

Volume 6, Issue 11 — July — December — 2022

**Journal-Economic development,
Technological change and Growth**

ISSN-On line: 2524-2024

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RINOE Journal – Economic Development Technological Chance and Growth

Volume 6, Issue 11, July – December 2022, is a journal edited semestral by RINOE. Agueinit # 4, Wilaya de Awserd, Sahara Occidental, Western Sahara. WEB: www.rinoe.org journal@rinoe.org. Editor in Chief: BUJARI - ALLI, Ali. PhD. ISSN-2524-2024. Responsible for the latest update of this number RINOE Computer Unit. ESCAMILLA-BOUCHÁN, Imelda. PhD, LUNA-SOTO, Vladimir. PhD. Agueinit # 4, Wilaya de Awserd, Sahara Occidental, Western Sahara, last updated December 31, 2022.

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Presentation of Content

In a first article we present, *3D infographic for the dissemination and protection of Tenango as cultural heritage of the State of Hidalgo*, by OLVERA-MEJÍA, Yair Félix, GEA-PÉREZ, Mario Alberto, RESENDIZ-RAMÍREZ, Ivone Vidalia and VARGAS-RANGEL, José Amílcar, with adscription in the Universidad Politécnica Metropolitana de Hidalgo, as a second article we present, *Development of a virtual all terrain simulation for driving a baja type vehicle and formula SAE*, by ALFARO-APANGO, Miguel Ángel, CUAUTLE-GUTIÉRREZ, Luis, GARCÍA-TEPOX José Domingo and CORONA-FLORES, Mario Eduardo, with adscription in the Universidad Popular Autónoma del Estado de Puebla, as the third article we present, *Business processes of the software industry in the city of San Francisco de Campeche*, by MEX-ALVAREZ, Diana Concepción, HERNÁNDEZ-CRUZ, Luz María, LLANES-CHIQUINI, Charlotte Monserrat and PÉREZ-CANUL, Carlos Alberto, with adscription in the Universidad Autónoma de Campeche, as fourth article we present, *E-commerce sustainability strategy in the entrepreneurship Victoria de Durango, Dgo. Mexico*, by LECHUGA-NEVÁREZ, Mayela del Rayo, with adscription in the Instituto Tecnológico de Durango.

Content

Article	Page
3D infographic for the dissemination and protection of Tenango as cultural heritage of the State of Hidalgo OLVERA-MEJÍA, Yair Félix, GEA-PÉREZ, Mario Alberto, RESENDIZ-RAMÍREZ, Ivone Vidalia and VARGAS-RANGEL, José Amílcar <i>Universidad Politécnica Metropolitana de Hidalgo</i>	1-12
Development of a virtual all terrain simulation for driving a baja type vehicle and formula SAE ALFARO-APANGO, Miguel Ángel, CUAUTLE-GUTIÉRREZ, Luis, GARCÍA-TEPOX José Domingo and CORONA-FLORES, Mario Eduardo <i>Universidad Popular Autónoma del Estado de Puebla</i>	13-22
Business processes of the software industry in the city of San Francisco de Campeche MEX-ALVAREZ, Diana Concepción, HERNÁNDEZ-CRUZ, Luz María, LLANES-CHIQUINI, Charlotte Monserrat and PÉREZ-CANUL, Carlos Alberto <i>Universidad Autónoma de Campeche</i>	23-32
E-commerce sustainability strategy in the entrepreneurship Victoria de Durango, Dgo. Mexico LECHUGA-NEVÁREZ, Mayela del Rayo <i>Instituto Tecnológico de Durango</i>	33-45

3D infographic for the dissemination and protection of Tenango as cultural heritage of the State of Hidalgo

Infografía 3D para la difusión y protección del Tenango como patrimonio cultural del Estado de Hidalgo

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DOI: 10.35429/JEDT.2022.11.6.1.12

Received July 30, 2022; Accepted December 30, 2022

Abstract

Cultural heritage deals with the traditions, beliefs and achievements of a community; thus, it is the creative expression of its existence and of everything inherited from generation to generation. However, on many occasions these goods or manifestations are not as well-known because they are part of small towns, as is the case of Tenango in the state of Hidalgo. Therefore, various global companies have profited from these works of art and have made them their own, generating large economic income, without giving recognition and royalties to the people who originally created these pieces. For this reason, the present text is oriented to the creation of a mobile application based on a 3D infographic with various 3D models of garments and accessories that contain Tenangos, this with the purpose that people know them, as well as their history, way of manufacturing, among many other details, in order to become aware of the importance of these handicrafts in Mexican culture and prevent outsiders from obtaining benefits from their illegal reproduction. This encourages the use of innovative means for the dissemination of cultural heritage through mobile applications and social networks.

3D infographic, Cultural heritage, Tenango

Resumen

El patrimonio cultural habla de las tradiciones, las creencias y los logros de un pueblo, por lo que es la expresión creativa de su existencia y de todo lo heredado de generación en generación. Sin embargo, en muchas ocasiones esos bienes o manifestaciones no son tan conocidos debido a que forman parte de poblaciones pequeñas, como es el caso del Tenango en el estado de Hidalgo. Por lo que diversas empresas globales han lucrado con estas obras de arte y las han hecho propias, generando grandes ingresos económicos, sin dar el reconocimiento y regalías a las personas que crearon estas piezas originalmente. Por tal motivo, el presente texto está orientado a la creación de una aplicación móvil basada en una infografía 3D con diversos modelos 3D de prendas y accesorios que contienen Tenangos, esto con el propósito de que las personas los conozcan, al igual que su historia, forma de fabricación, entre muchos otros detalles, para así tomar conciencia de la importancia de estas artesanías en la cultura mexicana y evitar que personas ajenas lucren con su reproducción ilegal. Con ello se fomenta el uso de medios innovadores para la difusión del patrimonio cultural mediante aplicaciones móviles y redes sociales.

Infografía 3D, Patrimonio cultural, Tenango

Citation: OLVERA-MEJÍA, Yair Félix, GEA-PÉREZ, Mario Alberto, RESENDIZ-RAMÍREZ, Ivone Vidalia and VARGAS-RANGEL, José Amílcar. 3D infographic for the dissemination and protection of Tenango as cultural heritage of the State of Hidalgo. Journal-Economic Development Technological Chance and Growth. 2022. 6-11:1-12.

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Introduction

During the present millennium, the artisans working in the region of Tenango de Doria, in the state of Hidalgo, have turned the trade they initially practiced surviving into a handicraft industry. The Tenango, as this embroidered piece is called, has evolved to become an authentic work of art with an infinite number of details. In fact, they are no longer only purchased by people locally, but are also sought after nationally and even internationally thanks to the use of technology to promote and obtain them.

However, there are also some unwanted admirers who have set their eyes on these pieces. Recently, some international fashion brands have published products with ornaments belonging to the characteristic iconography of the Otomi, but without mentioning that they come from Tenango de Doria or that they have an origin in this culture. For example, the Benetton company used an image similar to that of the Tenangos on a swimsuit, the company claimed that the design "came from an internet search" and that its product department "did not know about the traditional work of this community". Alma Yuridia Santos Modesto, a member of a collective of artisans in the village, commented that the visibility given by global brands using Otomí designs "gives our work a lot more exposure". But she added: "It would be nice if they would take us into account. Maybe giving us a little more work. A few years ago, her collective made embroidered bags for the Carolina Herrera brand. But more recently, the same fashion house used the iconography of the Tenangos in its 2020 collections without giving them any credit (Malkin, 2019).

In the face of public outcry following countless accusations of cultural appropriation, the fashion industry is undergoing a profound transformation. Around the world, fashion designers are being urged to take into account elements taken from other cultures and to offer products that respect their traditions. While there is still no consensus on the meaning of the term Cultural Appropriation, Intellectual Property is certainly called to be part of the solutions to curb this harmful practice (Vézina, 2019).

Although many alternatives have been developed to try to please both sides of this problem, with the rise of social networks, the use of technology to assist in the generation of so-called Virtual Heritage has gained relevance. Through the use of virtual content, cultural heritage can take a step forward and embark on an equal footing in the new era of information and communication technologies. With 3D virtual content, more and better dissemination and marketing can be achieved. The fact that it can be linked to a web page also makes it possible to achieve greater dissemination among the new generations, who are more inclined to acquire information through this channel (Gómez, Jiménez and Benavent, 2015). In the field of Cultural Heritage, the importance of 3D recording and documentation through digital techniques is an innovative practice that is undergoing exponential development. In this sense, in the fields of various areas such as architecture, paleontology, archeology or sculpture, the taking of 3D data is an established working method, given that these are non-destructive and highly graphic methodologies that, in turn, allow real-time monitoring, visualization without manipulation, virtual intervention and dissemination of collections through virtual spaces (Niquet and Barberá, 2018).

For such reason, the present work is oriented to the creation of a 3D infographic that collaborates to disseminate and protect the cultural heritage of Tenango at a national and international level. The 3D infographic is visualized within a mobile application, which helps to reach many people in a short period of time through social networks. With this, it is intended to give the recognition it deserves to the creations of the people who live in Tenango de Doria, since it is important to know the cultural heritage of the country and protect it from people who try to take advantage of it without proper permission.

Tenango

According to Roa Gómez (2020), Tenango de Doria is one of the 84 municipalities of the state of Hidalgo, and is located in the region known as the Otomí-Tepehua mountain range. The word Tenango is of Nahuatl origin (Tenanco) and means "in the place of the walls". And the municipal seat of the municipality bears the same name. It is a town with an indigenous population of Otomi origin, which has its foundations in ancient times. In a timely manner, it is very important to describe the methodologies, procedures and equipment used in the production work of their handmade crafts, since it is in this municipality, and in neighboring localities, where embroidered textiles popularly called Tenango are produced.

Negrete (2014) mentions that Tenangos are drawings that reflect the cosmogony and cosmovision of indigenous women from the Otomí-Tepehua region, in the state of Hidalgo, mainly embodied in unique and unrepeatable multicolored embroidery. Additionally, for Monterrubio, Hernández and Medina (2019), in the traditional Otomi embroideries one can find the meaning of Tenango, in terms of the representation not only of their own cosmovision, but also of their ceremonies, festivals and traditions. For example, sequences of birds and deer alternating with plants and flowers are common.

Among the Nahua and Otomi, birds are sacred animals and are related to the souls of the dead. The deer is the king of the animals and is considered the protector of the hills and milpas, it is the bearer of riches and participates in the lunar symbolism, with its golden hooves and horns as a crown. Plants and flowers are used in all moments of a person's life and in various festivities, representing protection, respect, gratitude and happiness (Galinier, 1990). Likewise, the Otomi cosmovision is still full of rites and ceremonies related to the fertility of the earth and protection by supernatural beings. In the ancient Otomi ideology there were animal spirits called Rogi that lived in the forests, they were known as Toná if they were protectors of an entire village. The Toná of San Pablito was a four-headed eagle that can be seen in some embroideries (Vergara, 2004).

As for the motifs represented in the Tenangos, the universe inhabited by animals, real or imaginary, is the most recurrent. There is also a great diversity of animals such as deer, rabbits, foxes, armadillos, birds, rodents, insects and worms, which live in plants, flowers and tree branches. Since their origin, the Tenangos contain images of fantastic beings, some with human forms and others associated with mythical and imaginary beings, first drawn and then embroidered on cotton cloth.

In the words of Nemuda (2020), within the Tenango artisan community there are several norms to be able to guarantee that the Tenango made is an original and completely handmade piece. These norms indicate that it depends on the size of the piece if it should be made by the same person from start to finish. If the demand for the Tenango at that moment is sufficient, then it can be made by several people at the same time, in order to create a collaborative piece and thus be able to supply the demand. To make the embroidery, it must be made with cotton threads and embroidered on a natural fiber textile such as silk, cotton, linen, wool or other (commonly on a blanket). Due to its complexity, it can take from a couple of weeks to a year to be finished.

The embroidery process consists of drawing a series of patterns inspired by some event, or as it is commonly done, inspired by the flora and fauna of the region. Subsequently, the embroidery begins. To do this, it must first be ensured that the embroidery has the precise distance from one thread to another so that the background fabric is not perceived, or open at any time, the fabric must be properly stretched to avoid possible folds. The embroidery technique consists of two thread stitches in a straight line, the outline of the figure is not marked, it is only filled in straight stitch, one thread next to the other, so this must be accurate in distance to mark the outline of the figure in this way, taking care not to lose the sense or separate the stitch too much. The embroidery and the shape of the figure must be marked with the thread carefully and progressively. The result of this whole process can be seen in Figure 1 (Bertuzzi, 2020).



Figure 1 Example of Tenango
Source: Own elaboration

Crafts as cultural heritage

At the international level, the United Nations Educational, Scientific and Cultural Organization UNESCO (1997), defines handicrafts as follows: "Handicraft products are those produced by craftsmen, either entirely by hand, or with the aid of hand tools or even mechanical means, provided that the direct manual contribution of the craftsman remains the most important component of the finished product. They are produced without limitation in terms of quantity and using raw materials from sustainable resources. The special nature of handicraft products is based on their distinctive characteristics, which may be utilitarian, aesthetic, artistic, creative, culturally linked, decorative, functional, traditional, symbolic, and religiously and socially significant."

For Rivas (2018), crafts can be placed as cultural heritage because through it people can identify themselves, transfer the technique from generation to generation, and feel represented by seeing their product in other places outside their land of origin. Craftsmanship as cultural heritage allows the craftsman to be very careful to inherit his knowledge and to polish the skill in his heirs. In ancient times, it was the artisans who were responsible for providing their family and community with the indispensable elements for daily life. Today, this is known as popular culture.

For UNESCO, cultural heritage is the cultural heritage of a community's past, maintained to the present day and transmitted to present generations. From a scientific point of view, cultural heritage is identified with the overall cultural heritage of the species and, therefore, with the formalized knowledge that can be preserved and transmitted about it, without any distinction based on extra-cultural legitimacy or other symbolic attributions (Prats, 2000).

At first glance, it seems easy to define the concept of cultural heritage, but this is not the case. Olaia Fontal (2003) has analyzed the different meanings of heritage: as inherited property, as historical selection, as a sediment of the cultural plot and as a shaper of social identity, to which we can also add its role as a reference model. For his part, González-Varas (2000) has limited the categorization of artistic monument only to those objects that are granted an articular and distinctive value and meaning, which differentiate them from other types of objects. Coinciding with this evaluable dimension, Josep Ballart (1997) has defined the types of values that can be granted to cultural property, dividing them into three major categories: use value, formal value and symbolic-significant value. Finally, public institutions at both the regional and international levels have proposed successive classifications and denominations, contained in laws that do not always coincide, for the elements that are considered part of cultural heritage (Peñalva, 2005).

