (UGC) metaverse ecosystem where users can purchase virtual real estate (LAND) and create their own games and content to generate economic profit.

The Sandbox facilitates virtual asset transactions and promotes economic circulation within the platform through its native cryptocurrency, SAND. Users own virtual real estate in the form of NFTs and can host events or sell various content on their land to generate revenue. Notably, The Sandbox supports the interoperability of virtual assets, allowing users to utilize their purchased NFT assets across other metaverse platforms. This feature gives content creators greater flexibility in conducting economic activities.

The key to The Sandbox's success lies in its ability to enable users to engage in economic activities that closely resemble those in the real world, by creating games and

commercial content based on virtual real estate. This characteristic serves as a valuable reference for enhancing the economic potential of the Korean Digital Citizenship NFT model through the creation of K-Culture-based virtual content and the engagement of global fandoms.

2.3.4 Implications of Case Analysis

The cases of Estonia's e-Residency program, Decentraland, and The Sandbox provide significant insights into the integration of digital citizenship, NFTs, and the metaverse. These three examples offer various perspectives on the technical and economic implementation of a "Metaverse-based Korean Digital Citizenship NFT," while highlighting critical directions for model development.

First, Estonia's e-Residency program is a prime example of a system that enables digital identity and cross-border economic activity. This program allows entrepreneurs worldwide to operate businesses under Estonia's legal protection while efficiently utilizing its digital infrastructure. Similarly, the Korean Digital Citizenship NFT could leverage the metaverse to support global economic activities that transcend physical borders. The metaverse environment, when combined with K-Culture, holds even greater cultural appeal than Estonia's model, with significant potential to attract a global fandom.

Second, Decentraland is a successful case of establishing an economic ecosystem centered on virtual real estate, offering economic opportunities through virtual assets. Users can own virtual real estate, generate profits, and participate in decentralized governance (DAO), making autonomous decisions. Although the Korean Digital Citizenship NFT model is likely to be based on centralized governance, if it adopts a blockchain system similar to Decentraland, it could ensure transparency and user

participation, enabling digital citizenship holders to fully capitalize on economic opportunities.

Third, The Sandbox fosters an economic ecosystem centered around user-generated content (UGC), where virtual real estate and content ownership are secured through NFTs, and interoperability is supported. This structure indicates that when the Korean Digital Citizenship NFT model integrates K-Culture-based content creation, global users could participate in content production, offering broader economic opportunities. The interoperability demonstrated by The Sandbox shows the potential for the Korean model to expand economic possibilities by linking with various metaverse platforms.

In conclusion, these three cases illustrate how a digital citizenship NFT model can be implemented from technological, legal, and economic perspectives. By actively leveraging K-Culture's global fandom and Korea's advanced ICT infrastructure, the "Metaverse-based Korean Digital Citizenship NFT" has the potential to develop into an innovative model that maximizes economic opportunities and attracts global talent. Korea could then secure a leading position in the digital economy and achieve sustainable economic growth.

3. The Korean Digital Citizenship NFT Model

3.1 Overview of the Korean Digital Citizenship NFT

The "Metaverse-based Korean Digital Citizenship NFT" model presents a new concept of citizenship tailored for the digital age by combining Korea's K-Culture and advanced ICT infrastructure. Inspired by Estonia's e-Residency program, this model is proposed as a more innovative and expansive version, leveraging Korea's cultural and technological strengths. It focuses on issuing digital citizenship targeting the global

fandom of K-Culture, while offering technical exchanges and market entry benefits for global startups. Through this, Korea can promote economic growth and enhance its national competitiveness in the digital era.

This model is built on blockchain, smart contracts, digital IDs, and decentralized storage technologies, using the unique properties of NFTs to enhance security and traceability. NFT technology plays a central role in this digital citizenship model, ensuring the secure management of digital identity and ownership. Digital citizenship issued via NFTs can provide users with various benefits within the metaverse, while also offering practical advantages—such as discounts on accommodation, transportation, and shopping—through automated smart contracts when users visit Korea. By developing and expanding this infrastructure, Korea can strengthen its potential to become a global leader in the digital economy and improve its foundational infrastructure in the process.

