# FEASIBILITY STUDY OF IMPLEMENTATION OF AUGMENTED REALITY IN A TELECOMMUNICATIONS OPERATOR

# ESTUDIO DE VIABILIDAD DE IMPLANTACIÓN DE LA REALIDAD MEJORADA EN UN PORTADOR DE TELECOMUNICACIONES

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**ABSTRACT**:

**Introduction:** Augmented Reality (AR) is a new technology that allows companies to innovate in order to communicate. It is defined as the combination of the real world with virtual objects.
**Objective:** To identify the feasibility of implementation of AR in a telecommunications company.
**Methodology**: We used qualitative research, descriptive through documentary research of secondary data.
**Results:** The investment for the use of AR only the store operator, where the research was performed, would not be profitable, given the size of the unit and the universe of consumers

that would be achieved with the proposed deployment of AR. But the operator at Brazil level can make great advantage of AR in marketing.

**Conclusions:** It was suggested the use of AR for Operator as a means of innovation and differential against competitors. The knowledge gained in this work was of great importance because it provide study AR, learn the concept, its benefits and the areas that can be used.

**Keywords:** Augmented reality; Telecommunication; Information and communication technology.

# 1 INTRODUCTION

The global competitiveness between companies makes the contest for customers increasingly fierce, and in a world where the demand for information is increasing, it is essential that managers have the scope of information systems to filter incoming data and transform them into useful information for the organization, helping them in decision-making and business strategies. Companies need to be attentive to new global trends to offer its customers innovative products and services.

Technology has advanced in a surprising way in recent years, and the tendency is to happen faster and faster and change the way people interact with the world. In this context, innovation is the key word, so that companies can use the technology to their advantage by offering differentiated products and services, whether for leisure, work or even to facilitate the day-to-day lives.

This research aimed to study the feasibility of deploying a new technology in a telecommunications operator. The topic to be addressed is the Augmented Reality (AR), a new trend with regard to how people interact with the real world and virtual elements, creating a mixed environment in real time. Augmented reality has application in various segments, such as in surgical procedures, engineering, entertainment and education.

The AR is already used in some segments and the challenge is that telecommunications operator, specifically the mobile, able to deploy this technology in order to provide its customers with new forms of fun and entertainment, generating positive results for the company. One of the challenges faced by mobile carrier to deploy the AR is that the mobiles need to be quite sophisticated, requiring an open operating system and allows downloading applications. Depending on the service of

AR to be used, the cell must also have GPS, motion sensors and 3G, and now users of such technology and devices are still limited.

They are also necessary investments in software development, as well as partnering with manufacturers to deploy the AR. All this must be analyzed so that you can deploy the service. But the market for mobile AR is growing and many global operator are investing in this new service. In Brazil, the operator investigated supports research projects in AR, through the "Operator Institute", with the mission to increase the use of new technologies of information and communication, to develop innovative opportunities, which is the case of Augmented Reality.

The operator researched is positioned at the market as a company that invests in high-innovative products and services. The AR is a new global trend with respect to the interactivity between the real and virtual world. This can be a good opportunity for the researched operator to increase his group of products and services, presenting its customers new ways to communicate. For this, investments are needed in Information and Communication Technology (ICT), through a detailed feasibility study on the implementation of AR Operator researched.

The survey was conducted on the Operator stores researched located in Santa Catarina, and was essentially analyze the marketing feasibility of the use of AR in a telecommunications operator to make it a competitive edge. For this, we sought primarily conceptual and empirical foundations, it was made use of methodological procedures, presentation of the collected data, survey results, and conclusion.

## 2    CONCEPTUAL AND EMPIRICAL FOUNDATIONS

In this section, we present the theoretical basis used in the research, covering the contextualization of information systems, information technology, and innovation.

## 2.1    Information Systems

Information Systems (IS) are an important tool for organizations, as support for management to analyze facts and make decisions more clearly and accurately (STAIR; REYNOLDS, 2002).

For Laudon and Laudon (2004), an information system can be defined as a set of interrelated components that seeks or retrieves, processes, stores, distributes information to support decision making, coordination and control of an organization. In other words, is a tool that processes the data, filters it is important for the organization and transforms it into relevant information for managers.

To Foina (2001), an information system can be classified as the integration of technological and organizational resources that handling (capture, process and distribute) the information in an organization.

