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ORIGINAL

The Metaverse as an Innovative Digital Tool for Optimizing the Free Trade Zone - Surcolombiana

El metaverso como herramienta digital e innovadora de optimización de la zona franca –Surcolombiana

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ABSTRACT

This paper aims to explore the metaverse through the lens of free trade zones, identifying potential benefits in the areas of digital technology and innovation. The goal is to foster greater interaction with customers to maximize sales. This metaverse allows customers to meet, interact, socialize, and conduct business in an environment supported by a 3D universe. This proposal aims to channel and optimize current digital trends to drive the management, organization, and expansion of the scope of operations for the free trade zone in the city of Neiva, as it serves as the gateway to southern Colombia and a key hub for the department of Huila. Notably, free trade zones (FTZs) or special economic zones (SEZs) are among the rage among governments that hope to increase trade and investment. These zones have become key areas where exporters, importers, and other investors receive significant benefits in terms of taxes, tariffs, and regulatory matters; however, this boom is creating distortions within economies, as well as significant fiscal costs, not to mention the negative impact of the COVID-19 health emergency. During the analysis of the 12 companies operating in the southern Colombian free trade zone, the main variables enabling the implementation of the CoSpaces tool will be identified. This tool was chosen because of its features; among the most significant are that it can be used on computers as well as mobile devices, and notably, it offers a free version. This research employs a mixed-methods approach with a descriptive and exploratory focus. This hypothesis is based on the successful functionality of digital tools in free trade zones.

Keywords: Innovation; Digital Tool; Metaverse; Optimization; Free Zone.

RESUMEN

Este artículos esta tiene como objetivo analizar el metaverso desde el funcionamiento de las zonas francas identificando las posibilidades de beneficio en los ámbitos de lo digital y la innovación, se pretende generar mayor interacción con los clientes con miras a maximizar las ventas. Este metaverso les permitirá a los clientes reunirse, interactuar y socializar y concretar negocios en un ambiente apoyado en un universo 3D. La presente propuesta tiene como objetivo canalizar y optimizar las actuales tendencias digitales, con el fin de impulsar la gestión, organización y ampliación del espectro de acción por parte de la zona franca de la ciudad de Neiva ya que esta misma es la puerta de entrada del sur de Colombia y un referente para el departamento del Huila. Cabe mencionar que las zonas Francas ZFs o Zonas Económicas Especiales (SEZ, por sus siglas en inglés) son furor entre los gobiernos que esperan aumentar sus números de comercio e inversión, estas mismas se han convertido en claves en donde los exportadores e importaciones entre otros inversionistas reciben grandes beneficios en impuestos, aranceles y temas regulatorios, sin embargo, este auge está creando distorsiones dentro de las economías, así como significativos costos fiscales sin mencionar del impacto negativo que dejo la emergencia sanitaria por parte del covid 19. Durante el ejercicio de caracterización de las 12 empresas que hacen presencia en la zona franca surcolombiana se identificaran las principales variables que permita la implementación de la herramienta CoSpaces, se elige esta dadas las características, entre las más significativas están que se puede utilizar en computadores, también en dispositivos móviles y algo que se destaca es que tiene una versión gratuita, Esta investigación es mixta con un enfoque descriptivo, exploratorio. La hipótesis construida parte del éxito

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de la funcionabilidad de las herramientas digitales a las ZF.

Palabras clave: Innovación; Herramienta Digital Metaverso; Optimización; Zona Franca.

INTRODUCTION

Free Zones are specific geographic areas within a country where industrial activities involving goods and services or commercial activities are carried out under specific regulations regarding taxes, customs, and international trade. Industrial activities involving goods and services or commercial activities are conducted under special regulations concerning taxation, customs, and foreign trade.

As Alansary et al.[1] argue, Free Zones are designed as enclaves with differentiated customs and tax regimes that favor export-oriented industrial processing and enhance the competitiveness of manufacturers in international markets. The issue of free trade zones at the national level is more widely addressed, given that Colombia has approximately 120 free trade zones distributed throughout the country. According to a study, these zones are grounded in the context of national market integration; trade agreements and strategic alliances contribute to economic development in the country's various regions; therefore, global technological, economic, social, and cultural advancements directly and indirectly influence the free trade zones embedded within regional development hubs, which serve as the economic engine of the region and contribute to job creation.

