Augmented Reality, Immersed Reality and Mixed Reality as a Business Strategy in Honduran Companies

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Augmented reality and immersive virtual reality are new technologies developed that can be used by Honduran companies to create particular experiences in users. The augmented reality that generates an enriched vision of reality, incorporating in the same elements that give added value through information relevant to users from virtual reality (immersive) which provides a feeling of immersion in the reality created by a System or program, placing the user in a totally unreal world, going through the mixed reality that brings together elements of the previous two and which are applied in various areas, both economic and social development, among others that can help to create new Products and services with added value to increase the income of MSMEs in all economic activities of the country in this globalized and digital world.

Keywords: augmented reality, virtual reality, mixed reality

INTRODUCTION

This article analyzes the experiences using these technologies in the business field in other types of research and how they can be applied in order to innovate and produce added value in the organizational development of Honduras. This paper analyzes the areas that are currently having the strongest application and how users employ it to achieve efficiency, profitability and process automation, as well as the impact level that can be positive or negative in organizations nationally or internationally.

It will also identify the application level that these technologies have in the country and the characteristics shown by the Honduran industry regarding the application and development in those areas that have the greatest influence, and the opportunities they offer.

To this end, the idea is to address the topic of augmented reality, immersive and mixed virtual reality in the areas of tourism, education, medicine, marketing, press and how they can be applied to the treating of disorders and psychological treatments, among others.

The competitiveness and volatility of 21st century markets demand that companies should increasingly implement new technological advances. Santiago, Gutiérrez and García (2007) affirm that nowadays the role of new companies must focus increasingly on the development of technologies that provide new experiences to their clients, including augmented reality, virtual reality and mixed reality.

For a better understanding about the topic to be addressed, we will briefly explain the theoretical and technical concepts in which this research is based.

Callejas, Quiroga and Alarcón (2011) define augmented reality as a technology that combines the real and virtual environment by placing a layer on reality in real time.

In the opinion of Caldera-Serrano (2014), augmented reality offers great possibilities because it brings a rich perception of reality through the combination of real and virtual elements in real time.

Sherman and Craig referred to by Piscitelli (2017), define virtual reality as a tool that is operated through a computerized system where users experience the sensation of being immersed in an unreal world and Olguin, Rivera and Hernández (2006) refer to it as the three-dimensional simulation of a real or imaginary environment, creating a complete interactive experience in visual, auditory and even tactile aspects.

Peñate, Roca and Del Pino (2014) define immersive virtual reality when a sensation of real presence is generated within the created (programmed) scenario which is complemented with information sources that may be auditory or tactile, but the visual one is predominant.

Lozano-Rodero (2013) explains mixed reality as a technology used to create environments that combine elements of the real and virtual world. It is the fusion of digital objects in a real environment without abandoning the specific characteristics of each one.

Augmented Reality, Immersive and Mixed Reality and Their Application in Different Business Areas

The use of this type of technology has been boosted in different economic activities that offer new experiences to their users. Callejas et al., (2011) indicate in their research regarding the implementation of augmented reality in tourism in the city of Tunja where an intelligent cell phone application was developed that places a virtual layer to the surface of the most relevant tourist sites, the user through his/her mobile device had access to the site's information and also had interaction with other associated places to increase cultural enrichment. It is important to emphasize that the application developed in the city of Tunja has contributed to an increase in local consumption by tourists, because they have had access through the application to food and handicraft establishments (Callejas et al., 2011).

On the other hand Reverté (2015) talks about an augmented reality application developed to be used in the tourism sector, which is about providing cultural and historical information to tourists through the use of the webcam in their mobile devices; with their cell phones, tablets or other mobile devices, tourists had to focus on the device or object of their interest and the program will automatically generate relevant historical data about it such as comments from Internet users on web pages, applications appearing (legends) of information instantly, according to Reverte this would be an advantage for resorts as it would attract the attention of a young audience as the millennials or centennials who are increasingly interested and immersed in the use of technology to acquire knowledge.

This navigation methodology that uses augmented reality differs from the printed or digital maps navigation because it is intuitive and allows the user to perceive reality permanently next to the deployed virtual layer or legend in the mobile application (Jackson, Angermann and Meier quoted by Mora and Geovanny, 2014).

According to La Prensa (2016) Honduras has 10 destinations with the highest tourist influx which generated more than 990 million lempiras (approximately USD 44 million) during the Morazán holiday in October 2016. This tool could give the opportunity to the companies of the different tourist areas as well as to the tourist to obtain information in real time about these tourist places, as well as visits to historical centers of indigenous communities and tours in natural areas characterized by a high diversity of flora and fauna would make the experience of the tourists more interesting and informative for the learning of the culture and country's history.