3.1.1 K-Culture-Based Digital Citizenship

K-Culture-based digital citizenship can play a crucial role in ensuring the continuous global spread of Hallyu (Korean Wave) content,. While K-pop, movies, dramas, and webtoons enjoy worldwide popularity, maintaining this momentum as a long-term growth engine requires a stable cultural ecosystem. In this context, digital citizenship NFTs offer a significant means of combining K-Culture with technological elements, providing new benefits to Hallyu fans.

Table 2. outlines the technical approach to implementing K-Culture-based digital citizenship NFTs. The issuance of blockchain-based NFTs can grant fans unique digital citizenship, while smart contracts can automate the provision of benefits. For instance, NFT holders visiting Korea could automatically receive benefits such as discounts on

accommodation, transportation, and shopping, with these privileges managed transparently on the blockchain. Additionally, by integrating digital IDs, the information of NFT holders can be securely managed, creating a system that allows for the systematic management and support of the global fanbase.

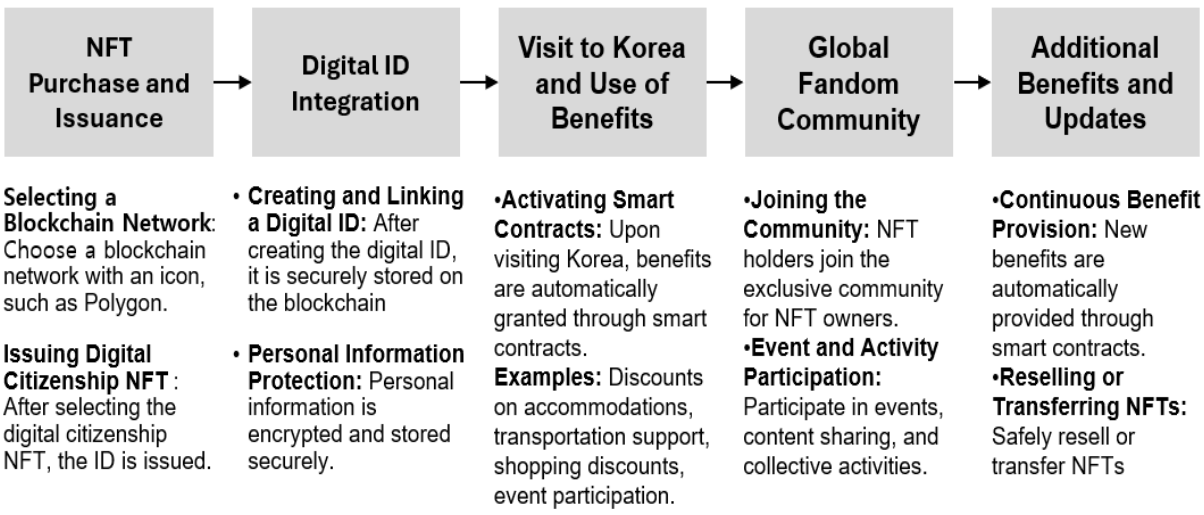
Table 2. *Technical Approach for K-Culture-based digital Citizenship NFTs*

Applied Technology	Details
Blockchain-based NFT Issuance	• Digital citizenship for K-Culture fans can be issued on blockchain networks like Ethereum or Polygon. • Blockchain-based NFTs can securely manage unique ID issuance, ownership, and transaction records, ensuring users' digital identities.
Automated Benefits through Smart Contracts	• Smart contracts are codes that automatically execute under certain conditions. NFT holders visiting Korea can automatically receive benefits such as discounts on accommodation, transportation, and free event participation through smart contracts.
Digital ID Integration	• Digital IDs, used to provide rights and benefits in specific digital spaces, can be securely stored and managed on blockchain. This ensures that users' personal information is protected, and their identities and rights are secured. • Since Digital ID infrastructure is resource-intensive, it is suggested to connect this with blockchain-based digital IDs that the Korean government is already promoting.
Global Fandom Community Building	• Communities for NFT holders are built through blockchain platforms. • These communities support K-Culture-related events, content sharing, and collective activities. Strengthening the connection of global fandoms beyond different K-Culture sectors will further spread Korean culture worldwide.