Like the term culture, heritage is a term that has evolved over time and has gone from being a concept related to the monumental and artistic (basically painting and sculpture), to the intangible, such as customs and traditions. The goods that make up cultural heritage exist from the very moment that man left material evidence of his presence and activities, giving rise to objects of all kinds, from works of art to objects of a utilitarian nature (González Varas, 2000). Nowadays, heritage is defined as a collective wealth of crucial importance for cultural democracy. It requires the ethical commitment and cooperation of the entire population to ensure both its conservation and its proper exploitation.

The development of a territory presupposes a vision that involves collective action, involving local and regional governments, the private sector and the population in general. This collective action involves numerous activities that can be based on cultural aspects, such as identity and heritage. Identity implies recognition and appropriation of historical memory, a past that can be reconstructed or reinvented, but which is known and appropriated by all. Valuing, restoring and protecting cultural heritage is a clear indicator of the recovery, reinvention and appropriation of a cultural identity (Molano, 2007).

Cultural appropriation

Cultural Appropriation is considered to be the phenomenon of taking elements from a minority culture and using them without their original meanings in a foreign context, almost always for commercial purposes. This terminology has been so little explored by experts in the field that it does not even exist in the dictionary of the Royal Academy of the Spanish Language (RAE). It has been understood then that cultural appropriation is actually a phenomenon that has so far generated a recent and in many cases effervescent interest (Tostado, 2020).

Cultural appropriation brings together various aspects of a complex phenomenon. Concepts such as plagiarism, intellectual property, heritage and creativity are in dispute and demand validity from different disciplinary fields. Substantively, however, the phenomenon refers to the denial or concealment of an original idea that belongs to another in order to attribute it as one's own. In addition, a social inequality is generally recognized between a dominant culture that usufruct cultural manifestations of another marginalized culture, as a form of oppression of minority cultures (Ziff and Rao, 1997; Young, 2010).

From the arts world, cultural appropriation is understood as the adoption or use of cultural elements by members of another culture. It is also known as cultural misappropriation, often described as harmful and considered a violation of intellectual property rights against the culture of origin (Ziff and Rao, 1997), even though in the legal world there are no international and legally binding regulations governing this type of practice (Sádaba, LaFata and Torres, 2020).

However, indigenous communities not only demand the recognition of authorship in a legal framework; they also demand the recognition of their identities at a cultural level, through the creation of a social link between those involved, which allows them to establish meeting points to legitimately relate to each other. This is what happens in the case of the accusations against the Spanish brand Mango and the French designer Isabel Marant, where the claim is not only the authorial attribution and appropriation of iconographic elements of a Latin American ethnic group, but the omission and lack of interaction with the people who have originally developed these techniques in Mexico, in the Mixe communities of Tlahuitoltepec and Otomí of Tenango de Doria (Ramírez, 2021).

More recently, in the Resort 2020 collection of the U.S. brand Carolina Herrera, recognized textile and embroidery techniques were used in Mexican artisan communities of Coahuila, Tehuantepec and Tenango de Doria. The Mexican Minister of Culture, Alejandra Frausto, denounced cultural appropriation and plagiarism, and demanded that the brand respond to the allegations. Through a press release, the brand stated that the designs were a "tribute to the richness of Mexican culture and its artisanal techniques" without acknowledging the act of misappropriation in its designs (Friedman, 2019).

It would seem that Mexico's cultural identity is for sale, but it is not the people who are left with the profits. Sculptures, paintings, but mainly textiles that imitate the aesthetics of native peoples of Latin America and Mexico, are marketed through the Internet. The embroideries of Tenango de Doria (Hidalgo), huipiles that imitate the elaborations of Oaxaca or T-shirts printed with the stone of the Sun (the Aztec calendar), are sold through Internet pages that constantly change their address and place of origin. The visual appeal of Mexico's embroidery, sculptures, paintings and other handicrafts has caused dozens of companies to appropriate the cultural heritage, without the creators seeing a single peso for their work, effort and creativity.

In this regard, the National Human Rights Commission issued a recommendation in which it warned that "Mexico does not have an adequate legal framework that addresses the specificities and characteristics of indigenous peoples and communities, the same that makes effective their right to protection" of their cultural heritage" (Rodríguez, 2021).

3D infographics

Infographics is a graphic piece that was born in the journalistic medium, having as a characteristic that it incorporates textual and visual elements, in an indissoluble relationship. Villaplana (2019) adds a third characteristic by understanding it as a means of information transmission. As an object of information design, infographics is one of the most used resources for the visualization of complex data in understandable and aesthetic informative pieces, which break visual fatigue by transmitting descriptive messages in an attractive way and generating learning.

However, although documentation based on two-dimensional graphic images for paper-type physical formats is essential, there are documentation systems capable of improving the quality of the information (Irujo-Ruiz and Prieto-Martínez, 2006). 3D computer graphics can be defined as the generation of images by computer. More specifically, it usually refers to the creation of images that try to imitate the three-dimensional world by calculating the behavior of light, volumes, atmosphere, shadows, textures, camera, movement, etc. 3D models digitally reproduce the real world, obviously without reaching the quality of detail existing in reality. By means of thousands of points and meshes, terrain and objects are imitated by means of simplified structures (Fraile, 2007). 3D modeling is presented as a system that can improve both field documentation and the dissemination of scientific results obtained through research.

The elements that make up a 3D infographic are: information, audiovisual language, video, 3D, text structure, typefaces, illustrations, maps, graphics, audio, video duration, visual and sound effects, as well as virtual environments. These conforming elements are not hierarchical, therefore, as they have the same level of importance, none of them can be omitted, since all of them together generate a 3D infographic.

In addition to entertainment, 3D technology goes hand in hand with current fashion and is at the forefront in the use of digital tools. The inclusion of the third dimension in this tool, responds to give the user another alternative to receive information that allows, according to the objectives of the project, to understand, understand, analyze, etc., any type of information that is intended to disseminate through this tool. The use of 3D in infographics, allows to give a greater breadth of the subject to be exposed. Thanks to its characteristics to move in three dimensions and give that feeling of depth, the way objects, environments or any graphic that is presented are visualized, give the user greater reference of volume, size, distance and shape that can be similar to things they know. From their experiences, they can compare or take as a reference to better contextualize the subject matter presented and not have to refer to the imagination.

3D modeling of tenangos

The idea of creating 3D infographics through a mobile application arises from the goal of finding new methods of dissemination or disclosure for what represents the cultural heritage of Tenango in Hidalgo and throughout Mexico, covering the origin, history, meaning, and process. To achieve these goals we contacted an artisan who lives in Tenango de Doria to present the project and get permission to reproduce his handicrafts digitally. The artisan, Clemente Reyes Jiménez, agreed to listen to the proposal and explained important points about Tenangos and his experience, in addition to agreeing to have his designs appear in the 3D computer graphics, providing several photographs of his works of art, among which the ones shown in Figure 2 stand out.



Figure 2 Tenangos made by artisan Clemente Reyes Jiménez

Source: Own elaboration

3D design refers to the three-dimensional creation of parts, objects or structures, generally used in engineering and architecture, or to the creation of 3D images related to the multimedia world and 3D animation. The basic steps to achieve a 3D object are: modeling, UV mapping, texturing, lighting and rendering. Modeling consists of shaping individual objects based on a reference image. UV mapping represents the texture coordinates on the model, which in 3D view coincide with the position of the vertices, but have an independent movement in their unfolded form. Texturing is performed to increase the detail and realism of the models by incorporating textures, it is an image that is placed on the faces of the polygon. Lighting or shading defines how the faces of a polygon will behave when illuminated by a strong light. Rendering generates an image from a model, i.e. it is the complex calculation developed by a computer to generate a 3D image.

The Marvelous Designer software is used for the modeling of the garment, this design program allows to capture digitally the manufacturing process of a garment. It is a very useful tool for the detail and quality of the textures. Obviously, the construction of each garment is made based on the artisan's designs to capture the iconography.

Once the garments are planned, the digitalization of the Tenangos begins, for which two programs were used. Illustrator is a program that allows to digitally capture drawings, the artisan's drawing is captured to make a digital representation as faithful as possible to the design. Having digitized each drawing, we chose to use a specialized program for embroidery, Drawings 4, which allows the texture of the embroidery to be precise and with a very high level of detail.

To capture the textures in each garment, the specialized software Substance Painter is used, this program contains a large number of default textures and allows you to create your own. For the texture of the fabric it is decided to use a predetermined texture of the program that adapts to the conditions of detail that is required. In order to import the created textures it is necessary to make use of another image editing software such as Photoshop, since it allows to create alphas or alpha channels, these are the ones that define the opacity of a pixel in an image. The alpha channel acts as a transparency mask that allows, in a virtual way, to compose opaque images or backgrounds with images with a certain degree of transparency. For the animation of the garments, each model is rotated through 360 degrees to show every detail of the clothing. This is done in Autodesk Maya, since it is compatible with Substance Painter, and exporting the textures to this program is more efficient. The animation is made at 24 frames per second, having a duration of 70 frames. This whole process is shown in Figure 3, and is repeated for each Tenango.

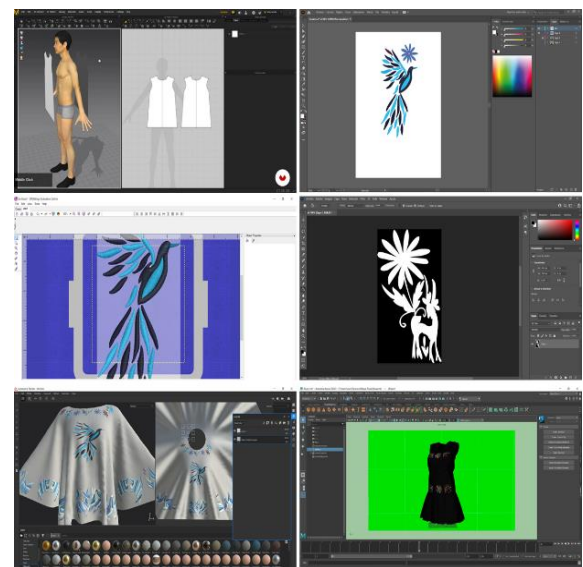


Figure 3 Process to create the 3D modeling of the Tenangos

Source: Own elaboration

For rendering, Autodesk Maya is also used in conjunction with the Arnold render engine, since it is one of the most compatible and intuitive. We chose to render with an image quality of Full-HD 1080 by 1920, since with that image resolution the implemented textures can be appreciated. Figure 4 shows some of the finished 3D models where you can see the detail of the textures, trying to match the original piece.



Figure 4 3D models of the Tenangos
Source: Own elaboration

Presentation of the infographic

Currently, social networks and mobile applications have become a great communication tool within society, with which it has been possible to project, inform and share information with various groups of people. For this reason we chose to create a mobile application that contains 3D infographics and where the user can interact a little more with the content, in addition to creating a video and broadcast it on social networks such as Instagram, Facebook and YouTube. Part of the operation of the mobile application is shown in Figure 5.

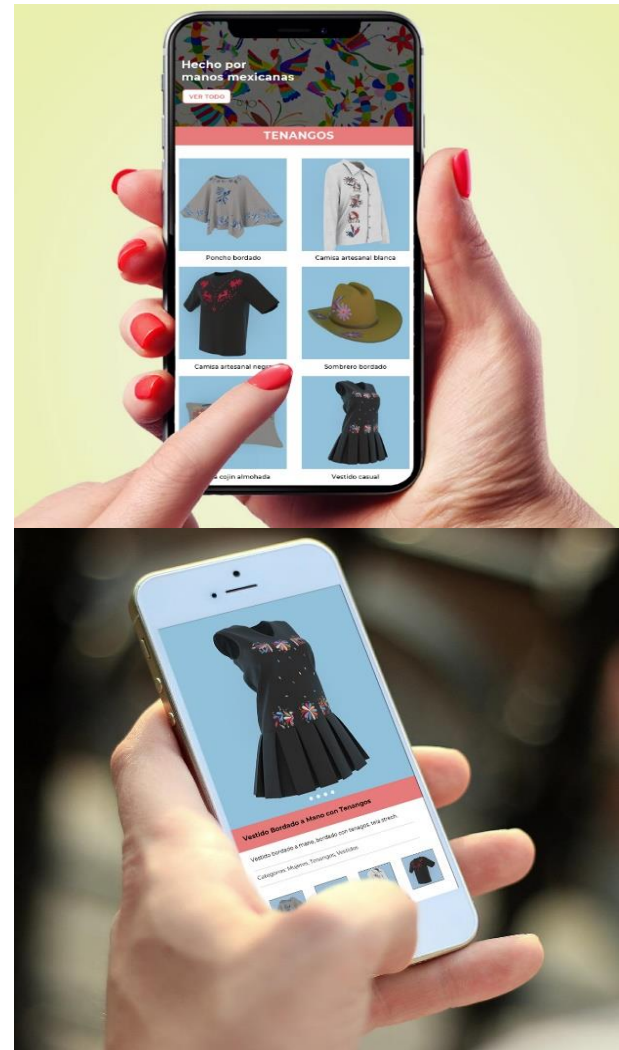


Figure 5 Mobile application with 3D infographics
Source: Own elaboration

In addition to the 3D models and animations, the application contains texts and audios that talk about the background of the Tenango, as well as the embroidery process that is carried out for its creation, and a bit of the history behind each of its forms. This is intended to allow users to interact with the Tenango and get to know it in detail.

To test the effectiveness of the application, a brief questionnaire was applied to 100 people in order to know their opinion. The results were positive, mainly among young people, since they accepted with pleasure and interest the use of new technologies to promote and make known Mexico's cultural heritage, as is the case of Tenango. They considered important the use of new media and technological tools even to promote tourism in these places, since some people had no knowledge of the municipality of Tenango de Doria. Currently there is more openness to the media and online dissemination, so they would reach more people in a short time.

It is evident that each person has different tastes and interests, but they are all consumers of digital technologies. Therefore, the main utility of the application is to disseminate and protect the cultural heritage of Tenango by increasing people's knowledge about its characteristics. Table I presents the main questions and results of the survey applied.

Ask	Yes	No
Does the app provide you with the necessary information about the Tenango creation process?	85	15
Does the app help to spread the cultural value of Tenango, mainly among teenagers?	96	4
Do the 3D models presented have the necessary quality to visualize the details of the Tenango?	92	8
Did you find the handling and interaction in the app adequate?	80	20
Do you agree with global brands using Tenango on their garments, with or without permission?	29	71
Comments: Very nice dresses and accessories, they look very realistic. They should also promote the place and not only Tenango. More tools like this are needed for everyone to know what is made in the country. A simple application, but with very valuable information about this work of art.		