Dalfovo and Amorim (2000) emphasize information systems into four categories, namely:

Information systems at the operational level: are information systems that monitor the elementary activities of the organization, with the scope, answer questions and routine flow of transactions;

Information systems at the knowledge level: systems that help employees specialized, in order to integrate new knowledge to the business and control the flow of documents;

Information systems at the administrative level: are systems that meet the activities of monitoring, control, decision making and administrative procedures at a medium level, in order to manage routine information to the sector direction;

Information systems at the strategic level: are information systems that support senior managers to plan long term.

O'Brein (2003) states that information systems are all interrelated and are formed by a group of people, software, hardware, communication networks and data resources that collect data and disseminate information for the organization.

## 2.2    Information and Communication Technology

Information Technology (IT) is a set of methods and tools that can be mechanized or not, it is proposed to ensure the quality and timeliness of information within the enterprise network (FOINA, 2001).

Rezende and Abreu (2001) conceptualize the IT as technological and computational resources to generate and use information.

According Foina (2001), the IT began with the use of computers in organizations. This is because before the advent of computers, information was shared through memos, typewritten and distributed through pouches. Sectors such as accounting and logistics were some that had benefits with the entry of technology offered by computers and management systems of this information. The author also adds saying that the IT mechanized few processes of decision making in organizations, creating information centers able to generate reports and information.

IT interacts with the organization of several ways. Among them, Walton (1993) argues that IT can create and promote new organizational solutions, when trains people to develop their work in organizations with centralized or decentralized management; creates new forms of communication thus accelerating the flow of information within the company; creates opportunity to be introduced organizational changes and administrative processes.

The information and communication technology (ICT) can be defined as a set of technological resources that are used in an integrated manner and who have common goal. The use of ICT can be made in various sectors, such as in industry (in the automation process), market (in management, in various forms of advertising), the investment sector (simultaneous information, instant communication), and education (in teaching and learning process, in Distance Education) (PACIEVITCH, 2010).

For Dias and Cornils (2008), the ICT has a key role in economic growth and increased productivity. The authors also added saying that ICTs are essential to the operation of the digital economy. In this scenario, telecommunications has a significant importance for the development of ICTs, because they represent almost 44% of its total value.

## 2.3    Telecommunication

Laudon and Laudon (2004) defines telecommunications as the communication of information electronically, which generally happens some distance. The authors also say that until a while ago, telecommunications was defined primarily by voice transmission through the use of telephone lines, but with the technological evolution that has changed. The transmission of telecommunications today are done digitally. Computers are involved in the process and transmit data from one place to another.

For O'Brien (2003), telecommunications is any form of information exchange through computerized networks.

There are several ways to use telecommunications services. Among them is the transmission cell. In this way, the location or area that is used by the service is divided into cells. Thus, if a user is using a cell phone in a moving car for example, it can communicate with other cell phones or regular phones usually, because the communication system is made of one cell to another. Signs of the cells are transmitted to a receiver and integrated into a regular telephony system (STAIR; REYNOLDS, 2002).

Telecommunications play a vital role in social and economic development. Studies in the United States show that every 1% penetration of broadband Internet service in a state, there is an increase of 0.2% to 0.3% of jobs per year. Thus, it can be stated that the telecommunications services contribute to the socioeconomic growth (DIAS; CORNILS, 2008).

**Telecommunications in BRAZIL**

We can divide the history of communications in Brazil in three major -stages. The first one corresponds to the presence of foreign companies in the country, which had practically a monopoly of telecommunications services. The second identifies with the monopoly of the Brazilian state, with the creation of Embratel and Telebrás. Since the last stage  began in the 90s and was marked by the privatization of state enterprises and the opening to foreign capital. Currently, communications are marked by the digitization of content, the development of Internet and technological convergence (PIMENTA, 2010).

Since July 1998, when occurred the privatization of the telecommunications sector in Brazil, there was a revolution in the sector within the country. There were large investments by operators to expand telecommunications services, both in fixed telephony as in mobile telephony. Not to mention the deployment of broadband connections, cable TV, the popularity of cell in all social classes and the technological and social advancement brought along with these changes (DIAS; CORNILS, 2008).

Dias and Cornils (2008) argue that the main purpose for the privatization of the telecommunications sector in 1998 was able to meet the demand for telephones and offer higher quality services, as Telebrás caused great dissatisfaction to the users due to lack of investment in infrastructure .