The metaverse is a new technological trend that has emerged in recent years. It involves the ability to access a virtual world through various digital tools to carry out daily activities. Anacona et al.[2] argued that virtual reality was primarily designed for workplaces and education; however, metaverses were also created for people's entertainment (video games, exploring entirely fictional worlds), among other examples of interaction between people and the digital universe.

A study report that advertising audiences have increased significantly, and for this reason, advertising investment has also increased, especially in digital channels, since 79 % of the world's population uses the internet daily, which amounts to approximately 1,971 billion euros invested in promotional campaigns. Therefore, advertising has evolved and migrated to other media, particularly digital platforms such as social media, the internet, mobile devices, podcasts, and images.

This project aims to explore the use of new methodologies for the metaverse. On the basis of an exhaustive literature review, we concluded that these could be applied to the Surcolombiana Free Trade Zone; to date, no research has been conducted in Colombia to establish the benefits of the metaverse for free trade zones.

The state must guarantee tax, tariff, and promotional policy benefits in free trade zones, which represent a model of regional development with a more competitive outlook in the subregional and global context. In the economic reality of the globalized world, the variables that influence economic processes are decisive in reducing the gaps between regions, which influence dynamic and sustained development hubs for the implementation of strategies that offer a competitive advantage and the promotion of new free trade zones within the framework of the nation's development and growth, driven by exports to international markets.

According to the Organization for Economic Cooperation and Development,[3] policies for productive transformation and the integration of countries such as Colombia into international markets can catalyze competitive advantages linked to export diversification, innovation, and integration into global value chains, which constitute key factors for national socioeconomic development.

The purpose of this literature review is to explore the use of new methodologies for the metaverse. The metaverse aims to virtually bring reality closer through an easily accessible internet platform that allows for direct interaction with a specific place in time and space within a 3D universe. The resources for this design could be managed by various government entities in the department of Huila and integrated into the academic programs of the department's universities.

Hennig-Thurau et al.[4] note that the metaverse constitutes a new computer-mediated environment in which users represented by avatars can act and communicate in real time within virtual worlds, facilitating social interactions and encounters that go beyond traditional two-dimensional environments. Consequently, the plan is to create an alternative to the Surcolombiana Free Trade Zone to achieve greater engagement with its clients and thereby foster real-time proximity with various stakeholders.

The Surcolombiana Free Trade Zone occupies a significant site 4,5 kilometers from the city of Neiva, covering 567 901,8 square meters; its mission focuses on generating economic and social dynamics in southern Colombia through tax, customs, and foreign trade incentives. Its vision projects it as an integrative hub for entrepreneurship and business by 2030, generating competitive development with qualified users who consolidate their investment in the free trade zone. Products and services based in the department are sold there.[5,6,7]

The aim of the metaverse prototype is to establish a close relationship with different types of customers and other users, allowing them to verify and observe the production, storage, and subsequent sale of the various products and services offered by the South Colombian Free Trade Zone. This prototype also encourages the population to immerse themselves in metaverse processes, leading to increased consumption rates and customer-focused loyalty.[8,9]

A literature review was conducted to support the established objectives. This project was carried out with a theoretical review focused on the topic of free trade zones and the use of metaverse tools; furthermore, the implementation of this metaverse using the CoSpaces tool to achieve immersion from physical reality into virtual activity, which can be coordinated with universities and other entities linked to free trade zones, is recommended.[10]

The creation of free trade zones is among the most attractive government policy options as a fundamental part of the trade

liberalization process in many economies, since these state-promoted spaces not only facilitate foreign trade and attract foreign investment but also incentivize technological innovation and regional development within the framework of economic openness.[5]

Justification

Free trade zones have existed for centuries, originally dating back to the 18th century, to promote re-export trade, and the vast majority took the form of cities, such as Gibraltar (1704), Singapore (1819), Hong Kong (1848), Hamburg (1888), and Copenhagen (1891), located on major international trade routes.