Table 1 Survey of app users

Source: Own elaboration

According to Tostado (2020), the phenomenon of cultural appropriation has focused on the study of popular art as a commercial commodity, analyzing and contrasting the historical and social implications that this implies. The debate on the ownership of art is a deeply complex issue, as it currently encompasses many spaces, from the social to the economic. Since decades ago, an international legal scaffolding has been sought to determine the ownership of the cultural elements of each country (music, crafts, dance), so there are international legal guidelines that do not allow the registration of utilitarian products and intangible heritage such as Mexican cuisine and Mariachi. Some exceptional cases have become anecdotal, such as the patent of the Taco in 1979 registering this dish as an element of cultural penetration by the artist Maris Bustamante, or as, according to BBC investigations, the Chinese businessman Wu You Lin who appropriated the image of the Virgin of Guadalupe in 2002 until 2012 or finally Harry Henneman in 1996 with the Mexican National Anthem.

None of these examples had real practical repercussions in the use of iconographic elements, being the result of existing legal holes in the regulations of national and international patent laws and remaining in the imaginary of recent Mexican historical curiosities.

As proven in this analysis, and citing Ramírez (2021), there is a demand beyond the terms of authorship and ownership, related to the visibility, or lack thereof, that indigenous communities have vis-à-vis other socially privileged groups, such as fashion brands. Cultural appropriation is seen not only as theft, but also as a device that favors the absence of the other, that allows avoiding the relationship with others, that materializes a silencing of their voice and an invisibility that leaves them at the margin of a possible space of relationship. Likewise, when cultural demands cling to the concept of cultural appropriation, they seek something more than a legal obligation, they also expect recognition and participation in authorial terms. Recognition in order to stop the denial and invisibilization they experience, as happens when fashion brands evade the concretion of a link with those communities that are used to their advantage.

Despite their commercial purpose and the attempts of big industry to appropriate them, these embroideries continue to reflect ancient traditions and ways of conceiving and interpreting the natural and supernatural world, the real and the mythical, the past and the present. The communities of Tenango de Doria and its surroundings have not lost their own vision of the world and their immediate environment. Their ideas, feelings and concerns are still alive, which they express in drawings and embroidery. It is the duty of each person to recognize their roots, value the tangible and intangible heritage, rescue the knowledge of indigenous groups, respect nature, and preserve the historical memory through the Tenangos (Monterrubio, Hernández and Medina, 2019).

Acknowledgements

The authors are grateful for the support provided by the artisan Clemente Reyes Jiménez, who offered his Tenangos for the development of this project. They also thank Cesar Daniel Varela Ayala for the realization of the 3D models.

Conclusions

Tenango is a craft that identifies not only the region of Tenango de Doria, but also the entire state of Hidalgo, due to the recognition it has acquired nationally and even internationally. As in any artisan process, the finished object is not only the result of a mixture of raw materials, techniques and methods, but also the inherited knowledge, the daily work, the ways of perceiving the world and the feeling and creativity of the artisan. Each embroidery is then characterized by being unique and unrepeatable. Once the motifs are drawn on cotton fabric, the embroiderers fill them with threads of different colors, which give great originality and identity to this craft.

Since the Tenangos have a unique beauty, several companies have tried to plagiarize them to commercialize them on their own and obtain economic profits, sometimes with the permission of the artisans, but most of the time without their consent and without giving them the credit and royalties they deserve. These events have motivated these communities to promote the designation of origin and the designation as cultural heritage.

Although they already have these designations, new tools and means are always needed to disseminate these crafts, as well as the process followed for their embroidery. Since that is where much of its value lies, in the time and dedication that artisans dedicate to its design and creation. So potential customers should pay the right price for one of these pieces, and not be tempted to buy them with pirate brands or brands that have no rights over their marketing and steal other people's ideas for their own benefit.

The mobile application presented in this document, contains various models and 3D animations with extremely realistic textures of various dresses and accessories with embroidered Tenangos. The purpose is not only for people to know them in detail, but also to know their history and the process followed to create each one of them. As it is a technological innovation, it is mainly focused on the new generations, those who are immersed in the fashion world and spend a lot of time in front of a computer looking for clothes and more accessories to buy. It is important for everyone to know that big brands cannot take over the ideas and work of small communities far from the big cities.

And if this is the case, they should not buy these illegal products, but rather buy them with 100 percent Mexican handicrafts. The application also aims to raise awareness among users about this problem, so that they raise their voices and defend products made in Mexico.

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Development of a virtual all terrain simulation for driving a baja type vehicle and formula SAE

Desarrollo de una simulación virtual todo terreno para conducción de un vehículo tipo baja y formula SAE

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DOI: 10.35429/JEDT.2022.11.6.13.22

Received July 10, 2022; Accepted December 30, 2022

Abstract

The technological heyday aimed at virtual reality has managed to develop processes and tools never seen before that allow us to add simulation methodologies in a virtual environment for the launch of any prototype, in such a way that the first physical models are almost the final ones after having performed strict tests on them in a 3D analysis. The exploration that will be shown below focuses on analyzing the different presentations of virtual reality regarding the visualization, animation and dimensional validation of a Baja and Formula SAE type vehicle, this with the purpose of improving vehicle development processes through the application of this tool, optimizing the experience of designers, saving time and increasing operational efficiency. With the help of a VR team and special software for 3D visualization (VRED), the quality offered by the virtual environment was evaluated, as well as the different tools offered by the software to make the virtual experience as close to reality as possible. . The results obtained in this investigation will allow the reader to know the tools that were used during the process to create a virtual environment and have the ability to interact with the model and the environment created.

Baja SAE, Formula SAE, Validation, VRED, Visualization, Virtual Reality, Animation

Resumen

El apogeo tecnológico dirigido a la realidad virtual ha logrado desarrollar procesos y herramientas nunca antes vistas que nos permiten agregar metodologías de simulación en un ambiente virtual para el lanzamiento de cualquier prototipo, de tal manera que los primeros modelos físicos ya sean casi los finales después de haberles realizado pruebas estrictas en un análisis en 3D. La exploración que se mostrará a continuación se enfoca en analizar las diferentes presentaciones de la realidad virtual con respecto a la visualización, Animación y validación dimensional de un vehículo tipo Baja y Formula SAE, esto con el propósito de mejorar los procesos de desarrollo de vehículos mediante la aplicación de esta herramienta, optimizando la experiencia de los encargados del diseño, ahorrando tiempos y aumentando la eficiencia operativa. Con la ayuda de un equipo de VR y un software especial para la visualización en 3D (VRED) se evaluó la calidad que ofrece el entorno virtual, así como las distintas herramientas que ofrece el software para volver la experiencia virtual lo más cercana a la realidad. Los resultados obtenidos en esta investigación permitirán al lector conocer las herramientas que se utilizaron durante el proceso para crear un entorno virtual y tener la capacidad de interactuar con el modelo y el entorno creado.

Baja SAE, Fórmula SAE, Validación, VRED, Visualización, Realidad Virtual, Animación

Citation: ALFARO-APANGO, Miguel Ángel, CUAUTLE-GUTIÉRREZ, Luis, GARCÍA-TEPOX José Domingo and CORONA-FLORES, Mario Eduardo. Development of a virtual all terrain simulation for driving a baja type vehicle and formula SAE. Journal-Economic Development Technological Chance and Growth. 2022. 6-11:13-22.

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Introduction

Throughout the years technologies are changing or modified by the consumer to achieve a greater field of action as a larger development in the long run as is the use of Virtual Reality not only for large or small industries if not for all possible fields where you manage to find an opportunity for their applications in a real environment [1]. Virtual reality in recent years has managed to take off with great force by the applications in which it has been applied previously as in which it is currently being applied to mention more practical examples of this program we see it applied in the training of surgeons [2], pilots [3] and firefighters [4] are taking advantage of the realism and flexibility offered by virtual reality. Generating that users experience their functions as real as possible as a first approach to their respective fields of action by the skills and experiences that are gradually learned and can later be reflected in real life [5].

The Baja and Formula SAE type vehicles that will be shown are designed to participate in competitions of their branches, these events are held around the world, within these they manage to expose the designs of different off-road or track vehicles, built by their teams based on the Baja SAE regulations of the competition [6]. The contribution that we seek to give to this technology is that the representative teams in this case of the Universidad Popular Autónoma del Estado de Puebla is to be able to model and visualize their vehicles with the goal of recreating their movements respectively of each one in order to identify their correct route in the most realistic way and close to a scale size and can make the necessary changes to pass the different tests that encompass these competitions.

The use of virtual reality did not lead to the use of these tools in a more dynamic way by the type of vehicles being used by Baja and Formula SAE created by students of the Universidad Popular Autónoma del Estado de Puebla, in order to assess the quality of the route in the environment of the virtual prototype and evaluate the dimensional validation offered by the VRED software.

Virtual reality is currently understood as a digital experience enhanced through a vision gadget (special viewers) by means of which, before the reproduction of an environment (artificial or obtained from real events), physical and emotional sensations and reactions are achieved, just as they are experienced in real life [7].

Problem

Before being able to add a CAD model to a virtual reality software, it was necessary to investigate the features offered by such software and also to know the correct programming to use in order to make possible the animations. As part of the obstacles of this project it was found that the number of programs that will be in charge of being able to perform this type of projects is minimal at the moment and the little information released of the correct programming in Python, in addition to the fact that not all programs have student licenses. During the search process, good software was identified but with limitations, such as access to the program and its features, and the only way to use it was to purchase it.

The program used for the visualization of the 3D models in a virtual environment was VRED. During the process it was identified the problem that the tools of this program change depending on the version, since in current versions of the software there are more complex tools with less information released, it should be clarified that not all versions handle the same interface which forced to make different tests in order to achieve the desired result even with the lack of information.

For the selection of the CAD models to be imported to the virtual reality software (VRed) it was necessary to homologate them with respect to other prototypes of vehicle design. In the case of this project, the CAD models to be used are the competition models of the UPAEP university, both the Baja and the Formula SAE.

The tools and the different elements that will be added will be to make the virtual experience more pleasant and comfortable for those who are viewing the model with the virtual reality glasses, as part of these amenities is the interaction with the change of environment, as well as with the change of model to be displayed, the power to make a measurement point to point and in addition managing to generate a dynamic animation of the vehicles of each of the teams in their branch respectively.

When these functions are active and working, we will proceed to make a displacement of the model so that the user can observe in detail the route of a Formula or Low SAE type vehicle and also be able to see specifically how the components of each area work together to generate the movement of the vehicle.

Justification

Throughout history, the automotive industry has been updated to be able to have a relationship with its consumers, allowing access to new technologies such as virtual reality, which already has more than 50 years of trajectory, which previously focused on other areas such as video games, culture, art and entertainment. This generated an opportunity for growth in the automotive sector, which is gradually developing.

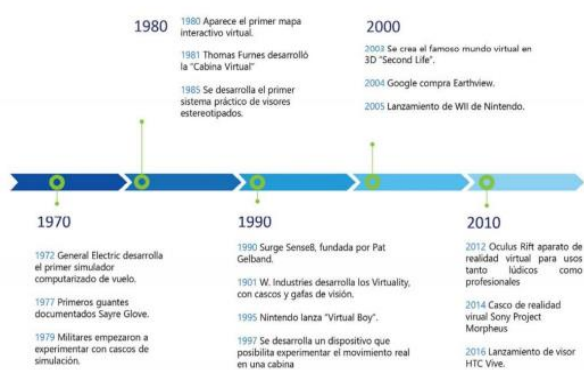


Figure 1 Development of Virtual Reality

Source: [7]

The popularity of these new technologies has increased considerably due to the multiple benefits they offer in the area of design and marketing, sources such as INSIDER Intelligence, which are dedicated to research and statistical forecasts on various topics, took on the task of forecasting the increase in the use of VR and AR. In the image number 2 is presented in a bar chart, the percentages of people using these technologies, either with headset or non headset, only for the years 2019 to 2023. Although the forecast was made exclusively for the U.S. population, this helped to have a clearer idea of the progress being made in the field of virtual reality.

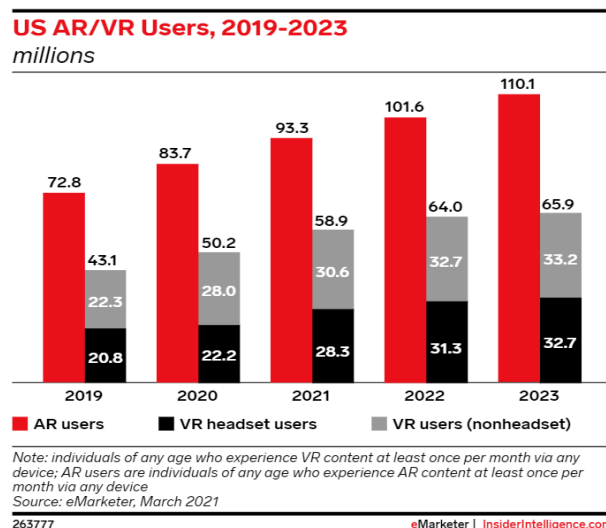


Figure 2 Table of forecasts on the increase in the use of RV and RA

Source: [8]

Conceptualization

As part of the theoretical and practical development for this work, it was essential to go deeper into the topic of the virtual environment focused on the existing standards for this type of technologies and thus be able to justify the work more clearly. Among the existing standards, ISO/IEC TR 18040:2019 Information technology- Computer graphics, image processing and environmental data representation-Live actor and entity representation in Mixed and Augmented Reality (MAR) was located; which manages to present the correct compatibility between data to share them in the correct way, since it provides a reference model for applications in MAR, in addition, it manages and controls learning, education and entertainment (LAE) in a MAR environment [9].

Another standard found during the research is ISO/IEC TR 23842- 1:2020 Information technology for learning, education and training-Human factor guidelines for virtual reality content-Part 1: Considerations when using VR content [10]. This standard specifies the different considerations that designers should have for the proper and effective use of the virtual environment in different areas, such as education, learning and training as the first part, this standard has an extension of the content, subdividing the standard into two, to achieve a more dynamic content for the reader with the following nomenclature ISO/IEC TR 23842-2:2020 Information technology for learning, education, and training-Human factor guidelines for virtual reality content-Part 2: Considerations when making VR content [11]

Objetive

The joint goal of the virtual reality team and the representative team of Baja and Formula SAE is to present the vehicle in a virtual environment taking into account the needs of each team, in order to show the growth of these innovation methodologies for the construction, validation, visualization and dynamic animation of the models.