Based on this framework, we can anticipate what kind of experience a customer might have, as illustrated in Figure 3, the customer journey of the K-Culture-based Korean Digital Citizenship NFT. First, the customer would purchase and receive an NFT via the blockchain network. This NFT would then be linked with a digital ID, allowing the customer to enjoy various benefits. Upon visiting Korea, the promised benefits would be automatically applied through smart contracts, such as discounts on accommodations, transportation, and more. Additionally, by participating in the global fandom community, the customer can engage in content sharing and join events. The continuous provision and update of these benefits would significantly enhance the overall customer experience.

Furthermore, Figure 4 illustrates how the Korean Digital Citizenship NFT network, built on advanced ICT infrastructure, can operate as an economic ecosystem based on this technological approach. The diagram demonstrates the flow of resources, interactions, and transactions, showcasing the potential of an interconnected digital economy that leverages blockchain, smart contracts, and NFTs to create value within the ecosystem.

Figure 3. *Customer journey of the K-Culture-based Korean Digital Citizenship NFT*

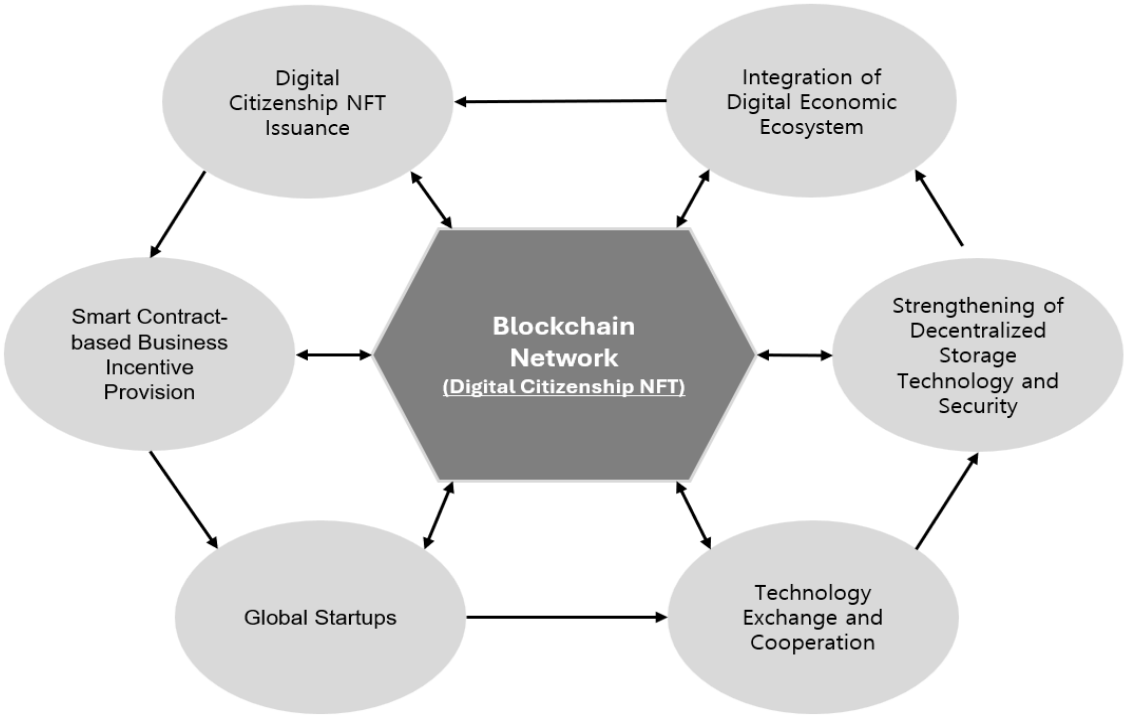


The issuance of digital citizenship centered on a K-Culture-based blockchain network, smart contract-driven business incentives, and technological exchanges with global startups serve as crucial elements in strengthening Korea's digital economy. At the same time, these initiatives can further expand the global fanbase and establish an innovative tool to enhance Korea's cultural and economic influence on a global scale.