For Pires (2009), the restructuring of the Brazilian telecommunications sector, which culminated in the privatization of Telebras System, comprised of six distinct steps: (1) a Constitutional Amendment No. 8, of 8/15/95, which eliminated the exclusive concession for public services; (2)  the Minimum Telecommunications Law (law 9295, of 07/19/96), which had an emergency character to allow the establishment of criteria for service concessions; (3) the approval of the General Telecommunications Law (LGT – law 9472, of 07/16/97), which established the principles of new institutional sector; (4) the approval of the General Concession Plan (GCP), which set general parameters for establishing competition in the sector; (5) the broad restructuring of the Telebrás System, state-owned that was split into three major utility holding companies of local services of fixed telephony and (6) bidding for authorization for the operation of the mirror companies in the same field of fixed telephony operators coming from the Telebrás.

What was the privilege of few, has become universal. The growth of the telecommunications sector in Brazil is increasing each year. Since 1997, the telecommunications sector received a major investment in Brazil, second only to oil and gas. The investments made by 2008 meet 95.5% the expectation of economic growth in Brazil. Compared with other sectors like transport, where the bottlenecks in investment are striking, given only 58.3% required. This shows how the sector is well positioned in the market (DIAS; CORNILS, 2008).

### *Mobile Trends*

Kalakota and Robinson (2002) state that in the coming years, the use of mobile devices will become common as increases the availability of access the broadband network and wireless networks. As a result, arise new business opportunities and the companies need to change in order to gain competitive advantage.

Studying specifically the issue of strategic alignment of Internet use, Saccol (2003) concludes that the challenges of his adoption beyond the found in alignment of IT strategy, because involve a number of organizational elements such as variables in the external environment (customers, competitors, access to technology) and variables of the internal environment, not only in IT (infrastructure, governance, risk involved).

One of the most challenging tasks for managers is to identify a significant trend of business and momentary "fashions". This analysis becomes even more critical when it comes to technology. This is because the forces that influence such investment decisions (the social, economic and technological) change quickly and include extreme connectivity, unpredictable swings in consumer taste (KALAKOTA; ROBINSON, 2002).

Agreeing with Saccol (2003), Kalakota and Robinson (2002) state that the trends following in broader themes: changing priorities of consumers, innovation in hardware and devices, and innovation in infrastructure.

To Kalakota and Robinson (2002), the consumer makes their purchase choices based on your needs. Whenever there is a technological innovation, the consumer change the perception of what is important and necessary to him. As a result, consumers shift their choices and redirect their loyalty. Consumers seek new experiences that make your life more interactive, and in the case of mobile solutions, the path to meet this need following three trends, considered essential:

1) The networked society: more and more customers demand information and communication, regardless of location. People want wireless communication is available any time.

2) Speed on service: consumers want to the technology shorten the waiting time in service, delete rows make the tasks of everyday life, both personal and professional faster.

3) Simplicity and convenience: the client gives great value to services easy to use and convenient. Technological innovations should be within reach the understanding of its users, with software simple to install and devices easy to use;

4) Innovation and implementation in hardware and equipment: technology has advanced very rapidly in recent years and the cost of the technology components is diminishing, there was an increase in the economy of mass production. These factors are driving down prices of technology products, putting mobile devices within reach of a large portion of the population, increasing the market penetration of these products. The new generation of technological devices should be compact, high performance and low power consumption.

Another feature popular among mobile phone users is the convergence. Mobile phones are replacing several other products in one and the challenge for manufacturers is to innovate while keeping the design acceptable to the end user, with access to internet, email, multimedia features, among others (KALAKOTA; ROBINSON, 2002).

Investigating the e-business initiatives in traditional companies, Willcocks and Plant (2001) reached two conclusions. The first, going to the Internet was an evolutionary process for companies and second, involved planning and flexibility in the face of market development and technology.

MacKenna (1997), when analyzing the business environment of companies in the early 90s, already alerted to the need to implement marketing support systems, capable of maintaining constant links with all stakeholders who seek to relate to the company.

Thus, the trends create new investment opportunities and we need companies to conduct market analyzes in order to identify business opportunities (KALAKOTA; ROBINSON, 2002).

## 2.4    Innovation

To Gundling (1999), innovation can be viewed as a new idea, turned into defined actions or implementations, will result in an improvement, a gain or profit to the organization. The difference between innovation and creativity lies in the impact that the first generation for the entire organization.