Methodology

As part of the correct construction of this project it was necessary to follow a series of initial steps in order to visualize the vehicle properly and present a final product adequate to the requirements of each competition regulation. During the design and simulation process it was inevitable to have errors in order to reach the correct manipulation and understanding of the software and thus achieve a quality virtual experience.

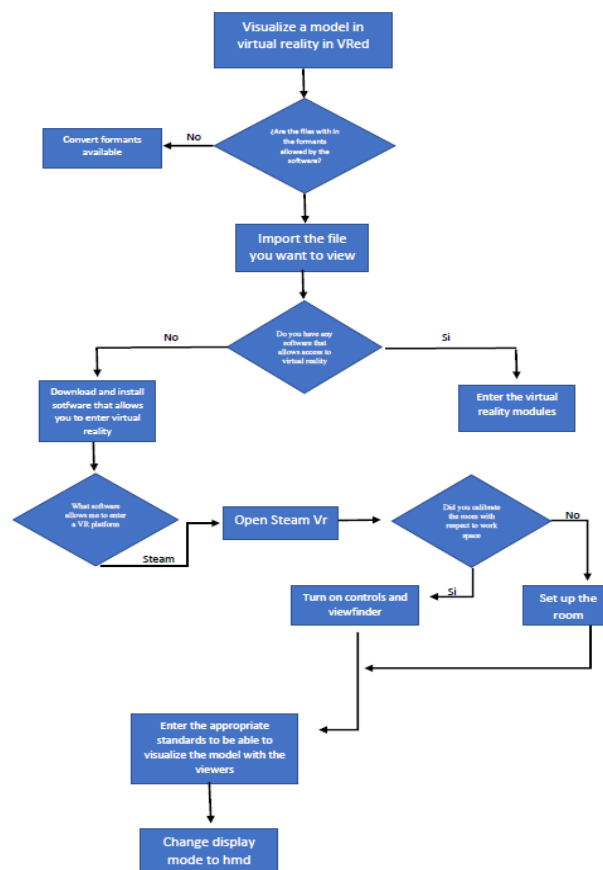


Figure 3 Flowchart for modeling a vehicle in a virtual environment

In order to start the project process it was necessary to download the VRed program through the Autodesk platform, to enter this platform it is necessary to enter student data and thus have downloaded the student license, taking into account the year of the version to use.

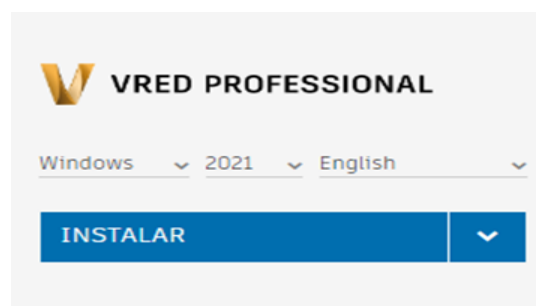


Figure 4 Software download screen

Once installed, the next step was the creation of the document (Graph). We started by importing and placing the CAD models of each branch in which the UPAEP University participates with the stp format, as well as the use of images with extension type (hdr, mtd, tif or dif) to mention a few, to be able to add in this way environments in 360 formats and to be able to visualize the desired image.



Figure 5 Image in 360 format for Vred

Once the workspace was created and the CAD models (Formula and Low SAE) were inserted, the next step was to arrange them in their color shades and add textures to achieve a more realistic and cleaner finish.



Figure 6 Color and texture arrangement in Cad formula SAE

First of all, it is necessary to activate the menu that enables access to different settings (Scripts - VR menu - Show VR menu) because the version used this in order to use two specific functions which are teleport (to be able to move anywhere in the environment) and measure (to check the model in the virtual reality environment).

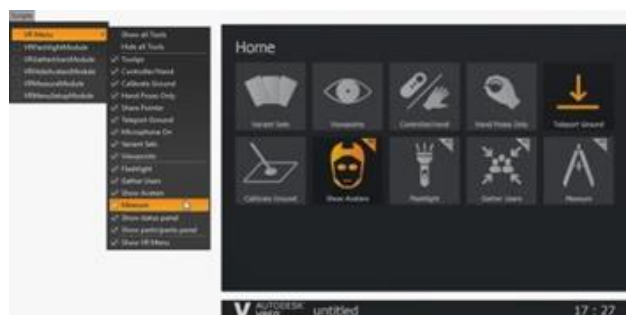


Figure 7 Function menu of Vred version 2021

Once this was done, we looked for a work table with the extension .stp, which will serve as the basis for us to simulate, through Python programming, a set of buttons that serve as commands to activate the various tools that help us to interact with both the prototype and the environment.



Figure 8 Work table

We proceeded to the creation of the commands in the work area to perform the interaction activities subdivided into 4 sub menus (Environment, Variants, Tools, Antialiasing), which were grouped and developed the panels of each of these tools in order to interact with the environment and CAD models, in this case the Formula SAE and Baja SAE.



Figure 9 Work table with added submenus.

Once all the programming was done, we continued with the development of the animation of the models (Baja and Formula SAE) and thus achieve that the vehicle within the virtual environment has a cyclic path in the environment of the selection.

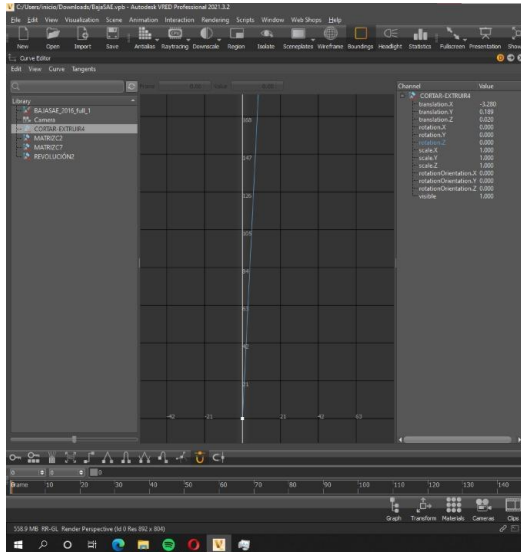


Figure 10 Cyclic animation graphic

Subsequently, the environment was modified. To create a virtual environment it is necessary to take into account the extensions to have an image that meets the format requirements of the software, in order to have an environment as close as possible to the real one.

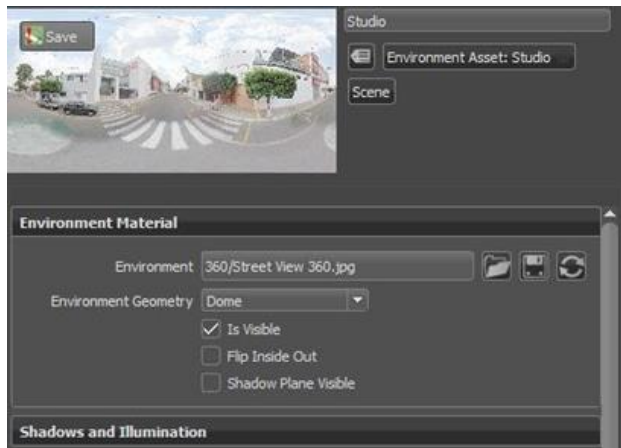


Figure 11 Environment change panel

To conclude this work, the vehicles were visualized by applying the above procedures for each one of them and thus have a quality and presentable product.



Figure 12 Final model of the project

Animation

In this work we developed the animations of the models with which we are working, generating a better perspective of how the models can move in a real way, in the same way we can adjust certain parameters of the models so that they are in the best way and can meet the general and specific objectives of the project, the final animations were as follows, in the image 13 we can visualize the cars of the UPAEP university of both branches, in which we can see that it is in an unpaved environment, since it is the environment where the competitions for this type of vehicles are performed.

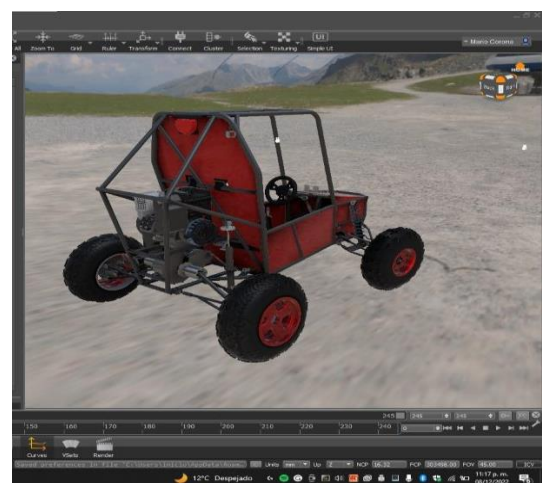


Figure 13 Animation of the SAE Lower Model

In order to achieve the dynamic animation of these vehicles, a series of graphs were created as shown in image 14, which determine through manipulation the type and degree of movement of the selected part within the assembly.

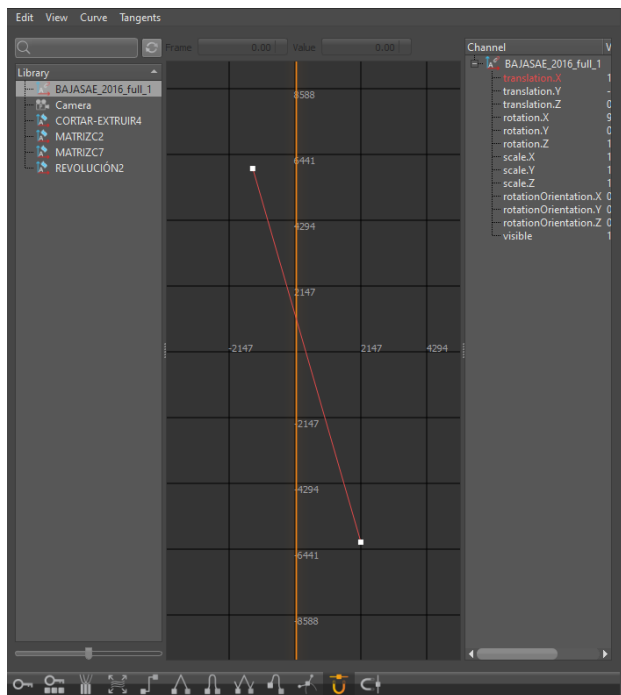


Figure 14 Graphic used for the animation of the Baja SAE

Through the ehremiante curves is how you can recreate this type of movements, along with the ability to create nodes that help the interaction with the subject that is immersed in the virtual environment.



Figure 15 Graphic used for the animation of the Baja SAE.

Results

To evaluate the final experience of the virtual environment, the evaluation was subdivided into 3 categories: the animation of the vehicles, the visual detail of the model and the ability to interact with the environment and the model, with the purpose of taking into account all the fundamental aspects of the virtual environment. On the animation side, we were able to add a series of different routes in which the prototype of the Baja and Formula SAE vehicles could be presented in different ways, within these animations we were able to modify the speed and cycles. In order to make the experience more real, a scenario known by the team members was added, so it was decided to capture one of the streets of the city of Puebla (Av. 11 poniente, between C. 23 and 25 sur).



Figure 16 Scenario selected by the team. Av. 11 poniente, between C. 23 and 25 sur

Regarding the visual detail of the models in the virtual environment, we came to the conclusion that all the parts, accessories and components that make up the Baja and Formula SAE vehicles have a very high visualization quality. In this way we were able to see both vehicles in detail and thus present to each team the proposals of the design models in a real size.



Figure 17 Presentation of the Baja SAE model in simulator

As a result of the last criterion about being able to interact with the model and the virtual environment, they were mostly enriching for the creation of a more real and interactive environment with the user and is that within the virtual environment was added a panel of tools that allows you to make the change of scenario and model.



Figure 18 Presentation of the Formula SAE model in simulator

To finalize this work, a questionnaire was developed with the purpose of generating a more accurate opinion of the quality of the work done for the creation of the virtual reality models presented.

For the data analysis a non-probabilistic sampling by convenience was carried out, resulting in a population of 11 males and 9 females, this instrument was based in the facilities of the Universidad Popular Autónoma del Estado de Puebla, in the summer academic period, it can be highlighted that the student population in this period is of low demand as it is a private institution. The instrument was validated by calculating Cronbach's alpha with a value equal to 0.7382. The questions related to the equipment (viewers) affected your experience reported the lowest values, so that future studies will consider improving the experience and raising awareness of the use of the equipment beforehand. Table 1 shows the averages and variances obtained from the sample studied.

Ask	Average	Variance
The quality of the models is adequate to distinguish the subsystems that make up the vehicle.	4.22	1.59
The quality of the stage is adequate.	4.61	0.25
The animation of the vehicles is adequate.	4.89	0.10
Understanding how to use the tools turns out to be easy.	4.5	0.38
The equipment (scopes) affected your experience.	3.17	3.09
The components of each vehicle are similar to the real thing.	4.61	0.25
Hand controls are easy to use	4.72	0.21
The use of the tool panel was adequate.	4.72	0.33

Table 1 Statistics obtained from the simple

It is also noted that the animations of the vehicles are adequate, the hand controls are easy to use and the use of the tools panel was adequate. Something that is of interest was that some users reported the absence of an environment accompanied by sound to achieve a more impacting effect in the experience, on the other hand, the presence of dizziness when turning the viewers was detected precisely because it was the first time using the equipment and the lack of awareness in the correct handling of the equipment.

The details in the scenarios were very well qualified, generating a reality that makes you have an immersion in your environment. The open questions identified areas of opportunity to evaluate other scenarios, such as the validation of prototypes at real scales and thus save response times in modifications of a design before building it, achieving an impact in different areas of study.

Conclusions

The work previously presented on the development of a Virtual Simulation for the Driving Evaluation of a Baja and Formula SAE Type Vehicle was born from the need to have a prototype of the cars designed by the members of both teams, with the objective of having the possibility of redesigning the model if any design error were to occur or if it is required to create another proposal to change the order of the subsystems within the vehicle. Within the development of this virtual experience, the process that was carried out during all the work that goes from the conceptualization to the modeling of the virtual environment is exposed, it is necessary to emphasize the limited information that is available with respect to these new technologies, since it was one of the biggest limitations that were found during the conceptualization process.

Also one of the problems that we came to have in mind was the correct application and development of the codes used in Python to achieve the correct animation of the vehicles since it was stated that if it was not well done the animation was not generated or simply did a different thing than expected since Python is a more specialized software for the use of commands and codes needed to generate movement since most companies that create these programs ask for money to use the software, without having a few days of testing and evaluating whether the software has the necessary tools to achieve the objectives. On the other hand, the experience that was had as a team is something unique, having the possibility to study, use and test these new technologies opens the mind to new possibilities and new ways in which these tools can be used by the new generations. It is a fact that virtual reality is one of the technologies with the highest growth projection, according to the latest IDC Research forecasts (2020), investment in VR and AR will multiply by 21 in the next four years, reaching 72.8 billion euros in 2022 [12]. It is worth noting that both technologies will take an important part for the digital transformation plans of companies, therefore it is expected that by 2024 more than 50% of large European companies have a VR and AR strategy.