3.1.2 Advanced ICT Infrastructure-Based Digital Citizenship

Another critical element is the use of Korea's advanced ICT infrastructure in digital citizenship. For global startups, access to cutting-edge ICT infrastructure and skilled talent is essential. This model, as illustrated in Figure 4, "Korean Digital Citizenship NFT Utilizing Advanced ICT Infrastructure," issues digital citizenship NFTs to foreign startups aiming to enter the global market, offering them opportunities for entry into the Korean market and technology exchange. Through this approach, Korea can evolve into a global

Figure 4. *Korean Digital Citizenship NFT network, on advanced ICT infrastructure*



technology hub, accelerating economic growth and creating new jobs. The technical approach of this model is examined in Table 3, which outlines the implementation of ICT-based digital citizenship NFTs.

3.1.3 Technical Challenges and Solutions

The Korean Digital Citizenship NFT model can be successfully implemented through legal and policy support, along with the resolution of technical challenges. Several technical hurdles must be addressed to ensure the successful realization of the digital citizenship NFT model.

Table 3 *Technical Approach to implement ICT -based Digital Citizenship NFTs*

Applied Technology	Details
Digital Citizenship NFT Issuance	• The Korean government or designated institutions issue NFTs on blockchain networks, using smart contracts to manage business activities and rights. *Estonia's e-Residency program could be a benchmark for this case
Business Incentives through Smart Contracts	• During a startup's business activities in Korea, certain achievements (e.g., creating a certain number of jobs, transferring technology, launching innovative products) will trigger automatic incentives (e.g., tax reductions, investment attraction, technological support) through smart contracts. *Estonia manages such incentives through its legal and tax systems
Integration into the Digital Economic Ecosystem	• Startups that acquire NFTs will gain access to necessary resources to effectively integrate into Korea's digital ecosystem. *A blockchain-based digital hub should be established with the cooperation of government, financial institutions, major companies, and academic entities to support technology exchange and collaboration
Enhanced Distributed Storage and Security	• All related data will be securely stored using distributed storage technology and strong encryption to minimize risks of hacking or data breaches.

First, the scalability of the blockchain must be improved. Currently, blockchain technology faces limitations in transaction speed and processing capacity, which hinder its ability to provide stable services for many users. To resolve this, technologies such as Layer 2 solutions or sharding[6] should be introduced to enhance blockchain scalability.

Second, data security must be reinforced. Since digital citizenship NFTs may contain sensitive user information, it is crucial to prevent data leaks and hacking. Distributed storage technologies and encryption should be employed to securely manage data, and the security of smart contracts must be strengthened. This requires rigorous verification and security testing to avoid code errors or malicious attacks on smart contracts.

Third, the complexity of smart contracts must be addressed. While smart contracts play a critical role in automating the benefits of digital citizenship NFTs, setting complex conditions could lead to unforeseen errors. To mitigate this risk, a simplified smart contract structure should be adopted, and legal validation procedures should be established. Furthermore, cooperation with regulatory bodies is essential to ensure that smart contracts are legally recognized, avoiding conflicts between domestic regulations and international legal frameworks.

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[6] Layer 2 Solutions and Sharding: These are key technologies designed to resolve the scalability issues of blockchain networks. As the number of users and transaction volumes increase, blockchain networks tend to slow down and become more costly to operate

Layer 2 Solutions: These scalability technologies operate on top of the primary blockchain network (Layer 1). They handle transactions off the main network, reducing the load on it and offering faster transaction processing at a lower cost. Notable examples include Plasma, Rollups, and State Channels.