But a broader view, beyond the organizational issue, Tebaldi and Elmslie (2012), argue that the estimates provide evidence that, controlling for the size of an economy and positioning the country at the frontier of knowledge, institutions will have a strong positive effect on innovation. Economies that have free market policies, lower perception of corruption, or whose legal systems are more effective and predictable, will experience higher rates of innovation (patent production).

In perception of Faria and Lima (2012), the creation of new knowledge is a case in which the behavior of different agents can affect the performance of other actors in a positive way, since the foreground create positive situations in the market. Thus, research the existence of performance spillovers associated with innovation activities, by the amount of innovation produced by the company and control this factor, is itself an innovation.

Tebaldi and Elmslie (2012) have in their work that the survey results suggest that Brazil had the market system with the same regulation as the USA – the difference in the quality of regulation between these two countries is about 1.2 – the Brazilians would have produced about 2.5 times more patents that they produced between 1970 and 2003. Therefore, control of corruption, policies favorable market, protection of property rights and an effective judicial system can increase the rate of an innovation economy (production of patents).

## 2.5    Augmented Reality

Augmented Reality (AR) can be defined as the superposition of three-dimensional virtual objects, computer generated, with a real environment, through some technological device (MILGRAN et al., 1994).

Kirner and Siscoutto (2007) define    AR as the enrichment of the real environment with virtual objects using a technological device running in real time. To

Milgran et al. (1994), is a mixture of real and virtual worlds somewhere in the reality/virtuality continuous, which connects completely real environments and completely virtual environments.

Filippo, Endler and Fucks (2005) argue that AR supplements the real world through virtual things that occupy the same space in the real world. It is a system that supplements the real world with virtual objects generated by computer, looking coexist in the same space and having the following properties:

1) Combines real and virtual objects in real environment;

2) Performs real-time interactivity;

3) Aligns real and virtual objects together;

4) Applies to all senses, including hearing, touch, smell and strength.

Although AR is little known and that there are few studies in the area, its design was conceived in the 60s, when Ivan Sutherland used a helmet with transparent display which were presented 3D images, suggesting a window into the virtual world (FILIPPO; ENDLER; FUCKS, 2005).

The experiment done by Ivan Sutherland at the time is closer to Virtual Reality (VR), which is based on an advanced interface for computerized applications that are able to provide interaction and navigation in a three-dimensional environment with the support of multi-sensory devices. In an environment of VR, predominates the virtual and the user is totally inert in a virtual environment without contact with the real environment (KIRNER; SISCOUTTO, 2007).

Table 1 differentiates the characteristics of VR and AR.

**Table 1** - Characteristics of the VR and AR

| Virtual Reality | Augmented Reality |
|---|---|
| The environment is entirely virtual, computer generated | Enriches the scene of the real world with virtual objects |
| The visual sensation is controlled by the system | The user holds the sense of presence in the real world |
| Need a mechanism to combine the real with the virtual | Need a mechanism to integrate the user to the virtual world |

**Source:** Developed by author (2012)

Research on AR become stronger from the 90s, when several studies could be distinguished from each other and separated by different topics each other (KIRNER; SISCOUTTO, 2007).

Today, with the advancement of technology and reduction in costs for study in the AR is beginning to emerge as an alternative in various business segments.

Lanzetta (2010) says that AR besides increasing the quality of communication with the consumer, emerging as a new solution relationship. The challenge now is not only to make ads more interesting, but generate a communication relevant to the brand experience.

The use of AR as a form of innovation in the way of communicating with the customer is fact. All it takes is creativity for companies to implement the AR intelligently in order to delight customers with a service useful and interesting.

For Azuma (1997), AR can be used anytime you need to present information that is not fully available or detectable by human senses and that the application can make it visible, audible or palpable. For an action happening with the AR is needed:

1) A real object with some kind of benchmark that enables the interpretation and creation of the virtual object.

2) Camera or device capable of transmitting the image of the real object

3) Software able to interpret the signal transmitted by the camera or device

4) Virtual model, preferably in 3D.

For the image can be generated lay the real object, in this case represented by the symbol in front of the camera that captures the image and with the help of the software generates the virtual object on the screen that can be a computer, special glasses for AR or a cell phone (CIPRIANO, 2009).