In Ireland and Colombia, modern industrial free zones emerged in the late 1950s with the creation of the Shannon free zone and the Barranquilla free zone by governments, with the aim of promoting employment, exports, and foreign direct investment. "Free zones" are recent variations of traditional trade zones, but they share a common characteristic: they are considered geographic areas outside the customs territory, allowing for the import and export of goods without tariffs or other duties.[11]

Today, many technological advancements in which the human capacity to fully comprehend and utilize digital information have not yet been fully realized, as the exponential growth of digital information exceeds individuals' cognitive capacity to process it, which can lead to information overload and ineffective decision-making in various social and organizational contexts.[6] One of these advancements—and perhaps the most powerful in the development of the new universe of technologies and communications—is the virtual world of the metaverse. Much has been said about this virtual reality space, but it is true that it raises many questions because it is a universe completely different from the real world.[12,13]

The market's need or desire to reap the benefits of technology stems from the fact that technology is currently growing at an exponential rate, whereas the commercial sources and strategies currently on the market are, for the most part, obsolete. Sometimes, organizations misinterpret markets by setting aside new technologies; this allows large commercial enterprises to capitalize on the technological boom, leaving small and medium-sized enterprises at the mercy of obsolete marketing strategies.[14]

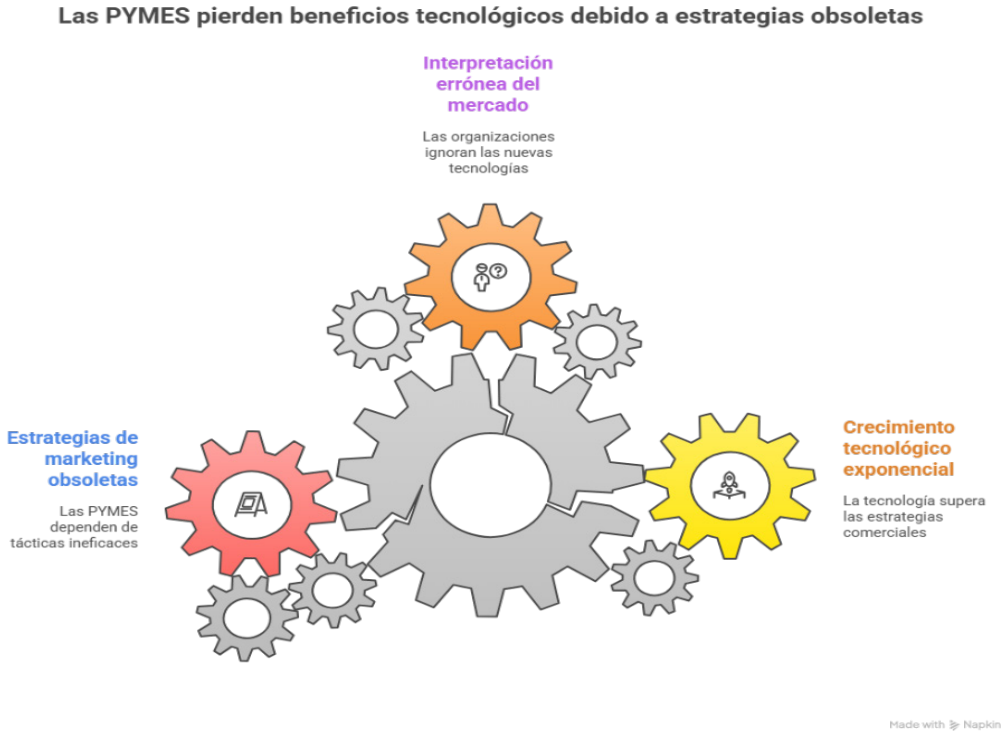
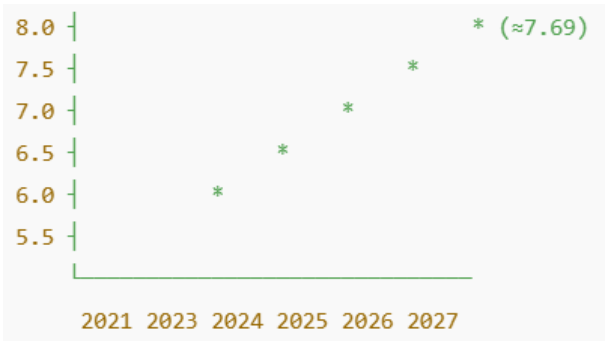