Finally, it is essential to mention how important were both the results and the comments made by the participants of the sampling, within this feedback the great experience they had within the virtual environment and the great detail of the models, in the same way they commented on the proposals to use these tools and software within their projects, but in different areas. The authors are in favor of the idea that this technology is being known by many more people, this will help that in the future every day there will be more innovations in the field and thus to know all the possibilities that exist for these technologies.

Acknowledgments

The authors of this work are grateful for the support given by Mtro. Jose de Jesus Cordero Guridi (UPAEP), for the revision and correction of the content of this work, as well as to the Universidad Popular Autónoma del Estado de Puebla for the ease of use of equipment such as laboratories for the creation of this work.

Funding

This work was totally financed by the Universidad Autónoma del Estado de Puebla A.C.

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Business processes of the software industry in the city of San Francisco de Campeche

Procesos empresariales de la industria de software de la ciudad de San Francisco de Campeche

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DOI:10.35429/JEDT.2022.11.6.23.32

Received September 10, 2022; Accepted December 30, 2022

Abstract

In Mexico, micro, small and medium-sized enterprises (MSMEs) are the backbone of the economy because they generate approximately 52% of the gross domestic product and 72% of direct employment (INEGI, 2019). For their part, MSMEs developing software, both in industrialized countries and in less developed countries, face global competitiveness, so the role of the State and its ability to direct the economy represents a determining factor in the promotion of this industry. This research presents the results of a diagnosis of the characteristics in which the software industry operates in the city of San Francisco de Campeche, capital of the state of Campeche. The results allow identifying the most relevant characteristics of this industry in order to examine the areas of opportunity to increase its productivity and economic growth, which translates into benefits for the society of Campeche.

Software industry, Clusters, MSMEs software, Technology, Development

Resumen

En México, las micro, pequeñas y medianas empresas (MiPymes), son la columna vertebral de la economía debido a que genera aproximadamente el 52 % del producto interno bruto, y el 72 % del empleo directo (INEGI, 2019) Por su parte, las MiPymes desarrolladoras de software, tanto en países industrializados como en los de menor grado de desarrollo, se enfrentan a una competitividad mundial, por lo que el papel del Estado y su capacidad de direccionar la economía representa un factor determinante en el impulso de esta industria. Esta investigación presenta los resultados de un diagnóstico sobre las características en las que opera la industria de software en la ciudad de San Francisco de Campeche, capital del estado de Campeche. Los resultados permiten identificar las características más relevantes de esta industria para examinar las áreas de oportunidad con el fin de elevar su productividad y crecimiento económico, lo que se traduce en beneficio para la sociedad campechana.

Industria de software, Clústeres, MiPymes software, Tecnología, Desarrollo

Citation: MEX-ALVAREZ, Diana Concepción, HERNÁNDEZ-CRUZ, Luz María, LLANES-CHIQUINI, Charlotte Monserrat and PÉREZ-CANUL, Carlos Alberto. Business processes of the software industry in the city of San Francisco de Campeche. Journal-Economic Development Technological Chance and Growth. 2022. 6-11:23-32.

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Introduction

Micro, small and medium-sized enterprises (MSMEs) represent the segment of the economy that provides the largest number of economic units and employed personnel worldwide; hence the relevance of this type of enterprise and the need to strengthen their performance, as they have a fundamental impact on the overall behaviour of national economies (Bastos et al., 2009) (Biolchini et al., 2005).

MSMEs make up the majority of the workforce in the world, accounting for more than 80% of the companies in the countries, their main characteristics are: having limited human resources and capital, not having an implemented development standard, committing to any type of work that is presented to them, noting the lack of specialisation in a specific niche and generating unrealistic estimates in time and resources (Ortiz and Arredondo, 2014). (Ortiz and Arredondo, 2014).

The criteria for classifying micro, small and medium-sized enterprises are different in each country; traditionally, the number of workers has been used as a criterion for stratifying establishments by size, and as complementary criteria, total annual sales, income and fixed assets.

According to data from the 2009 economic census of the National Institute of Statistics, Geography and Informatics, in Mexico MSMEs have become the backbone of the economy because they generate approximately 52 % of gross domestic product and 72 % of direct employment (INEGI, 2010). However, they subsist in the midst of an aggressive, demanding market, with insufficient access to update their technology, complex administrative procedures, few facilities to obtain credit, so that it could be thought that it is only the government's responsibility to promote them, however it should be a joint effort, to conceptualise in a different way that favours an integral productive apparatus in which, among other factors, long-term sustainable business models are preserved, with job creation or maintenance, increasing own capital savings that favours their growth. (Hernández, 2009).

MSMEs in the software industry are not exempt from these problems, facing global competition, which is why the state and its ability to direct the economy takes on a preponderant role (Wadee, 1999). It is important to investigate the way in which micro, small and medium-sized software development companies survive as economic units, and to identify the reasons that prevent them from growing organisationally and economically, as they are part of the economic engine of countries. In Latin America, several studies have been carried out to improve the software industry, taking as a reference the factors that have influenced the high competitiveness of this sector in countries such as South Korea, Taiwan and Singapore, among others of the so-called Asian tigers (Jenkins, 2007).

A growth factor for software development companies is their membership in a cluster, which according to Michael Porter, is defined as: "Geographic concentrations of interconnected firms, specialised suppliers, service providers, industrial firms, related industries, training institutions, and support organisations linked to technologies or end products within a local area or region" (Porter, 1998). Within the cluster, regardless of structure, size and sector, a number of basic concepts can be identified that develop its nature:

Community: firms operate in common fields or related industries with a shared market focus or sphere of activity.

Concentration: a cluster of firms can and do interact in a more direct and fluid way.

Connectedness: firms strengthen different types of relationships with each other (Salinas and Montes, 2016).

The initial activities of a cluster are in the universities, because the professionals who have graduated from these universities will be the employees of the companies, and there is even the phenomenon of having worked for the same companies before and, therefore, they are concentrated in a geographical area (López and Ramon, 2009).

One of the characteristics of the cluster is that common professionals come together spontaneously to exchange experiences and ideas, something that rarely happens in global relationships. This is where the true value of a business cluster lies (Orozco and Garcia, 2003).

Cluster initiatives should seek to generate favourable ecosystems for innovation, where multidisciplinary actions involving various actors and sectors are carried out. This paper presents the internal organisation of software development companies in the city of San Francisco de Campeche, capital of the State of Campeche. It presents data on how they have organised themselves externally through a cluster, and also those who have decided to work separately,

Methodology

The methodology for this work begins with the creation of an instrument that will help to measure the software industry in the city of San Francisco de Campeche, divided into three stages:

Instrument design

The systematic review methodology was used, which was developed in order to compile and evaluate the available evidence pertaining to a topic.

Protocol development

a) Question formulation

1) Question focus:

To identify the set of indicators to create an instrument to assess the software industry in the city of San Francisco de Campeche.

2) Breadth and quality of the question.

a) Problem:

Currently there are no recent studies that indicate or detail the condition in which the software industry is in San Francisco de Campeche, that is why it is of utmost importance to propose a set of indicators that help to create an instrument to be able to measure the performance of the software industry.

b) Question:

What are the most relevant indicators to evaluate the software industry in the city of San Francisco de Campeche?

Is it possible to classify the indicators that allow to evaluate the software industry of the city of San Francisco de Campeche?

c) Keywords and synonyms:

The definitions used to solve the research question were: software, software industry, technology, growth, boom, economy, investments, ICT, software clusters, 2004, 2005, 2007, 2008, 2009, 2012, 2014, 2018.

d) Intervention:

Indicators to assess the software industry in the city of San Francisco de Campeche.

e) Outcome:

Studies to identify strengths, weaknesses, opportunities and threats of the software industry sector in the city of San Francisco de Campeche.

f) Field of research:

Publications related to the quality area of the software industry from countries around the world.

Construction of the instrument: indicators

The process and results of the systematic literature review are presented in the article "Propuesta de indicadores para evaluar la industria de software de una región", by Mex Álvarez, Manzanilla Yeh, Hernández Cruz, Cab Chan and Ortiz Cuevas where 42 specific, observable and measurable indicators were obtained that can be used to show the changes and progress that the software industry is making and that were classified into seven categories.

The proposed categories are: organisation, human resources, financial situation, infrastructure, research, innovation, development and technology, products and services, markets, business processes, and marketing and communication.

With the generation of these indicators, studies can be carried out to identify the strengths, weaknesses, opportunities and threats of a software industry sector (Mex Alvarez et al., 2021).

In this work, two of the seven categories are presented, which are research, innovation and technological development, as well as business processes, in which 16 indicators were established for the first category and 63 for the second. In order to collect the indicators with the least possible number of questions in a synthesised manner, questions were designed that encompass several indicators (Romero and Camio, 2010) [15], distributed as shown in figure 1.

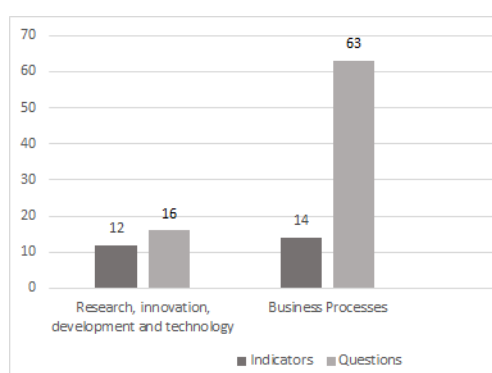


Figure 1 Indicators and questions by category

Source: Own elaboration

Application of the instrument

In order to collect the participations of the companies invited to the research project, the administrator of the platform called: Virtual Observer, should register them with their name, contact telephone number and e-mail address. Figure 2 shows the registration window.

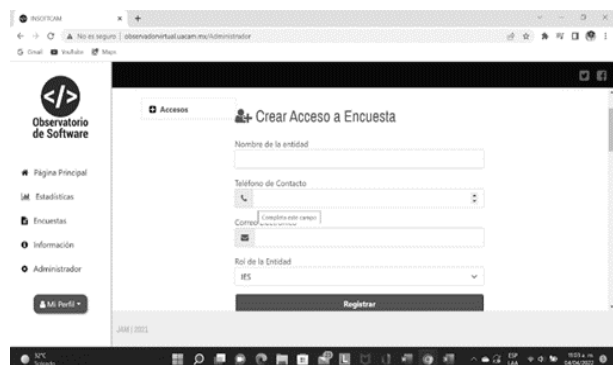


Figure 2 Registration window

Source: Own elaboration

Once the entity is registered, a token is generated that will be active until the survey is completed. Figure 3 shows the window where tokens are administered.

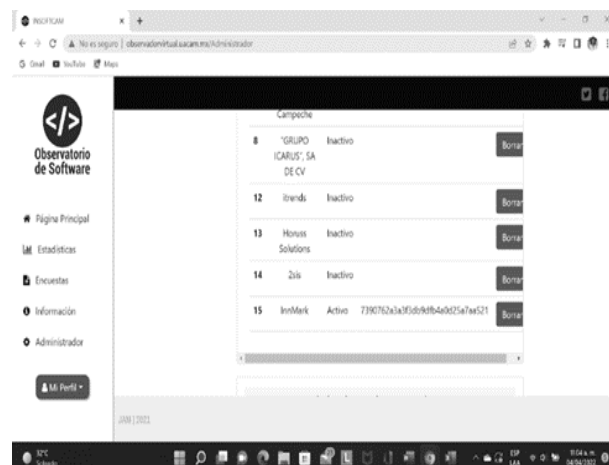


Figure 3 Administration of tokens

Source: Own elaboration

Registered companies can answer the questionnaire by entering the URL: <http://observadorvirtual.uacam.mx/Encuestas>.

They must then enter the token, which was previously sent by e-mail. Figure 4 shows the login window.

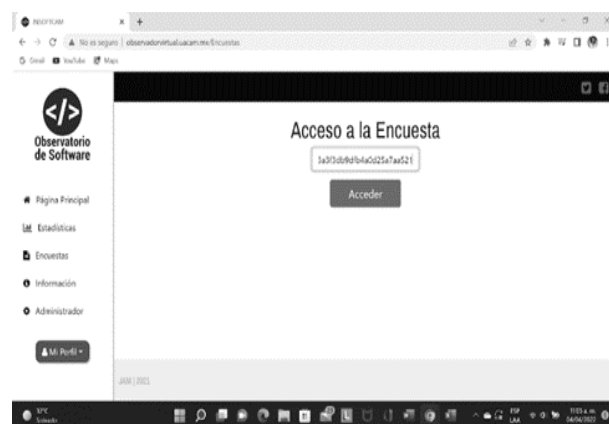


Figure 4 Access window

Source: Own elaboration

Once the token has been validated, they can start filling in the corresponding answers, as shown in figure 5.

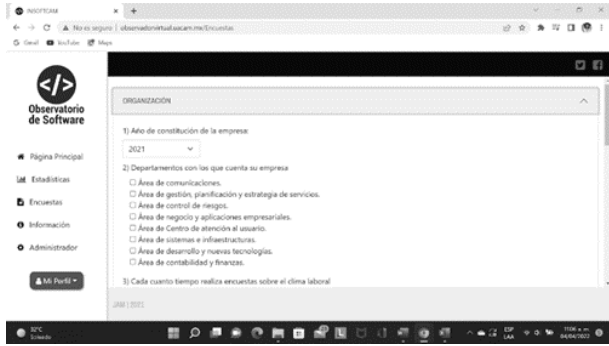


Figure 5 Survey capture form
Source: own elaboration

Target population

According to data extracted from INEGI, during the 2020 population census, the state of Campeche consists of approximately 928,363 inhabitants, of which 294,077 are located in the capital city called San Francisco de Campeche (Campeche Innovation Agenda, 2015) The municipality of Campeche is the first in order of demographic importance of the eleven that make up the state. Its municipal capital is the city of San Francisco de Campeche, capital of the state and main urban centre, covering a territorial extension of 3,410.64 km², which represents 5.99 % of the total area of the state and its population density is 91.2 inhabitants/km².

From an economic point of view, the state of Campeche is among the richest in the South-Southeast region, due to its oil activity (Campeche Innovation Agenda, 2015). Another characteristic of the state is the promotion of sustainability, being one of the most competitive entities in monitoring air quality and having the highest volume of wastewater treated.

The software industry in the State of Campeche began in the 1990s with an SME made up of entrepreneurial industrial engineers and computer science graduates, about which there is little information, since it lasted only a few years in operation. The average age of operating software development MSMEs in Campeche is 10.5 years.