Sharding: Sharding applies database partitioning techniques to blockchain. By dividing the blockchain into smaller parts (shards), multiple nodes can process transactions simultaneously, significantly improving network processing speed. Since each shard processes only a portion of the blockchain's data, not every node needs to process the entire blockchain, increasing overall network efficiency.

These technical challenges are not insurmountable, and overcoming them could significantly enhance national competitiveness as the solutions are developed and implemented.

3.2 Economic and Social Implications

The two models proposed earlier extend beyond mere technological implementation and are expected to yield the following social and economic benefits.

First, Advancement of the Digital Industry and Economic Growth: The Korean Digital Citizenship NFT model is not just a technological innovation but could serve as a key catalyst in promoting Korea's overall digital industry. The activation of new digital goods and services, such as NFT-based virtual real estate and digital asset trading, will drive innovation across a range of industries, including blockchain technology, cybersecurity, and digital content creation. This will help position Korea as a leader in the global digital economy while also positively impacting emerging digital industries. For example, if NFT-based virtual real estate trading becomes widespread within the metaverse, it could attract foreign investors and create new investment opportunities, accelerating economic growth. The global NFT market was estimated at $25 billion in 2022, and if Korea captures 5% of this market, it could generate approximately $1.25 billion (about 1.6 trillion KRW) in economic revenue(Despite Market Crash, 2023).

Second, Strengthening Digital Sovereignty: The Digital Citizenship NFT can serve as a key tool for enhancing Korea's digital sovereignty by ensuring the management and protection of digital assets. While promoting global cultural exchange, Korea can guarantee the security and transparency of digital assets, thereby securing its independence in the digital age. This will not only strengthen national competitiveness

but also bolster Korea's independence and autonomy.

Third, Job Creation and Support for Emerging Industries: In addition to driving economic growth, the Digital Citizenship NFT could act as an important catalyst for creating new jobs. In particular, industries such as blockchain, cybersecurity, and digital content creation are expected to generate new employment opportunities. As the startup ecosystem supporting NFT transactions and digital content production grows, both domestic and international startups will find new business opportunities in Korea, leading to job creation. Automated business incentives through smart contracts will further facilitate the economic activities of these startups within Korea.

Fourth, Attraction of Global Talent and the Creation of an Innovation Ecosystem: The Digital Citizenship NFT could play a vital role in attracting global talent and startups. The influx of highly skilled professionals is essential for fostering an innovation ecosystem, positioning Korea as a global technology hub. Through digital economic growth and technological innovation, this model can significantly contribute to national economic growth and enhance global competitiveness.

Fifth, Social Integration and Addressing Population Decline: By fostering global cultural exchange and building new digital communities, the Digital Citizenship NFT can help strengthen social integration. The influx of young and skilled foreign talent could provide a policy solution to South Korea's declining birthrate and population issues, which threaten the country's sustainability. Additionally, it could absorb Korea's experienced, highly educated retirees into the labor force, boosting the productive population.

Sixth, Fiscal Stabilization and Increased Tax Revenue: The Digital Citizenship NFT

can contribute to fiscal stabilization by facilitating digital asset transactions. The activation of these transactions will increase tax revenue and help stabilize public pension funds. As NFT-based digital asset trading becomes more active, transaction fees and taxes will enhance national finances, which, in turn, will contribute to the stability of the social security system. This will play a significant role in maximizing economic benefits, along with improving the national brand image.

3.3 Discussion on Legal and Policy Support

For the successful implementation of the "Metaverse-based Korean Digital Citizenship NFT" model, legal and policy support is essential. In particular, establishing a legal infrastructure related to the issuance of NFTs is a critical component. Relevant institutions must create clear legal regulations and supportive policies concerning blockchain and NFT technologies to ensure that the issuance and management of digital citizenship are carried out legally. This includes the development of specific laws addressing intellectual property rights, personal data protection, and data ownership in the process of NFT issuance. Furthermore, a legal framework that defines the rights and responsibilities of NFT holders should also be established.