There are still obstacles to be overcome for the use of AR. Today, the cost for deployment in areas such as medicine, and industrial mechanics require high investments. But as they advance research in this area, is growing optimism and a very brief future applications with the use of RA depend only on the creativity of researchers and companies interested in having a competitive advantage by using AR (FUSCO, 2010).

According to Reuters (2009) in 2008 were invested in the world about 6 million in mobile AR, but the outlook is for strong growth. By 2014, the market for AR should

reach over 350 million dollars through paid download applications, games, advertising and subscription services.

The cell can be exploited for the use of AR in various ways. Mobiles makers like HTC and Nokia have invested in the service. HTC launched the G1 phone with Android operating system that allows downloading multiple applications. Among them is the Wikitude AR Travel Guide, with the help of the camera phone, seeking information on several names of points of interest. The information generated by the application are found at sites such as Panoramio and are updated in real time thanks to the accelerometer and the phone has GPS.

Nokia, largest mobile phone maker in the world is now also developing applications of AR through its research center, the Nokia Research Center. One of the systems developed by the group called MARA - Mobile Augmented Reality Application (ZUÑIGA TORRES, 2008).

The system MARA uses the device's camera to capture images of the environment and generate location information through data generated by sensors embedded devices that connect to the internet through the phone and generate information on the mobile screen.

The application of AR can be used by mobile phone users to generate information about a particular location. With software installed on a mobile device is possible to obtain real-time information on places such as bars, restaurants, tourist routes, access to content from one store, among others (VILLARES, 2008).

With the advancement of software, hardware and telecommunications, came a voice interfaces, tangible and haptic, enabling users to access a feeling as if they were in the real world, in other words, speaking, making gestures, among others. All of these developments, not only in software but also in computers, circuits, power processing, computer graphics, networks, internet, contributed to the emergence of powerful 3D interfaces, including VR and AR. VR and AR emerge as a new generation with the use of three-dimensional features (KIRNER; SICOUTTO, 2007).

AR services for locating and finding information need traffic data. Thus, operators can ensure revenue by linking the sale of these services with a package of data traffic.

The competition between telecom operators is too large, and competition for customers and profitability requires large investments in marketing, innovative

technology and services company, that make a difference against competitors. The use of  AR as a form of marketing is one of the possible investment options, and provide the customer a new and different experience in the way of communicating with the company (LANZETTA, 2010).

## 3	METHODOLOGICAL PROCEDURES

The research developed for this work to meet the objectives, it is a descriptive research, since its purpose is to describe the feasibility of implementing the AR the researched company. According to Malhotra (2006), descriptive research is a type of conclusive research that has as main objective the description of something – usually features or functions of the market. It is a widely used research by commercial companies because it includes various features.

To complete this methodology we used the exploratory research, which aims to focus on a problem about which the researcher has no information or knowledge sufficient to establish strategies or assumptions to achieve their goals (MIGUELES, 2004).

It was also used for this research the model document, which according to Padua (2004) is characterized by being made from authentic contemporary documents, and has had wide application in social areas, historical research to describe facts/data to compare social characteristics and trends, and documents from secondary sources such as statistical data, believed to be reliable and prepared by specialized institutes.

The research on the nature of the data it is a qualitative research done through unstructured questionnaire, conducted in depth with individual interviews (one director of production). As Malhotra (2006), qualitative research is a research methodology unstructured and exploratory based on small samples that provides insights and understanding of the context of the problem. That is, provides better insight and understanding, providing judgments before or after the fact, and based on small and unrepresentative samples.

## 4    RESULTS AND DISCUSSION

To do the feasibility study, the research sought to investigate whether a company in Brazil have used AR, which the steps involved in the process, cost of implementation, among other issues that would lead a company to invest in reality increases. However, we could not find any company willing to disclose information regarding use of the AR.

In Brazil, none of the telecom operators invested so far in a project of implementation of AR, which somehow can be a competitive advantage to have a differential operator studied through an entirely new market place.

The AR should move around the world about 350 million dollars by 2014, up almost 6,000% compared to same period in 2008. Much of that value will come from downloading applications, games, advertising, subscription services and others. That is, there is much market to be explored and the range of services to be offered is promising.

The operator studied is now the second largest mobile operator in the country in number of customers (TELECO, 2010). Table 2 discloses the placement of telecom operators in Brazil until the month of September 2010.