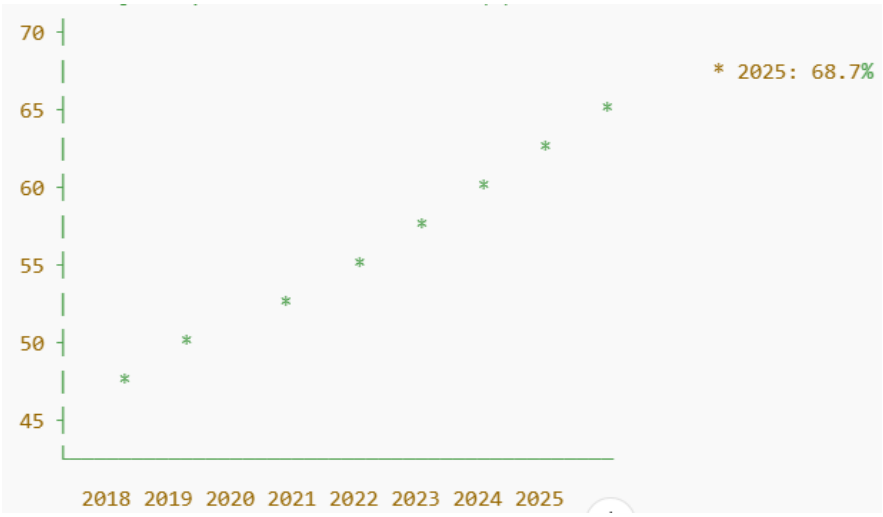
Figure 1. Role of Technology in Organizations

There is a need to create impactful business strategies that incorporate digital experiences, allowing consumers to learn about and become familiar with the product without having to sell it directly. To this end, a technology catalog is organized, and a new consumer experience is introduced so that consumers can learn about the product's specific features. This research is conducted within the framework of this emerging reality, and the aim is for various entities to consider developing tools to enter and gain visibility in the metaverse, bearing in mind that it is a new technological universe for everyone. These tools are projected for the future as a trend that is practically easy to implement because of the technological boom.

The transformations of the digital age have led to a technological revolution in information and communication, driving the integration of the internet into virtually all spheres of human activity—such as education, work, leisure, socialization, and consumption—and even transforming cloud-based data management and everyday processes of social interaction. According to a study, as shown in figure 2, the number of mobile subscriptions in 2021 stood at 6,259 billion and are expected to reach 7,690 billion by 2027. Approximately 70 % of the current population owns a cell phone, and according to World Bank statistics, in 2020, 60 % of people worldwide owned a cell phone.



Source: https://www.statista.com/statistics/330695/
Figure 2. Global Mobile Subscription Data (2021–2027)



Source: World Bank https://datos.bancomundial.org/
Figure 3. Percentage of the global population with internet access

Millennials, or Generation Y—comprising individuals born between approximately 1980 and the mid-1990s—is a cohort that grew up during a period of rapid technological and internet expansion, transitioning from personal computers to mobile devices, embracing social media, and shaping new patterns of online consumption. These behaviors imply a greater willingness to try technologies that make life easier, a strong presence on traditional social media and in e-commerce, and a preference for brands and experiences that incorporate values of sustainability and environmental commitment.[7]

Generation Z, comprising people born between 1994 and 2010, is known as the "digital natives" because they have always been connected to the internet and cell phones, learning through videos and social media. This is the most diverse and multicultural generation, with a strong social commitment that promotes healthy coexistence against bullying and cares about the values of the brands whose products they purchase. They are also known for multitasking; they are users of newer social media platforms that allow them to communicate via short messages. With these platforms emerging, the professions of YouTubers and influencers are easily influenced by entertainment idols, communicate through selfies, acronyms, and emojis, share all kinds of content, and are known for multitasking.[15,16]

METHOD

It is crucial to understand the characteristics of the users targeted by the corporate Metaverse, especially in the South Colombian Free Trade Zone, as technologies have transformed many aspects of human activity, particularly in the tech sector. The widespread adoption of cell phones and the apps that can be installed on them has opened up a wide range of possibilities for a variety of activities and interactions.