Tourism generated in 2016 about 3% of gross domestic product, accumulating a total of L14,785 billion of Lempiras, a number that increased by 10% compared to last year that reached L13,428 billion of Lempiras according to the Central Bank of Honduras (2017). The trend has been increasing in relation to this economic activity, which has not yet developed its full potential. The ground has not yet been

prepared to host foreign tourists, due to the lack of infrastructure and technological tools that provide visitors with a differentiated and unique experience during their stay in Honduras (El Heraldo, 2017).

The worldwide acceptance of the new technological trend is revolutionizing and totally changing the professional, student and normal citizen lifestyle, through the use of the device called "smartphone" opening the doors to endless opportunities and knowledge in real time, for application or "apps" developers who increasingly invent products and services through the smart phone platform to improve sales in organizations (Mendez, 2017).

The smartphones demand in Honduras has shown an upward trend in recent years, sales in 2015 increased 30% and in 2016 grew by 40%, positioning an approximate of more than 3.1 million smartphones in the market (La Prensa, 2016). Performing a demographic analysis taking into consideration that the population in Honduras at the end of 2016 was 8.866.351 according to the National Statistics Institute (2017). There is a market penetration by smartphones of 35% at national level in Honduras, which stimulates the gradual and unconscious use of virtual reality in daily living and using these technologies of immersive, augmented and mixed virtual realities in almost any human activity area. Why does the smart phone involuntarily open a new world of possibilities for the user to have direct access to the new technologies of virtual realities? Mora and Geovanny (2014) affirm that:

> Augmented reality applications have been developed for mobile devices, due to their processing capacity and the components they have such as camera, accelerometer, GPS, among others. Mobile devices are currently equipped with sufficient hardware components to develop applications for providing the user with augmented reality experiences (p.7).

This innovation, promoted by the large manufacturing companies of advanced technology devices, has introduced to the market the necessary device that boosts innovation and implementation of different technologies in several areas (Ritchie, Sandoval and Lavigne, 2013).

These technological advances have given added value to these devices which, through their complexity, allow them to be instruments for collecting information in real time and combining it with programming, a number of revolutions can be made to contemporary economic activities (Joo, García and Martínez 2015). An example of this is the famous private transportation company "Uber" which using a device either mobile or tablet connects the user in real time with the business platform to coordinate a personalized transportation according to the addresses provided.

This technology is being used in developed countries and is beginning to be implemented in Honduras by the newly created company "Smartaxi" which is created for the same purpose as Uber (La Prensa, 2017a).

Another area where virtual and augmented reality can be implemented is the education field. Morales, Bellezza and Caggiano (2016) describe virtual and augmented reality as an innovating application option both in pedagogical spaces for teaching and schoolchildren and in entrepreneurial learning. In the specific case of education it can help students and teachers to bring theoretical knowledge into practice through the use of these technologies that can also generate the opportunity to manage and build new knowledge to students and teachers for solving social and economic problems in a maintainable and environmentally sustainable way.

The National Autonomous University of Honduras, through the *Magazine UNAH INNOV@ 3rd edition,* Pérez and Lagos (2014) introduce *"The Diagnostic" for using augmented reality as a didactic resource in UNAH-TEC Danlí*, where it clearly shows that the use of augmented reality in the educational process would be a very useful tool for the consolidation of knowledge by students, this study developed to apply augmented reality in the subjects of the Administrative data processing career, determines that there are qualified personnel and the willingness and knowledge of using technologies and equipment to develop augmented reality by teachers and students. In addition to "...representing a very useful tool to achieve significant learning from students and innovating in the educational practice of teachers." (Pérez and Lagos, 2014, p.27).

It is clear that the new technologies implementation in the educational area in Honduras is a topic that takes more and more relevance at all levels, according to Núñez (2017), the educational plan to be implemented for the period 2017-2030 focuses on teacher training and the use of technologies in classrooms as a measure to improve teaching in the country. As Solís rightly states, quoted by Núñez (2017) when indicating that teacher training is:

> The key to good things being done in classrooms in order to adopt an education model based on 21st century pedagogy, rather than the one currently found in the country's schools (Nuñez, 2017, parr 6).