Table 2 - Ranking of accesses by mobile operator

|       | Operator  | Access     | Participation (%) |
|-------|-----------|------------|-------------------|
| 1st   | VIVO      | 57,714,394 | 30.14             |
| 2nd   | CLARO     | 48,766,711 | 25.47             |
| 3rd   | TIM       | 46,946,628 | 24.52             |
| 4th   | OI        | 37,357,581 | 19.51             |
| 5th   | CTBC      | 589,394    | 0.31              |
| 6th   | SERCOMTEL | 77,129     | 0.04              |
| 7th   | AEIOU     | 20,305     | 0.01              |

**Source:** Developed by author (2012)

The amount of access in the operator studied is very expressive, reaching almost 50 million customers (PACIEVITCH, 2010). This shows the size of the market potential that can reach with the use of  AR.

According to Godoy (2010) developed applications for mobile phones by 2013 should generate revenues of $ 15.6 billion, 800% higher than that recorded in 2009, when it reached $ 1.94 billion. The idea is to stimulate the development of

applications for the most widely used mobile platforms, such as iPhone, Blackberry, Android, Windows Mobile and Symbian. And among these is AR applications.

In recent years mobile phones have been developed with much more technology, faster processors, greater storage capacity, higher quality cameras, GPS (Global Positioning System) and operating systems that allow interface with multiple applications. With that, the cellphones have become a more attractive way to develop a platform for AR systems to allow for an interaction with the environment in real time via the cellphone's screen.

Provider searched invests in advertising, especially in the months in which there are holidays like Mother's Day and Christmas. One of the suggestions for the implementation of AR is to use campaigns in newspapers and magazines where you have a marker of AR with the offer of a cell. Using the principles of use of AR, the client can direct the marker on a *Webcam* and with the help of an application on the site operator, the phone is designed and the client makes the experience of knowing the phone through the AR. It is suggested as the operator has to create a link where the customer can buy the phone in the shop operator.

In addition to earning revenue from the sale of basic voice services, internet, text messaging, the Operator has a site called 'Operator Ideas', which is a portal designed exclusively for customers can customize your phone with wallpapers, music, games, videos and various other applications developed for its customers. Some services are also available for customers from other operators. With that comes an opportunity to implement AR. Mobile phones today are more modern, with numerous features and faster processors. Then, the operator may sell in your store AR games. Besides offering an entirely new entertainment service, the operator can still get revenue from the sale of games.

The operator can also develop an application in AR in which the customer locate stores and outlets to recharge using your own cell phone.

The operator also uses as a form of advertising and outdoor advertising ads, which are a form of media, high-impact and easy viewing, depending only on a good location. In this type of media there is also room for development in AR. Simply insert a marker in the outdoor and the camera phone, the user can view the AR.

The Operator has a relationship program for customers who pay monthly bill for services used. The program is called 'Operator Club' and it customers accumulate

points that can be processed in minutes or discounts for the purchase of mobile phones. Through direct-mail operator can use markers on AR to show the mobile that the customer can make or acquire under special conditions, a simple correspondence transforming into something more interesting, and give the customer a better view of the cell, since it can be viewed in 3D.

It was developed in the research, a budget with costs for implementation of AR. Several software development companies and technology have been consulted, and was possible with a budget that works with the development of AR. The 'Producer Cinemar' sent a proposal based on implementation of AR in many services.

Before placing the values involved in the project, it is necessary to understand some stages of development of AR. Information about the steps that involve an AR project were described by the Director of Production Cinemar:

1) Developing a business idea;
2) Development of 3D object – this step can take up to three months for completion varies according to the complexity of the image you want to use in AR. The market value to build a 3D object is around $ 2,500.00;
3) After the 3D object to be ready, enter the animation, make the 3D object come alive and be inserted in an environment (software) capable of generating interaction with AR.

The development of a project on AR is complex. It takes time and a lot of knowledge of professionals of different areas.

The Design of AR must take into account the following factors: objective; material composition of AR; sound effects; audience; building 3D objects; resizing 3D objects; action strategy; animation of objects; synchronization objects with the markers; duration of action of Marketing; interaction with the environment (slope, movements, etc.); software development (each AR uses its own software); media (which will be inserted: online or offline); interactivity; extra versions software for other operating systems; dissemination (advertising AR); soundtrack; versions for different browsers; and graphic art (bookmarks in folders, catalogs, web pages, etc.).

Depending on the complexity of the project, may have to be considered other factors, such as licenses, registrations, employees, market analyzes, statistics, languages, psychology, among others.