That is why people have also changed the way they interact with the products they consume, as their perspective on the world and on living life has evolved: while older generations such as *baby boomers* (born between 1946 and 1964) and Generation X tended to prioritize job stability, traditional lifestyles, and more conservative consumption patterns, subsequent generations grew up in different technological and cultural contexts that influence their purchasing habits and relationships with products.

A more open lifestyle and inclusive mindset characterize the millennial generation, also known as millennials or Generation Y. Born between the early 1980s and the mid-1990s, they set the tone for a generational shift that has continued to evolve to this day. They are also known as the boomerang and Peter Pan generations because of their positive and negative qualities, which include more free-spirited sensibility, unrealistic career expectations, a lack of interest in remaining in the same job for life, technological savvy, support for causes such as equal rights, sex education, and the free flow of knowledge, as well as being politically critical

and not fervent followers.

Google, Facebook, Samsung, Microsoft, Sony, and HTC are among the pioneers who see the metaverse as a future technology with multiple possibilities, and exponential growth is anticipated with significant participation from the productive sector, as it is essential for companies to have an online presence. Virtual and augmented reality, as well as internet connectivity, are becoming just as necessary and essential as the internet itself. Currently, the PlayStation VR, Oculus Rift, and HTC Vive virtual reality headsets are leading the market, but more companies are entering the space, and several are exploring how to integrate this technology with their business objectives, especially in sectors such as engineering.

NASA is another example, as it uses virtual reality devices for employee training—for instance, to simulate the International Space Station—thereby reducing training costs. This also reduces occupational risks associated with this activity or with other companies that train employees in the operation of hazardous machinery or risks associated with plant facilities, as well as helping to prevent occupational hazards.

The current research is based on a mixed-methods design that combines descriptive and exploratory approaches, with the aim of providing a broader and more rigorous understanding of the phenomenon under study. To this end, various data collection techniques are employed, notably the administration of 30 surveys to key stakeholders and a literature review, which allows for the integration of both quantitative and qualitative data.

According to a study, this methodological strategy enables the collection of multiple perspectives, increasing the precision of observation and strengthening the validity of the findings. Similarly, the combination of sources and methods facilitates the construction of a clearer and more contextualized view of reality while generating both divergence and complementarity in the information. This approach is essential for achieving the stated objectives and for formulating solutions grounded in solid evidence

The project will utilize technological resources to create a prototype that will begin with a literature review. Additionally, a proposal for implementing the metaverse will be developed using the CoSpaces tool to achieve the transition from physical to virtual reality for the 13 companies located in the southern Colombian free trade zone.

The CoSpaces tool was chosen because of its features, the most notable of which include the ability to use it on computers and mobile devices. Furthermore, while the free version has some limitations regarding its use, it allows for a solid foundation of the process, enabling testing and preliminary adaptation of the metaverse. Once the information gathering and characterization phase is complete, the sequence of steps to design the prototype is implemented, with the construction stages following the guidelines provided by CoSpaces. The research concludes with the proposal presented to the leaders of the southern Colombian free trade zone.

RESULTS

After the current state of the metaverse in business was analyzed, certain characteristics that define the development of this virtual parallel world, which blends with the real world, were identified. First, participants who engage with the metaverse proposal learn about the South Colombian Free Trade Zone by familiarizing themselves with its products and services. Next, they will discover more about metaverses, the target audience, and trends in technology, marketing, and entertainment. Through this initiative, other companies may be encouraged to establish a presence in the free trade zone and understand the benefits it offers.