In 2010, the Information Technology Industry Council of Campeche (CITI Campeche) was created, becoming the first technology cluster in the state. CITI Campeche began with the mission of contributing to the development of the IT industry, promoting the various companies that formed it, as well as the creation of new companies that respond to the needs of the national and international market, all through strategic alliances. Unfortunately, the Campeche cluster did not manage to transcend and a few years later it was closed. In 2019, a new cluster of information and communication technologies was created in Campeche, born from an alliance between professional companies in the ICT sector, government, universities and leaders in the state of Campeche, called Ah Kim Tech.

The companies that make up this cluster are listed in Table I according to their line of business, i.e., by the type of productive and economic activities that the companies have.

PYMES	Turn
Pyme 1	Software development, related services and marketing
Pyme 2	Design and related services
Pyme 3	IT security
Pyme 4	UAV implementation
Pyme 5	Marketing company
Pyme 6	Industrial projects and civil works
Pyme 7	Software development and marketing
Pyme 8	Design and related services
Pyme 9	Other
Pyme 10	Software development, commercialisation, networking, marketing
Pyme 11	Industrial projects and civil works
Pyme 12	Other

Table 1 Ah Kim Tech cluster companies
Source: Own elaboration

Of the 12 companies that make up this cluster, only three are dedicated to software development. It is worth noting that most of the companies that make up the cluster in the city of San Francisco de Campeche include more than one line of business in their companies, as is the case of SME 10, SME 7 and SME 1, which, despite being software developers, also handle marketing, commercialisation and network management. The business lines of the cluster companies can be seen in figure 6.

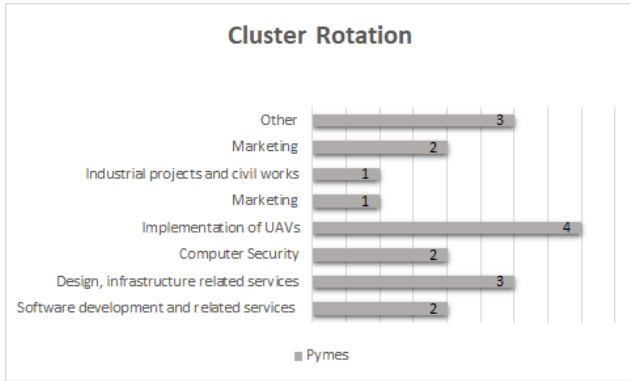


Figure 6 Business lines of the companies in the cluster
Source: Own elaboration

The target population of the instrument is made up of all the software development companies that have their fiscal domicile in the city of San Francisco de Campeche, a total of six, of which three belong to the Ah Kim Tech cluster and three do not belong to any association.

On the other hand, there are three development companies that are not affiliated to any association or cluster. These are listed in table II.

PYMES	Turn
Pyme 13	Software developer and marketing.
Pyme 14	Software developer, network administration and training.
Pyme 15	Software developer and marketing.

Table 2 Non-affiliated software development companies
Source: Own elaboration

Like the companies affiliated to the cluster, the non-affiliated companies also cover more than one line of business. Figure 7 shows the lines of business of the non-affiliated companies.

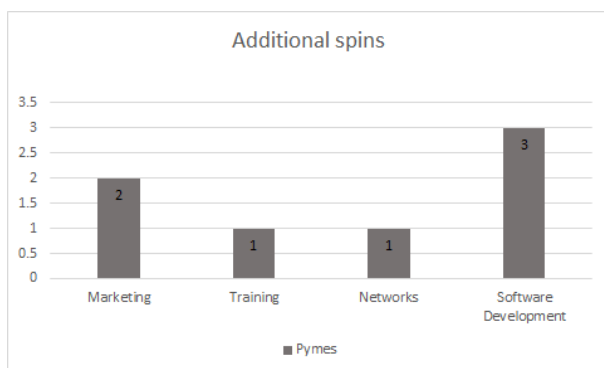


Figure 7 Turnover of non-affiliated companies
Source: Own elaboration

The application of this instrument was carried out during the month of March 2022, a total of five development companies participated, two from the Ah Kim Tech cluster (since one of the three, for health reasons the manager was unable to answer the survey) and three that are not affiliated, as shown in Figure 8.



Figure 8 SME participation
Source: Own elaboration

Results

The software developed, called "Virtual Observatory", automatically performs the statistical analysis of the data thanks to the definitions of variables and formulas that were established in the construction of the instrument, therefore, it offers the option of visualising the results from different perspectives.

Figure 9 shows the innovation activities, it can be seen that none of the companies consider the activity of satisfying future needs as a priority, since they are based more on sustaining existing market needs, as well as responding to accidental activities and unexpected opportunities that may be created by competitors (Riva, 2005).

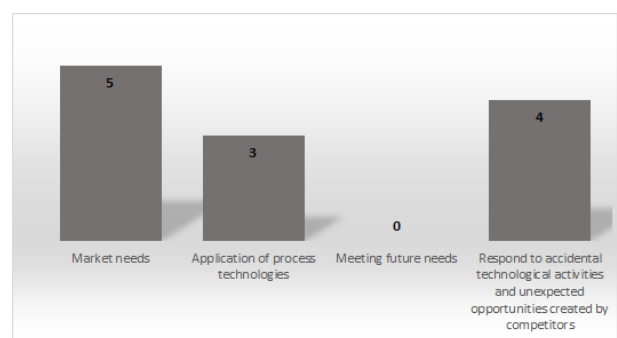


Figure 9 Number of MSMEs by innovation activities
Source: Own elaboration

Figure 10 shows the activities related to research, innovation and development that SMEs prefer not to carry out. This graph shows that one company is in the National Register of Scientific and Technological Institutions and Companies (RENIECYT).

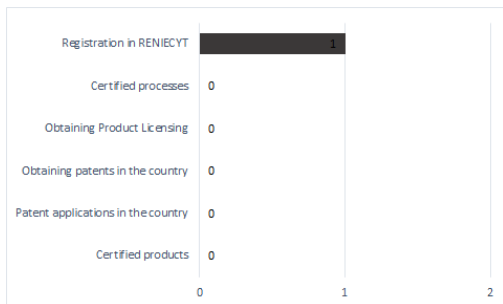


Figure 10 Number of MSMEs by research, innovation and development activities
Source: Own elaboration

Figure 11 shows some certifications that contribute to the improvement of MSMEs' business processes; however, in the survey, none of the MSMEs registered having any of them.

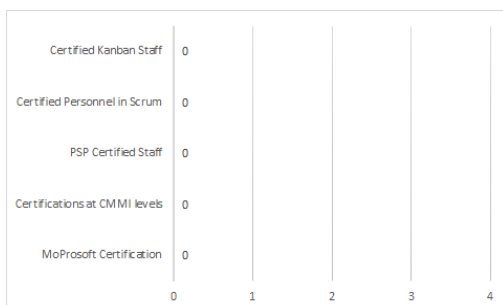


Figure 11 Number of MSMEs with certifications
Source: Own elaboration

Regarding measurement and control processes for quantitative process management, Figure 12 shows that a company carries out the activity of inspecting organisational process performance, which helps companies identify gaps in performance against business objectives and implement improvements to close the gaps (Garcia, 2013).

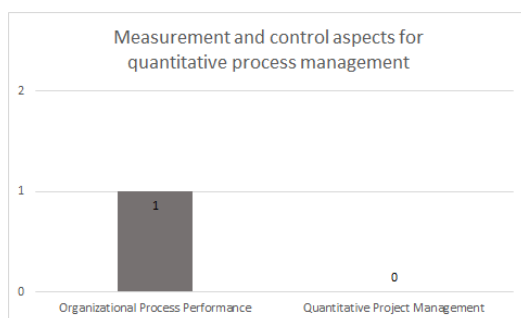


Figure 12 Number of MSMEs that use measurement and control aspects for quantitative process management
Source: Own elaboration

Figure 13 shows the number of MSMEs that carry out various activities to standardise their processes; among the most used are: validation, verification, product integration, technical solution and requirements development.

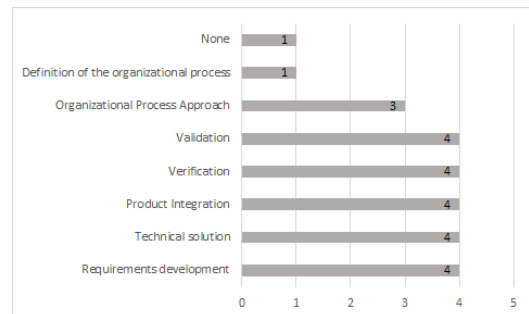


Figure 13 Number of MSMEs considering aspects for the standardisation of their processes
Source: Own elaboration

The results showed that three of the MSMEs do not use any of the basic aspects for the management of their projects, two of the participating companies consider that the most important aspects are project planning, as well as requirements management. Regarding process and product quality assurance, supplier agreement management and the monitoring and control programme are implemented by at least one of the companies, as shown in figure 14.

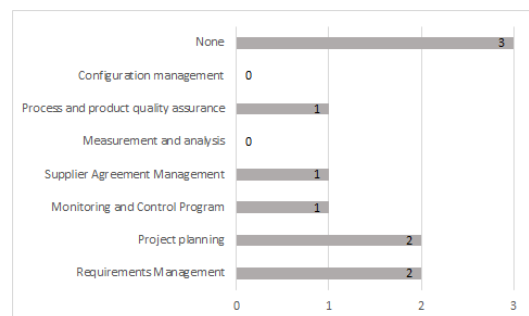


Figure 14 Number of MSMEs using basic aspects of project management
Source: Own elaboration

Conclusions

Thanks to the application of the instrument and the approach to development companies, it is possible to have an overview of the internal conditions involved in the economic development of the software industry in the city of San Francisco de Campeche, as well as to identify its composition and technical capabilities.

The software industry in Campeche is symmetrically segmented between companies that are committed to working collaboratively in a formal organisation such as a cluster and those that have managed to succeed without being part of a collaborative network. For future research, a comparative study of the strengths and weaknesses that characterise these two sectors can be undertaken (Jenkins, 2007).

We observe a software industry reactive to market needs, to improve processes or to respond to accidental technological activities and unexpected opportunities created by competitors, which has not yet come up with products to meet future needs. It would be useful to investigate the reasons why visualising new services has remained limited (Ortiz and Arredondo, 2014).

Most of the SMEs studied value the standardisation of their processes through validation, verification, product integration, technical solution and requirements development, however, to date none is certified or in the process of certification by any recognised standard, although one of them states that it has obtained certification by the Technical Standard NMX-059/01-NYCE-2005 of the MoProSoft software industry process model at level 2, thanks to the government programme Mexico Firts (Vera, 2019). It remains to be seen why companies have not opted for certification of their processes and personnel. On the other hand, project management is an activity that half of the companies do not carry out formally, which reinforces the importance of encouraging interest in raising the standards of internal processes (Merchán, 2007).

To conclude, we leave the reflection taken from the United Nations Conference on Trade and Development (Secretariat, 2001) to consider the software industry as a priority sector for the generation of new jobs and industrial growth based on the creation of software supply for export.

Acknowledgements

We are grateful to the Government of Mexico for funding this project, which through the Teacher Improvement Programme of the Ministry of Public Education is committed to strengthening the academic bodies of universities. We would also like to thank the Universidad Autónoma de Campeche for the facilities provided to carry out this research. We are especially grateful to the software companies located in the city of San Francisco de Campeche for opening their doors to us and giving us the opportunity to gather information about them.

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E-commerce sustainability strategy in the entrepreneurship Victoria de Durango, Dgo. Mexico

Comercio electrónico estrategia de sostenibilidad en el emprendimiento Victoria de Durango, Dgo. México

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DOI:10.35429/JEDT.2022.11.6.33.45

Received September 20, 2022; Accepted December 30, 2022

Abstract

Electronic commerce is the purchase - sale of products and / or services using electronic means, it has been a business strategy that entrepreneurship has used as an alternative of sustainability in the face of the conditions of the new normal. The objective of the study is to analyze electronic commerce as a sustainability strategy of entrepreneurship in the city of Victoria de Durango, Dgo. A quantitative approach was used for the research, with a descriptive, explanatory and correlational design and a cross-sectional scope. The sample was made up of 253 enterprises located in the city of Victoria de Durango. The results show that entrepreneurs made use of information technologies to implement electronic commerce, social networks as part of electronic commerce to promote and publicize their products and / or services and invested in training to strengthen this commercial strategy of sustainability. For entrepreneurs, the implementation of e-commerce in their business was part of the search for opportunities to remain in the highly competitive market. The information generated from this research will serve as background for future studies related to electronic commerce and entrepreneurship such as the importance of digital transformation in entrepreneurship, the importance of organizational culture in technological change in entrepreneurship.

E-commerce, Entrepreneurship, Organizational culture, Search for opportunities, Information and communication technologies

Resumen

El comercio electrónico es la compra - venta de productos y/o servicios haciendo uso de medios electrónicos, ha sido una estrategia empresarial que el emprendimiento ha usado como alternativa de sostenibilidad ante las condiciones de la nueva normalidad. El objetivo del estudio es analizar el comercio electrónico como estrategia de sostenibilidad del emprendimiento en la ciudad de Victoria de Durango, Dgo. Para la investigación se usó un enfoque cuantitativo, con un diseño descriptivo, explicativo y correlacional y un alcance transversal. La muestra quedó conformada por 253 emprendimientos ubicados en la ciudad de Victoria de Durango. Los resultados muestran que los emprendedores hicieron uso de tecnologías de información para implementar el comercio electrónico, de las redes sociales como parte del comercio electrónico para promocionar y dar a conocer sus productos y/o servicios e invirtieron en capacitación para fortalecer esta estrategia comercial de sostenibilidad. Para los emprendedores la implementación del comercio electrónico en sus negocio fue parte de la búsqueda de oportunidades para permanecer en el mercado tan competido. La información generada de esta investigación servirá como antecedentes para futuros estudios relacionados con comercio electrónico y emprendimiento como la importancia de la transformación digital en los emprendimientos, la importancia de la cultura organizacional en el cambio tecnológico en los emprendimientos.

Comercio electrónico, Emprendimiento, Cultura organizacional, Buscar oportunidades, Tecnologías de la información y comunicación

Citation: LECHUGA-NEVÁREZ, Mayela del Rayo. E-commerce sustainability strategy in the entrepreneurship Victoria de Durango, Dgo. Mexico. Journal-Economic Development Technological Chance and Growth. 2022. 6-11:33-45.