As long as teachers are better trained and updated in new methodologies and technological developments that can help to create a highly dynamic environment in classrooms, museums, theaters, national archives, among others promoting the participation, development and comprehensive training of students, a significant improvement in the development of cognitive skills can be achieved (Núñez 2017).

This comprehensive development can encourage new generations for the 21st century to become new entrepreneurs and generate jobs by innovating and implementing applications using this technology, while freeing themselves from the mental slavery or rationalized myth of Honduran society of studying to get a job.

In the Architecture area Fernández Álvarez (2010) and Tovar, Bohórquez and Puello (2014) affirm that the opportunities and methodologies offered by virtual and augmented reality to educate, train and develop skills in students for creating collaborative and interactive environments can achieve a change when it comes to understanding and developing topics such as graphic representation in areas such as architecture, engineering, building, among others.

The example provided by Tovar et al. (2014) in his study describes the development of an application for teaching in the area of dentistry and recommends that the first thing to be considered in order to develop an application of this type is to know the field or subject in question, choose the means or tools to be used for its development in the mobile device or computer, as well as to create the elements for the study according to the needs and ideal characteristics to promote better learning, implementation and the corresponding evaluation of it by the experts. The purpose of this is to determine whether the application developed really improves the relationship between knowledge and theory with practice in an effective way.

Fernandez (2013) indicates that the application of augmented reality in the newspaper sector may offer the opportunity not only to read the news, but the news could also be seen and heard with additional information, e.g. comments from other internet users.

In this way, the reader will not only have the writer's opinion, but will also have the opportunity to check the development of the news and the opinions of other users. Through the application of augmented reality, it will be possible to improve the readers' experience by complementing and enriching readers by providing them with the sensation of interaction with images and videos in real time, in contrast to what is written on paper (Fernández, 2013).

In Honduras, communications companies are using virtual linking methods for developing interactivity with users through smartphones by developing and implementing what we now know as augmented reality was the *quick response barcode (QR)* which stores information or connects web pages by decrypting their barcodes using a smartphone camera (Ruiz and Polo, 2012).

The augmented reality implementation involves a transformation in the relationship between the user and the surrounding images, reality and knowledge. In addition, its undeniable success in the marketing and advertising areas has progressed from being simply a value-added service to a new methodology that replaces the traditional one-way message to establish multiway communications (Ruiz and Polo, 2012).

What are the advantages of implementing and using augmented reality services in business marketing? In Honduras, a company known as "Más Digital" was created, which is a pioneer in augmented reality advertising. Its services offer the opportunity to create new experiences through multiple platforms where a 2D or 3D interaction is materialized and, according to them, causes a positive

impact on the user and an enrichment on the consumer through an interactive dynamic (Mas Digital, 2015).

To provide this innovative service, this technology must be developed on the basis of quality augmented reality, requiring specialized software, hardware and different formats for its implementation that needs specialized computer skills staff (Duque, 2012).

In addition to these economic sectors, augmented reality and immersive virtual reality find other spaces and other application options, for example in medicine as pointed out by Ortiz (2011), it is used for viewing biomedical images (tomography, x-rays, ultrasounds, mammograms among others), simulation of physiological systems for better understanding and development of immersive procedures, training in anatomy and visualization of a surgical procedure.

By applying augmented reality to this sector, physicians or students of this discipline can be trained to develop in the experimentation of new procedures, methods and modern technologies. But the development of low-cost strategies that could offer an opportunity not only for efficient spending by the State and universities, but also would improve health care for the population.

The modern technology implementations could bring huge benefits to the Honduran health system by reducing the delay in the current health care in the different rooms. At the present time there is a need for modern technological equipment in most centers and public hospitals resulting in long delays and late medical appointments to the high number of patients and citizens suffering from different pathologies. There is a great concern from the health authorities and a commitment in strengthening the different areas for an appropriate medicine technological development (Mejía, 2009).

In addition to the medicine area Botella, Baños, García-Palacios, Quero, Guillén and José Marco (2007) point out that clinical psychology has found in immersive virtual reality and augmented reality a very useful tool to help people overcome different types of disorders. For the treatment of anxiety disorders, for example, clinical psychology uses virtual reality; through this, 3D environments are created with objects that the patient can manipulate to give the sensation of reality. What is sought is for the patient to interact with them until he/she overcomes the anxiety caused by them. The fact of knowing that this interaction is not true creates in the patient a better disposition to face his/her fears through this technology (Botella, et al. 2007).