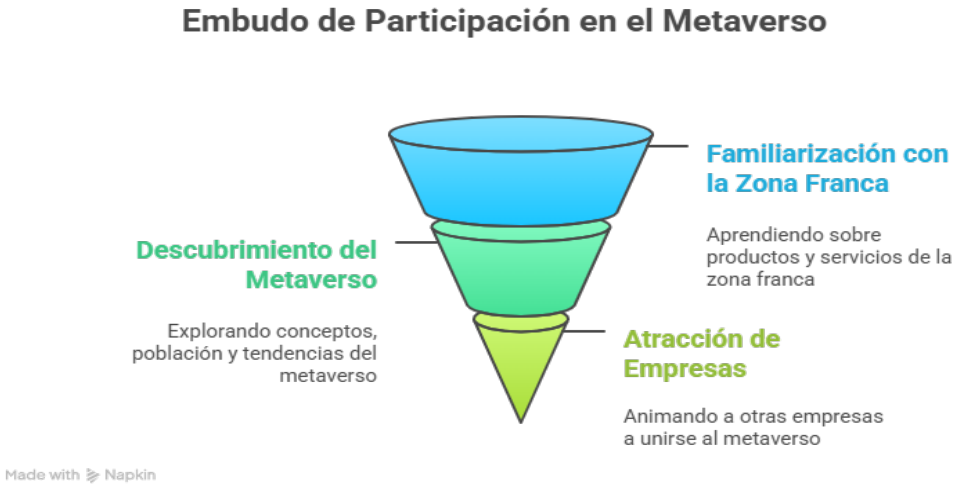


Figure 4. Metaverse Participation Funnel

The objective of this study was to create the best metaverse solution for the Surcolombiana Free Trade Zone. To this end, we employed a methodology involving the evaluation of various tools for metaverse development and analyzed their advantages and disadvantages, including Unity, Google VR, and Amazon Sumerian. After a one-by-one analysis was conducted, it was determined that the CoSpace tool was the best option, as it met the requirements of the Surcolombiana Free Trade Zone. The recommendations provided will be shared by the free trade zone's management so that they can consider the projected benefits and bring the initiative to fruition.

It is projected that several stakeholders will benefit from this initiative. On the one hand, the academic community includes

schools in municipalities that collaborate with SENA to train business technicians and entrepreneurs. Universities and their students in business programs—such as business administration and international business—will have the opportunity to put what they have learned into practice through immersion in the metaverse. On the other hand, there are entrepreneurs who can familiarize themselves with the benefits of locating their business units in these zones and capitalize on the opportunities they offer.



Note: CoSpaces

Figure 5. Prototype of the Surcolombiana CoSpaces Free Trade Zone

The projection of the Surcolombiana Free Trade Zone into the metaverse is essential because it allows for the expansion of its economic infrastructure into immersive environments that enhance competitiveness, attract investment, and increase international visibility.



Note: CoSpaces

Figure 6. Simulation of a Tour of the Surcolombiana Free Trade Zone

From a scientific and technological perspective, the integration of productive spaces into three-dimensional virtual ecosystems facilitates advanced modeling of logistics processes, simulation of operational flows, and experimentation with expansion scenarios without incurring physical costs, thereby increasing efficiency in strategic decision-making. Furthermore, the metaverse enables synchronous interactions between companies, investors, and users, facilitating highly realistic virtual tours, remote inspections, technical training, and demonstrations of goods and services under Industry 4.0 standards. Consequently, its adoption not only strengthens the free trade zone's technological governance but also transforms its capacity for integration into global value chains, aligning it with contemporary trends in digitalization, sustainability, and the smart economy.

Pregunta	Resultado
¿Cree que el metaverso puede mejorar la visibilidad internacional de la Zona Franca Surcolombiana?	89% respondió "Sí"
¿Considera que una representación virtual facilitaría la atracción de inversión extranjera?	84% respondió "Sí"
¿El metaverso permitiría simular procesos logísticos y operativos de manera más eficiente?	78% respondió "Sí"

Figure 7. Validation of the Perceived Utility of the Metaverse in Free Trade Zones

The results of the survey reflect a high degree of acceptance and interest among key stakeholders in the region to explore the metaverse as a strategic tool. As a hub of economic development, the South Colombian Free Trade Zone would benefit from a virtual representation that would allow it to showcase its logistics and infrastructure capabilities in real time. Simulate the import/export processes for training and continuous improvement. Attract investors through immersive tours and interactive presentations. Connect with other free trade zones in the country and around the world in collaborative environments.