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Introduction

The digital revolution has generated an increase in changes that have led to a transformation of the economy. At the end of the 1980s, with the use of the internet, the transformation towards the automation of business models began, through the use of digital platforms (Alejos & Pérez, 2022). Currently, forms of business activities are being sought that incorporate other dimensions, such as social and environmental (ECLAC, 2021), and that also incorporate value propositions in products and services (Alejos & Pérez, 2022).

In addition to this transformation, new challenges have arisen, such as the COVID-19 pandemic, which has immobilised and transformed the world in an inconceivable way. These exchanges have promoted the use of digital tools in the face of the economic shock we are experiencing, with e-commerce being the most popular (Misas, Silva & Ruiz, 2021).

E-commerce in the face of the new normal has come to revolutionise and generate competitive advantage in business ventures. In the business world, businesses must be competitive, as this is the only way to remain in today's highly competitive markets. That is why, when creating an organisation or enterprise, the best business strategy to follow must be chosen, as this is of utmost importance to achieve success, no company can be competing without a mission, without objectives, without goals and without the necessary strategies to achieve these objectives, so it is very important that the decision is thoroughly analysed (Nevárez, Hernández, Sierra & Reyes, 2021).

In this sense and according to Porter, the characteristics of the environment make it possible to increase innovation and quality of business processes, success is based on the strategic relationships maintained and the ability of enterprises to innovate, at this point it is important to note that one of the fundamental pillars of any business that wants to grow, develop and consolidate, is its ability to innovate and adapt to change, attention should be paid to the product, design, marketing and distribution of products; This allows managers to isolate the sources of value related to price (Villarreal, 2022).

In relation to entrepreneurship, the emphasis is on the creation and understanding of commercial opportunities to add value, these can have two externalities, one of which can be beneficial or detrimental to the welfare of society and third parties; whereby consumers and stakeholders have the responsibility to generate social change, being in this case sustainable entrepreneurship that provides a different outcome, contributing to social transformation and balancing the pattern of economic growth (Hummels and Argyrou, 2021). Currently this new approach entered a new phase of development within the era of digital technology, influenced by the innovative tendencies of entrepreneurs who must evaluate, create, track and identify business value opportunities taking the possible risks (Kurniawati, E., Al Siddiq, I. H., and Idris, F., 2020), under this approach, the implementation of e-commerce as a sustainability strategy has come to strengthen entrepreneurship under the conditions of the new normality, therefore, the strategy must be real and achievable otherwise the venture will not be able to carry it out (Nevárez, Hernández, Sierra & Reyes, 2021) and this will impact on the survival of the same.

Entrepreneurship as a pillar of economic and social development has been studied and analysed in aspects such as how it is produced, how products and services are promoted and how they are sold to customers. E-commerce is a bridge between the digital society and the transition to a sustainable economy (Ecommerce Europe, 2021).

However, the reality of each country, state, municipality or city, as is the case of Victoria de Durango, Durango, and the economic systems are different, so e-commerce has developed in different ways in these environments, which has led to and brought with it a number of aspects to consider (Misas, Silva & Ruiz, 2021) so that businesses can implement it as a strategy for sustainability in the face of the new normality. Given these precedents, the objective of this study is to analyse e-commerce as a sustainability strategy for entrepreneurship in the city of Victoria de Durango, Dgo.

Concept of e-commerce

The fourth digital revolution has given rise to an evolution for human beings that thrives without precedent, bringing about changes in the lifestyles of consumers and entrepreneurs. These changes do not mean an exception for the commercial sphere; on the contrary, they propose a transformation in the industry, for those who choose to adapt to this new lifestyle by offering sustainable products and services, which fit both conventional media and new technologies (Misas, Silva & Ruiz, 2021). This transition has been a challenge for all, especially for companies worldwide, as they must make improvements in their standards to mitigate the impact of their operations (Misas, Silva & Ruiz, 2021).

The World Trade Organization (1998) defines e-commerce as the production, distribution, marketing, sale or delivery of goods and services by electronic means (WTO, 1998).

The Organisation for Economic Co-operation and Development (2011) conceptualises e-commerce as the buying or selling of goods or services over computer-mediated networks, whether between businesses, households, individuals, governments and other public or private organisations.

Vanhoose (2003) describes it as any process that involves the exchange of property or the use of rights to goods and services electronically by linking devices and communicating interactively within the network.

E-commerce is a commercial business model where individuals interact electronically, without having to go in person to a physical shop; this type of business model desisted from offering products or services through simple catalogues in immovable pages, becoming an indispensable channel through which sales and profits are made that benefit entrepreneurs; serving as a business model for different areas of companies at national and international level (Mora, 2019)

According to Sánchez (2015, cited in Sumba et al., 2020), they argued that e-commerce has generated opportunities and benefits for companies, reaching users more quickly and accurately, managing to eliminate barriers and intermediaries, without the need to spend a lot of money.

In these definitions, two important elements can be identified: the use of technology and commercial exchange, which generates the activity of buying and selling or the exchange of goods or services using information technologies.

The users of Information and Communication Technologies with the increase in their use has given rise to a great diversity of interactions in their application, four forms of electronic commercial exchange are recognised: consumer to business e-commerce (C2B), business to consumer e-commerce (B2C), consumer to consumer e-commerce (C2C) and business to business e-commerce (B2B), the two most notable being B2C e-commerce and B2B e-commerce (Misas, Silva & Ruiz, 2021).

The first type is where entrepreneurs or a digital specialist, through an e-shop, provide potential consumers with their products or services. In the second, business-to-business transactions take place. Organisations make electronic purchases from their suppliers, who have developed websites or applications tailored to their business such as online shopping platforms (Misas, Silva & Ruiz, 2021).

Concept of Entrepreneurship

Talking about entrepreneurship is very interesting, even more so in the critical times that humanity is facing due to COVID 19, which is why it is of great interest nowadays (Jurado-Paz, 2022).

Entrepreneurship is a concept of recognised importance nowadays that plays an essential role in the economic development of a country and in social cohesion, as it represents a vehicle for personal development and offers the opportunity to improve employability (Krauss, 2011; Marina, 2010; Raposo and Paço, 2011; Rodríguez and Prieto, 2009).

Entrepreneurship is currently considered as a tool for states to promote economic, social, productive and even cultural development within the territories, however, despite the benefits of this trend, there are still considerable challenges for the contributions obtained to be truly sustainable and impactful (Jurado-Paz, 2021).

Entrepreneurship refers to the ability to start from scratch to create a project, an initiative or a business (Morales-López & Espitia-Rodríguez, 2021).

Entrepreneurship is the human capacity to start their own initiatives, lead them and make them the ideal scenario to benefit not only the individual but society in general. (Jurado-Paz, 2022).

Entrepreneurship is that attitude and aptitude of each university student that helps to initiate new projects and challenges (Machaca-Huancollo, Larico-Mamani, Condori-Cari & Coila-Alcocer, 2021).

There are also other perspectives that broaden the concept such as: Entrepreneurship means using creativity and applying innovative ideas to make a difference in the community by addressing a need or creating a socially conscious business and entrepreneurship is a way of thinking that extols collaboration, risk-taking and activation (Morales-López & Espitia-Rodríguez, 2021).

Ventures must adapt to technological advances to become more profitable (Castro, Bourne, Véliz & Ramírez, 2021).

Conceptualising sustainability

The word sustainable stands for something that is able to be preserved or reproduced by its own particularities without external support. The term can be applied to various issues: production methods, economic processes, among others (Isabel, Alarcón, Ronald & Johanna, 2016).

Sustainability is a complicated concept that goes beyond the environmental concept. It is an activity that seeks to satisfy economic, social, cultural diversity and healthy environmental needs. Although sustainability is a relatively new phenomenon, it has become a focus of attention in recent years as it has been proven that the development of sustainable ventures is not only the most feasible way to care for and preserve the planet, but also a new way to grow economically and add value to businesses (Montero & Laguardia, 2022).

Sustainability in business has a meaning of balance in the economic and social spheres. According to Ricart (2016), the search for sustainability requires a paradigm shift, which aims to involve changing the values of companies, i.e. instead of thinking that maximising shareholder value is the ultimate value of companies, it is about a change, a new vision where the company becomes aware of society, with the aim of surviving in the face of adverse circumstances. In this context, the main benefit is to achieve survival through productivity and wealth creation, affecting entrepreneurship and society in general.

Sustainability is the balance achieved by ventures during the different stages of the entrepreneurial process in their aim to survive in the face of the various obstacles presented and whose main consequence is survival.

Despite the importance of entrepreneurial activity, the generation of a significant impact on the economy implies guaranteeing the sustainability over time of the ventures and therefore the generation of value, but what is evident in reality is that a high percentage of these companies disappear in the short term (Sepúlveda & Reina, 2016).

E-commerce as an entrepreneurial sustainability strategy

A business strategy for sustainability is a process of discovery and innovation and continuous improvement based on business plans and actions that chart the course of an organisation. It is important to establish business strategies according to the needs of each organisation in order to obtain a competitive advantage that will allow the company's objectives to be met (Alaña et al., 2018).

E-commerce is a strategy that gives the company its development, expanding borders, reaching more customers, providing customer advice, marketing in a practical, fast and simple way, thus obtaining customer satisfaction and subsequent customer loyalty (Carrión-Carrión, Muñoz-Jimbo, Romero-Black & Mora-Sánchez, 2021).

E-commerce as a sustainability strategy provides a number of benefits to both companies and users, so that this tool allows efficient interaction in which the time of the company and the customer is optimised in the processes of purchase, sale by its ease of access to any virtual platform and thus provide a better service as the advice that is given as soon as the customer wants information of such product or service (Guzman and Abreo, 2017).

Globally e-commerce plays an important role in companies; by 2021 micro businesses will have a remarkable growth until 2022, currently Latin America leads in e-Commerce however in recent periods has obtained much profitability by this means, regionally Brazil leads the market with more than 28,000 million in sales using e-commerce as a tool in 2018, in second place is Mexico with 18,000 million at the same time Argentina earned 11,000 million and Colombia 6,000 million in profits from online product sales (Guerrero, 2019).

E-commerce as a sustainability strategy for entrepreneurship has become an essential factor, within the framework of the COVID-19 pandemic, where the main reason is to establish means of communication between companies and consumers, thus demonstrating a significant increase in sales in the ventures that already apply it; however, new companies face a great challenge in having to sacrifice their resources, which could be limited in order to obtain more sales (Unzueta, Hilares, Gumán & Wong, 2022).

Methodology

Taking into account the requirements established by the National Council of Science and Technology (CONACYT), the study is in the area of social sciences, in the field of administration and business; discipline: administration and management; sub-discipline: innovation management.

The research was carried out in the city of Victoria de Durango, the municipal capital of the municipality of Durango and capital of the state. The city has a population of 616,068 inhabitants according to the 2020 results of the XIV Population and Housing Census of the National Institute of Statistics and Geography (INEGI, 2020), it ranks 30th among the most populated cities in the country. It is located between the parallel 23°57' and 24°05' north latitude, between the meridians 104°33' and 104°43' referring to Greenwich (Inafed, 2016). The valley where it is located has an area of approximately 700 km² and is bordered to the north by the valley of Canatlán, to the south and west by the Sierra Madre Occidental, to the southeast by the Sierra del Registro and to the east by the plains area bordering it with a series of hills and elevations (Inafed, 2016) (See figure 1).



Figure 1 Geographical location of the study subject
Source: INEGI/CONABIO, (2010)

The study began with a literature review, which allowed the construction of the research context, as well as the strengthening of the theoretical framework on the topics of e-commerce, entrepreneurship and e-commerce as a sustainability strategy for entrepreneurship under the conditions of the new normality.

The approach of this work is quantitative, where the variables of e-commerce as a sustainability strategy and entrepreneurship were analysed.

The research design is correlational by establishing the relationship between the variables of the study. It is descriptive and explanatory in that it seeks to specify properties, characteristics and important features of the phenomenon, event, community, context or situation being analysed, non-experimental, as no manipulation of the variable is carried out (Hernández et al., 2017).

The scope is cross-sectional, i.e. the collection of information was carried out in a single period of time.

The technique used to collect the information was the survey and the instrument used was the questionnaire.

The design of the survey was based on the operationalisation of the variables after an exhaustive literature review (see table 1). The questionnaire consists of 50 questions to analyse each of the research variables (e-commerce as a strategy for sustainability and entrepreneurship), five questions for each factor of analysis, using the Likert scale, with the following values depending on the case, 0 totally disagree, 1 Disagree, 2 I am indifferent, 3 Agree and 4 Totally agree.

Variable	Factor
E-commerce as a sustainability strategy	Organisational culture
	Use of social networks
	Use of Information and Communication Technologies
	Knowledge in the use of Information and Communication Technologies
	Change of consumption patterns
Entrepreneurship	Taking Risks
	Initiative
	Perseverance
	Independence
	Seek Opportunities

Table 1 Variables of the subject of study and their factors of analysis

Source: Own elaboration, (2022)

To assess the validity of the questionnaire, the technique of expert judgement was applied, where their feedback allowed the instrument to be strengthened.

Subsequently, a pilot test was carried out and the reliability of the instrument was analysed using Cronbach's Alpha coefficient, obtaining a value of .901, which is considered to be a strong reliability.

The sample was determined from the population, with a confidence level of 95% and an error of 5%, as well as the type of sampling. Non-probability convenience sampling was used, considering the characteristics of the sample. The sample was determined following the inclusion criterion: enterprises in the city of Victoria de Durango, and consisted of 250 enterprises.

The information was collected through a formal request to the different subjects of the study.

Once the survey was applied, the database was created in Excel and then imported into SPSS ver. 25 for data processing, analysis and interpretation.

Results and discussion

This section shows the results obtained from this research whose objective is to analyse e-commerce as a strategy for sustainability in entrepreneurship in the city of Victoria de Durango, Dgo. Mexico. Once the fieldwork had been carried out, in which 253 entrepreneurs, owners of these enterprises in the state capital, were surveyed, the database was compiled and analysed, and the results are presented in the following sections: characterisation of the entrepreneurs who own the enterprises under study, characterisation of the enterprises surveyed, descriptive and statistical analysis of the factors and variables of the subject of the study.

Characterisation of the entrepreneurs who own the ventures under study

The characterisation of the entrepreneurs studied shows the most significant attributes of the sample studied, which are mentioned below: the average age of the entrepreneurs is 34.6 years; 53% (134) belong to the male gender while 47% (119) belong to the female gender, showing a reduction in this gap and with it the empowerment of women as the breadwinners of their families. In relation to marital status, 42% (106) are married, while 33% (84) are single.

Academic degree is another important factor, which shows that 23% (58) have primary school, 28% (71) secondary school, 25% (63) high school and 20% (51) bachelor's degree and only 4% (10) postgraduate degree. Regarding the socio-economic level, the data show that 88% (223) have an intermediate level. These data are shown in table 2.