Additionally, harmonization with global regulations is a significant challenge. If the Korean Digital Citizenship NFT targets global users, international cooperation will be necessary to prevent conflicts with the legal systems of other countries. To this end, the Korean government should collaborate with international organizations to align global digital citizenship and NFT-related regulatory frameworks. With such legal and policy support in place, the Korean Digital Citizenship NFT model will be able to operate more stably.

3.4 Emerging Trends and Future Outlook

The increasing adoption of digital assets and the ongoing efforts to integrate blockchain technology into various fields, such as education, healthcare, and governance, further enhance the development potential of the Digital Citizenship NFT.

In the education sector, there are opportunities to provide global students with access to Korea's educational content and resources. In the healthcare sector, ongoing attempts to link blockchain with telemedicine aim to establish new types of healthcare management systems. These emerging trends will bolster the feasibility and sustainability of the "Metaverse-based Korean Digital Citizenship NFT" model, as proposed in this study.

4. Conclusion

This study suggests that the "Metaverse-based Korean Digital Citizenship NFT" model has the potential to serve as an innovative solution to South Korea's population decline and economic challenges. The rapid aging of the population and declining birth rates in South Korea could lead to a weakening of national competitiveness, highlighting the need for new approaches beyond traditional policies. Based on Korea's two primary strengths—K-Culture and advanced ICT infrastructure—this research proposes a new paradigm to attract global talent and stimulate economic growth. The main findings of the study are summarized as follows:

First, the "Metaverse-based Korean Digital Citizenship NFT" model, utilizing the influence of K-Culture and Korea's technological infrastructure, shows significant potential for attracting global fandoms and startups, creating economic opportunities, and enhancing the national brand.

Second, this model, implemented through blockchain technology and smart contracts, enables the safe ownership and transaction of digital assets, thus promoting new forms of economic activity and providing an opportunity to strengthen the related infrastructure.

Third, by analyzing successful case studies such as Estonia's e-Residency, Decentraland, and The Sandbox, the feasibility, potential advantages, and key considerations for the implementation of the Korean model have been identified.

Fourth, beyond technological innovation, this model encompasses various socio-economic effects, such as strengthening digital sovereignty, creating jobs, attracting global talent, and stabilizing national finances

Finally, the model offers a creative solution to secondary issues posed by population decline and aging, including attracting new types of global talent, such as digital nomads, and tapping into the potential of the highly educated retired population

However, several challenges and limitations remain in the successful implementation of this model:

First, technical challenges such as blockchain scalability, data security, and the complexity of smart contracts need to be addressed. This study, reliant on theoretical approaches, did not delve deeply into the technical difficulties that may arise during actual implementation.

Second, the lack of a legal framework limits the examination of how NFT issuance and digital citizenship can harmonize with the legal system.

Third, as the study focuses on Korea's population issues and economic growth, it

does not discuss how this model could be applied in other countries with different cultural and social backgrounds. Further research is needed to explore how the model can be adjusted and adapted to varying national infrastructures and cultural contexts.

Lastly, while the study explores the potential of the "Metaverse-based Korean Digital Citizenship NFT" model through theoretical analysis and case studies, there is a lack of empirical data on its actual implementation and long-term effects. Future research should focus on conducting pilot projects, collecting data, gauging user acceptance, and exploring potential applications in various industrial sectors

In conclusion, the "Metaverse-based Korean Digital Citizenship NFT" model has strong potential to serve as an innovative solution to South Korea's population decline and economic challenges. By leveraging Korea’s cultural influence and technological strengths, the model could help the nation secure a leading position in the global digital economy and contribute to sustainable economic growth. Continued research and policy efforts will be essential to enhance the feasibility of the model and strengthen the infrastructure required to lead this new paradigm in the digital age.

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