Integrating the South Colombian Free Trade Zone into the metaverse is not only feasible but also necessary for positioning the region as a leader in innovation and competitiveness. Tools such as CoSpaces enable the creation of technologically advanced prototypes that can be used for promotion, training, simulation, and strategic management.

DISCUSSION

The Surcolombiana Free Trade Zone has not achieved the success projected at its launch, as few companies have established a presence there, and the idea of transitioning from a free trade zone to a real estate sector has been considered on several occasions. Upon further investigation of our proposal across various company departments—including innovation, technology, marketing, and sales—we considered integrating technological tools that highlight the benefits of being located in the Surcolombiana Free Trade Zone, thereby enabling more companies in the Surcolombiana region to capitalize on each of these benefits.[17,18,19]

In this way, we can achieve the main objective, which is to give the free trade zone greater visibility in a virtual and parallel space where each company can meet its sales goals and increase customer engagement.[20,21]

We understand that it is important for the free trade zone to have a digital and technological ecosystem that enables the development of a promotional platform where a metaverse prototype can be realized in the future; the free trade zone's entry into this world must occur in a way that facilitates coordination with the various stakeholders. We would like to highlight the willingness of the executives of the Surcolombiana Free Trade Zone to provide us with this valuable academic space, which allowed us to gain an in-depth understanding of the operational specifications that govern the functioning of free trade zones. This experience has been key to linking theoretical knowledge with real-world scenarios, thereby strengthening our capacity for analysis and technological projection.[22,23]

CONCLUSIONS

The metaverse, as its name suggests, is a diverse space in terms of its industrial applications. To explore its possibilities, more comprehensive market research is needed to enable its proper interpretation and use.

In addressing this challenge within the Surcolombiana Free Trade Zone, the metaverse, as a digital tool, offers a widely accessible alternative for individuals with internet access to quickly and virtually visit and explore real-world locations. The use of these spaces by major market-leading companies has demonstrated significant growth and positive acceptance among their customers.

The metaverse is a virtual space that allows any idea to be realized; virtual spaces can be designed to suit one's preferences and vision, diverse needs and concepts can be met, and skills can be developed using the CoSpaces tool to create the metaverse. This enables entrepreneurs who are currently based on showcase their products and venture into export processes to target markets.

For companies seeking constant change and evolution that aligns with the tastes and modus operandi of the different population groups to whom their products are offered, immersion in a metaverse becomes imperative. Therefore, the current project can continue to develop different games, themed rooms, and alternative spaces where customers are drawn to visit the website. Visitors must understand that the prototype to be implemented is a space designed to raise awareness of the unique characteristics experienced by free trade zones within the country.

Customers can be persuaded to consume new forms of existing products by transferring them to the metaverse, where they acquire added value through immersive experience and digital interaction. The virtual migration of consumers demonstrates that emerging technologies are oriented toward a cyber-consumption model, which is characteristic of the dynamics of the future. These types of changes not only enable the development of new market strategies but also drive the evolution of industries by breaking traditional paradigms. The metaverse thus becomes a space for experimentation and expansion, where companies can innovate in how they present their products, strengthen customer relationships, and consolidate competitive advantages in a globalized and digital environment

As outlined in the research, the virtual industry has experienced exponential growth in recent years. Currently, it is estimated that in developed countries, its reach is approximately 20 %, reflecting a solid trend toward the consolidation of digital environments as spaces for interaction and development. The expansion of the metaverse opens up the possibility of redefining how industries engage with their customers, partners, and communities, offering a setting where technological innovation becomes a driver of social and economic transformation. In this sense, the metaverse is emerging as a catalyst for new dynamics in consumption, production, and civic engagement, breaking down traditional barriers and envisioning a more interconnected and global future.

FINANCING

None.

CONFLICT OF INTEREST

None.

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