This is how augmented reality is used in psychology in order to help patients overcome various types of phobias, through augmented reality can be added to the real situation by using a technological means such as a mobile phone or other device (such as glasses or vision helmets), could add the element (animal or material) that produces a phobia to the specific patient, eventually the exposure to this kind of situations helps patients to decrease and sometimes overcome their phobia (Botella et al., 2007 and Jiménez, 2014).

Peñate et al., (2014) and Botella et al., (2007) refer to this same scope of application of augmented reality and immersive virtual reality in psychology by assuring that these represent a very effective tool above all in the treatment of disorders such as phobias and agoraphobias in comparison with the previous results obtained in exposure treatments carried out in real environments and traditional methods.

It is clear that the application areas of both augmented reality and immersive virtual reality support many study and business fields where there is a certain use, are technologies that can be used according to the type of industry needs, in accordance with De la Hoz, Sepulveda and Sarmiento (2015), in the transport sector through geolocation applications that provide users through their mobile devices information regarding nearby mass transport stations which not only consist of indicating the location of each one as a map would do, but also provide relevant information such as, comments from users through social networks and others relevant to users such as Google Maps and Waze.

It also ensures that the immersive virtual reality application is achieving excellent results in the simulation area generally used for combat training by some countries with the aim of generating well-trained cadets in different environments obtaining optimal results in aspects such as technique, resistance capacity and adaptation by them in a shorter time (Jiménez, 2014).

For Cruz, Morales and Ayala (2006), the area responsible for product design in companies that use immersive virtual reality generates a three-dimensional vision of the designs and a multisensory

experience by being able to manipulate the designed product prototypes to evaluate them effectively and creating them with the same characteristics according to the needs to be met.

CONCLUSION

Taking into account the required characteristics for the implementation of virtual and augmented reality, as well as the low investment cost required to be applied in any trading sector, partially one of the reasons why Honduras has not ventured into it to strengthen and innovate its businesses is because many companies are still not aware of what these new technological modalities are for increasing their customer portfolios, their characteristics and the advantages that their implementation would have in diverse economic areas of the country.

However, this does not mean that it is unknown in all areas or that activities are not being developed to promote its use and provide information on all the advantages it brings, La Prensa (2017b) shows that events and conferences have been held in order to promote the ways in which improved reality (including augmented reality, immersive and mixed virtual reality) can be applied in the country.

As Rojas indicated quoted by La Prensa (2017b), founder and director of MediaCity Games, Honduras is a country with great potential in technology. In an event held by Diario La Prensa called Innovation Fest that included the participation of international speakers in the city of San Pedro Sula, Rojas explained that 3 augmented reality projects are already being developed to be implemented in the country. Firstly, a surgical training system is being developed that will help young people to perform some procedures by using virtual reality. Secondly, he mentioned that augmented reality will be used in Nacho's book to promote learning in children in a more interactive way which is intended to learn by visualizing in a dynamic way the contents, and finally, a telepresence demonstration through which it will be possible to project two holograms in different spaces. Situations that have only been watched in sci-fi movies and that will be a reality in the coming years.

The immersive, augmented and mixed virtual reality generate for its users not only the opportunity of innovating or creating a new experience when going from the traditional way to perform an activity to a totally different and much more descriptive one.

For example, we can consider the education area, where young people who are involved in the educational process will not be left out of the knowledge transferred by the teacher supported by a textbook, but will also have the opportunity through these new technologies to live a rich educational experience that will allow them to have the sensation of manipulating their study elements. In contrast to traditional knowledge, which often turns monotonous and repetitive, contrary to living a differentiated and significant experience in students of different educational levels with these new technologies.

It is important to emphasize that several business areas have found in these new technologies, a very important tool to innovate and add value in companies, to create a new experience for customers when acquiring products or services.

Virtual and augmented reality can be applied by man in the desired environments, areas and contexts. There are no restrictions, because the application is simple and it does not require the use of equipment or development of overly sophisticated processes. If we consider these elements, the advantages are higher than the disadvantages in any industry or country's economical activity, even relating it to the cost benefit in contrast to other traditional methodologies of the last century that are much more expensive that are still used today.

It is thought that augmented and immersive virtual reality is only the one applied to video games or entertainment areas as it has traditionally been conceived, and seeing the broad scope and application sectors where this can be implemented for beneficial purposes and development for companies, economies and countries, it could be promoted from school as public policy.

To conclude these technologies can be used appropriately not only for developing industries, but also knowledges, to improve living conditions and to reduce levels of social inequality, creating spaces where it is possible to share cultural, technological, scientific, social and other kinds of riches in an interactive way.

ENDNOTES

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