N 253		
Factor	Indicator	Value
Gender	Female	47% (119)
	Male	53% (134)
Marital Status	Single	33% (84)
	Married	42% (106)
	Unmarried	21% (53)
	Widowed	4% (10)
Academic degree	Primary	23% (58)
	Secondary	28% (71)
	High school	25% (63)
	Bachelor's degree	20% (51)
	Postgraduate	4% (10)
Socio-economic status	High	8% (20)
	Medium	88% (223)
	Low	4% (10)

Table 2 Characterisation of the entrepreneurs surveyed.
Source: Own elaboration, (2022)

Characterisation of the enterprises surveyed

Of the enterprises studied, 86% (218) are micro, i.e., they have 0 to 10 employees and an average annual sales of up to 4 million pesos (DOF, 2009), while 12% (30) are small, with 11 to 50 employees and an average annual sales of 4.01 to 100 million pesos (DOF, 2009). Regarding the type of organisation, 23% (58) are ventures created and run by family members; in relation to the stage of the venture, 43% (109) are in start-up and growth, i.e. have an average age of 3 years, 38% (96) are in consolidation with an age of more than 3 years, but less than 10 years and 19% (48) are in expansion with an age of more than 10 years; 58% (147) of the surveyed enterprises belong to the service sector, 32% (81) to the consumer sector; 73% (185) of the enterprises in the study sample were created out of necessity, showing that they were created seeking to generate immediate income and their creation was done with very little rigidity in terms of the analysis of the business idea. These results are shown in table 3.

N 253		
Factor	Indicator	Value
Firm size	Micro	86% (218)
Factor	Small	12% (30)
	Medium	2% (5)
Type of organisation	Family	23% (58)
	Non-family	77% (195)
Stage of entrepreneurship	Idea	0% (0)
	Start-up and growth	43% (109)
	Consolidated	38% (96)
	Expansion	19% (48)
Turn	Services	58% (147)
	Industrial	8% (20)
	Consumer	32% (81)
	Transformation	2% (5)
Type of enterprise	By necessity	73% (185)
	By opportunity	27% (68)

Table 3 Characterisation of the surveyed enterprises
Source: Own elaboration, (2022)

Descriptive statistical analysis of the variables e-commerce as a strategy for sustainability and entrepreneurship

For the e-commerce variable, the most significant factor was Organisational Culture with a mean of 4.6 ± 0.3 , indicating that the implementation of e-commerce in the ventures implies a change in organisational culture and at the time there was resistance to this change. In this order, the next significant factor was the Use of Information and Communication Technologies with a mean of 4.5 ± 0.5 , which shows that the entrepreneurs had to make use of technological tools to automate their processes; then the Use of Social Networks factor with a mean of 4.4 ± 0.5 , which explains that they have been an option to promote themselves and an alternative to e-commerce sales at no extra cost. Along the same lines, the factors of Knowledge in the use of Information and Communication Technologies and Change of consumption patterns with a mean of 4.3 ± 0.5 , the competences and knowledge in information technologies of the collaborators and as a group were the decisive force in determining the success of this sustainability strategy such as e-commerce. In addition to this, the change of patterns experienced by consumers also influenced the cultural change by talking organisationally and implementing e-commerce as part of the sustainability of the venture under the conditions of the new normality.

For entrepreneurship, the factor that presented the greatest significance for the entrepreneur was Seek Opportunities with a mean of 4.5 ± 0.3 , showing that e-commerce has been part of the opportunities that entrepreneurs sought as a sustainability strategy; the next significant factor was Take Risk with a mean of 4.3 ± 0.4 , showing that entrepreneurs decided to take the risk of investing in information technologies to automate their processes to buy and sell their products and/or services. In this order of significance was the Initiative factor with a mean of 4.2 ± 0.5 , showing that entrepreneurs must have the capacity to transform and innovate within the businesses created. These results are shown in table 4.

Variable	Factor	Media σ
E-commerce as a sustainability strategy	Organisational culture	4.6 ± 0.3
	Use of social networks	4.4 ± 0.5
	Use of Information and Communication Technologies	4.5 ± 0.5
	Knowledge in the use of Information and Communication Technologies	4.3 ± 0.5
	Change of consumption patterns	4.3 ± 0.5
Entrepreneurship	Taking Risks	4.3 ± 0.4
	Initiative	4.2 ± 0.5
	Perseverance	3.8 ± 0.5
	Independence	4.1 ± 0.7
	Seek Opportunities	4.5 ± 0.3

Table 4 Factors for the variables e-commerce as a strategy for sustainability and entrepreneurship
Source: Own elaboration, (2022)

Inferential statistical analysis of the variables e-commerce as a strategy for sustainability and entrepreneurship

The Eta squared coefficient (η^2), shows the association between the factors considered to evaluate the variables considered in a study, in which there is an independent variable and a dependent variable. A strong effect was observed for each of the factors used to analyse e-commerce as a strategy for sustainability and entrepreneurship.

Analysing the e-commerce variable, the factor with the strongest association is Organisational Culture with a squared Eta of 0.656, explaining that the organisational culture of the enterprises has been an impediment to the implementation of e-commerce, breaking traditional cultural paradigms for some entrepreneurs has not been easy, they have had to make changes in their organisational structure, in their processes; then the factor of Use of Information and Communication Technologies with a squared Eta of 0.536, businesses have had to automate their processes, streamlining and facilitating accessibility to information, influencing the reduction of their costs and an approach to their customers through the design of sales strategies to meet their demands.

Then the factor Use of Social Networks with a square Eta value of 0.511, this factor together with the previous one complements the process of buying and selling products and / or services offered by electronic media of these enterprises studied; the factor with significance in this order of association was Knowledge in the use of Information and Communication Technologies with a square Eta value of 0.498, showing that in addition to the use of social media, the factor Use of Information and Communication Technologies was also significant. 498, showing that in addition to investment in technology, the entrepreneurs also invested in training to face and overcome resistance to technological change and to keep up with the demands of the new normal. And finally, the factor of Change in consumption patterns with a squared Eta of 0.306, indicating that companies have had to create tailor-made services and/or products, taking into account the needs of consumers, since e-commerce has been reactivated and has become a sustainability strategy for companies.

For the entrepreneurship variable, the factor with the highest association was Seek Opportunities with a squared Eta value of 0.697, this shows that entrepreneurs through e-commerce sought new opportunities for growth, development, consolidation and expansion; followed by the Initiative factor with a squared Eta value of 0.636, indicating that the ventures have innovated in their different activities, including the implementation of e-commerce to buy and sell products and/or services; then in this order of association, the Risk Taking factor with a squared Eta of 0.634, this explains that entrepreneurs have had to create services and/or products tailored to the needs of consumers, since e-commerce was reactivated and has become a sustainability strategy for the companies. 634, which explains that the entrepreneurs, faced with the conditions of the new normality, had to take the risk and implement e-commerce in their businesses in order to remain in the market, which is why they invested in information technologies and digital platforms, in training, and changed their organisational structure to enter this new business model.

Then the Independence factor with a squared Eta of 0.441, explaining that the implementation of e-commerce within the entrepreneurial activity generates freedom in the operational activities of the businesses. These results are shown in table 5.

Partnership measures			
Variable	Factor	Eta	Square Eta
E-commerce*Organisational culture		0.837	0.656
E-commerce*Use of Social Media		0.721	0.511
E-commerce*Use of Information and Communication Technology		0.737	0.536
E-commerce*Information and Communication Technology skills		0.698	0.498
E-commerce*Changing consumption patterns		0.537	0.306
Entrepreneurship* Risk-taking		0.793	0.634
Entrepreneurship* Initiative		0.796	0.636
Entrepreneurship * Perseverance		0.549	0.312
Entrepreneurship * Independence		0.559	0.441
Entrepreneurship* Seek Opportunities		0.898	0.697

Table 5 Measures of association between the variables of e-commerce as a sustainability and entrepreneurship strategy and their factors
 Source: Own elaboration, (2022)

Correlation analysis of the variables of e-commerce as a sustainability strategy and entrepreneurship

Correlation analysis indicates whether two variables are related. In this case the results show that e-commerce as a sustainability strategy and entrepreneurship are related, i.e. if the value of e-commerce increases, entrepreneurship will also increase (see table 6). Translated to the operational part of the study, this indicates that the implementation of e-commerce in businesses has been a positive sustainability strategy, which has allowed them to survive, develop, consolidate and expand in today's competitive markets.

Correlations			
E-commerce	Entrepreneurship		
E-commerce	Pearson correlation	1	.895**
	Sig. (one-sided)		.000
	N	253	253
Entrepreneurship	Pearson correlation	.895**	1
	Sig. (one-sided)	.000	
	N	253	253

Table 6 Correlation analysis of the variables of e-commerce as a sustainability strategy and entrepreneurship
 Source: Own elaboration, (2022)

Conclusions

The study fulfils the objective: to analyse e-commerce as a strategy for the sustainability of entrepreneurship in Victoria de Durango, Durango, Mexico, in this sense, once the study variables were analysed, the entrepreneurs in the city of Victoria de Durango, Dgo. Mexico, the results show that the average age of the entrepreneurs is 34.6 years; 53% (134) belong to the male gender while 47% (119) belong to the female gender, observing a reduction in this gap and with it the empowerment of women as the breadwinner of their families; the data show that 88% (223) have a medium socioeconomic level.

Of the enterprises studied, 86% (218) are micro, i.e. they have 0 to 10 employees and an average annual sales of up to 4 million pesos (DOF, 2009), 23% (58) are enterprises created and run by family members; 58% (147) of the enterprises surveyed belong to the service sector, 32% (81) to the consumer sector, 73% (185) of the enterprises surveyed belong to the service sector, 32% (81) to the consumer sector and 73% (185) of the enterprises surveyed are micro enterprises; 73% (185) of the enterprises in the study sample were created out of necessity, showing that they were created seeking to generate an immediate income and their creation was done with very little rigour in terms of the analysis of the business idea.

Given the conditions of the new normal, the enterprises implemented sustainable business strategies aligned with the use of e-commerce, the use of social networks such as Facebook, WhatsApp and digital platforms, assuming with responsibility and commitment their activity to meet the demands of consumers and society in general.

On the other hand, these ways of doing business have led to the optimisation of resources in the operation of enterprises, operating costs have been reduced, teleworking has regained value and in some cases entrepreneurs have stopped paying rent, under a sustainable development model that entrepreneurs could take into account in order to adopt on a permanent basis.

E-commerce as an aid to entrepreneurship had to break traditional paradigms of buying and selling, where the organisational culture of these had to undergo changes in order to implement it, as explained in the results section, where it is shown that it was the most significant factor in the e-commerce variable.

This e-commerce tool contributes significantly to the economic development of the enterprises as it allows them to generate income through both virtual and traditional sales, without doubt the use of Information and Communication Technologies has come to transform the way of doing business, being in the analysis the second most significant factor for the e-commerce variable.

The use of Social Media as part of the marketing strategy in the implementation of e-commerce by the enterprises complemented the business strategy.

Knowledge in the use of Information and Communication Technologies had to be strengthened, so entrepreneurs had to invest in training to prepare their employees and make e-commerce as a sustainability strategy more efficient and effective.

The change in consumption patterns meant that businesses have had to create tailor-made services and/or products, taking into account the needs of consumers, as e-commerce was reactivated and has become a sustainability strategy for companies.

The study also shows that entrepreneurs, faced with the conditions of the new normality, had to look for opportunities to remain in the market and in this search, e-commerce was an alternative solution and a sustainability strategy. Along the same lines, the initiative factor allowed them to innovate in the different buying and selling activities within their businesses, and they also decided to take risks and invest in infrastructure and information technologies, digital platforms, social networks and training to face the change in patterns and meet the demands of society, in addition to the above, the security of transactions required by e-commerce has also been an aspect that entrepreneurs have decided to address.

In conclusion, the implementation of e-commerce in entrepreneurship has been a positive sustainability strategy, which has allowed them to survive, develop, consolidate and expand in today's competitive markets.

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Abstract (In English, 150-200 words)

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Objectives
Methodology
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Keywords (In Spanish)

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Citation: Surname (IN UPPERCASE), Name 1st Author^{†*}, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor. Paper Title. Journal-Economic Development Technological Chance and Growth. Year 1-1: 1-11 [Times New Roman No.10]

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† Researcher contributing as first author.

Introduction

Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

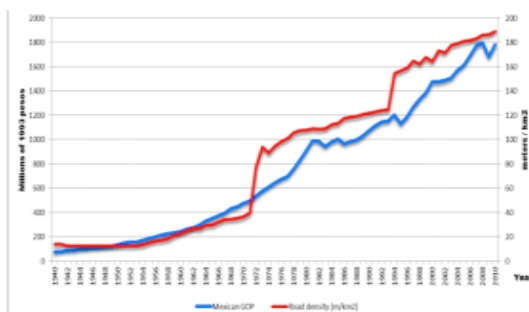
[Title No.12 in Times New Roman, single spaced and Bold]

Products in development No.12 Times New Roman, single spaced.

Including graphs, figures and tables-Editable

In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

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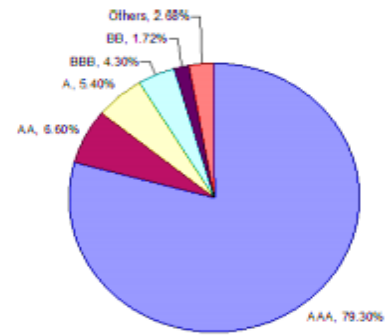


Figure 1 Title and Source (in italics).

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	favourable economic conditions to meet its commitments
CC	Borrower is highly vulnerable
C	Borrower may be in bankruptcy but is still paying its obligations
D	Borrower has defaulted on obligations and CRA believes that it will generally default on most or all obligations
MOODY'S scale varies slightly	
Investment Grade	From AAA to BAA3
Speculative Grade	From Ba1 to C, (C being in default)

Table 1 Title and Source (in italics).

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Each Article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^r \beta_h X_{hij} + u_j + e_{ij} \quad (1)$$

They must be editable and number aligned on the right side.

Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the Article.

Instructions for Scientific, Technological and Innovation Publication

Annexes

Tables and adequate sources thanks to indicate if they were funded by any institution, University or company.

Conclusions

Explain clearly the results and possibilities of improvement.

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Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use Roman Alphabet, all references you have used must be in the Roman Alphabet, even if you have quoted an Article, book in any of the official languages of the United Nations (English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic), you must write the reference in Roman script and not in any of the official languages.

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2. Description of the method

3. Analysis from the regression demand curve

4. Results

5. Thanks

6. Conclusions

7. References

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