In preparing the budget, which will be inserted into the project, we must evaluate the costs of all the professionals involved, use of equipment, leases, among others.

When developing an AR, it takes into account all the difficulty and complexity. As there are no conventional parameters, the AR can be classified into three categories (Table 3).

**Table 3** - Categories AR

| Category | Comment |
|---|---|
| Simple | It is considered that it has only a fixed 3D object. |
| Standard | It is considered that it has one or more 3D objects fixed and/or animated, that may or may not be inserted into a scene and still followed by the soundtrack and audio effects |
| Complex | Are those that, in addition to the Standard, have forms of interactivity, integration with other AR on the same screen (multiple markers), action and reaction between two or more AR (games), and other things yet to be developed in future |

**Source:** Developed by author (2012)

The level design has nothing to do with the complexity of AR, but with the marketing strategy and action plan, which can be from the offline viewing at a booth at a fair, up to a campaign of national advertising.


## 5   CONCLUSION


With globalization, new technologies have emerged to facilitate the lives of individuals and provide to organizations new forms of work and interaction with the environment.  AR is a technology that has great tendency of investments for the next years and already has practical application in some segments, especially for marketing.

Telecommunications companies are included in an activity where innovation combined with technology are essential to remain competitive in the market. Brazil is a market that is rising in this sector. The proof is that the amount of phones in the country has already surpassed the inhabitants. This makes the telecommunications sector attractive for investments, and  AR can be exploited in the telecommunications

segment. The Operator can be the first telecommunications operator in Brazil to use AR.

The investment for the use of AR only the store operator, where the research was performed, would not be profitable, given the size of the unit and the universe of consumers that would be achieved with the proposed deployment of AR. But the operator at Brazil level can make great advantage of AR in marketing.

Information technology is important in this scenario. It favors the development of products, services and open new markets. Research in AR are in constant development, with investment in equipment and software. However, there are still limitations on the cost of the cellphones compatible technology and its applications. To develop the research, it was difficult to find sources of research and applications in the Brazilian market, since few companies operate in the segment of AR in Brazil.

It was suggested the use of AR for Operator as a means of innovation and differential against competitors. The knowledge gained in this work was of great importance because it provide study AR, learn the concept, its benefits and the areas that can be used.

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*Título*

Estudo de viabilidade de implantação da realidade aumentada em uma operadora de telecomunicações

*Resumo*

**Introdução:** A Realidade Aumentada (RA) é uma nova tecnologia que possibilita as empresas inovar na forma de se comunicar. É definida como a combinação do mundo real com objetos virtuais.
**Objetivo:** Identificar a viabilidade de aplicação de RA em uma empresa de telecomunicações.
**Metodologia:** Pesquisa qualitativa descritiva, por meio de pesquisa documental de dados secundários.
**Resultados:** O investimento para a utilização da RA somente na loja da operadora pesquisada, onde foi realizada a pesquisa, não seria proveitoso, dado o tamanho da unidade e o universo de consumidores que seriam atingidos com o projeto de implantação da RA. Mas, a operadora a nível Brasil pode fazer grande proveito da RA em ações de marketing.
**Conclusões:** Foi sugerido o uso da RA para a Operadora pesquisada como forma de inovação e diferencial frente aos concorrentes. O conhecimento adquirido neste trabalho foi de grande importância, pois proporcionou estudar a RA, saber o seu conceito, os seus benefícios e as áreas em que pode ser utilizada.

**Palavras-chaves:** Realidade aumentada; Telecomunicação; Tecnologia da informação e comunicação.

**Título**

Estudio de viabilidad de implantación de la realidad mejorada en un portador de telecomunicaciones

**Resumen**

**Introducción:** La Realidad Aumentada (RA) es una nueva tecnología que permite a las empresas a innovar para comunicarse. Se define como la combinación del mundo real con objetos virtuales.
**Objetivo:** Determinar la viabilidad de aplicación de RA en una empresa de telecomunicaciones.
**Metodología:** La investigación descriptiva cualitativo, a través de la investigación documental de los datos secundarios.
**Resultados:** La inversión para el uso de la RA sólo buscó el encargado del almacén, donde se realizó la investigación, no sería rentable, dado el tamaño de la unidad y el universo de los consumidores que se lograrían con el proyecto de ejecución de la RA. Pero el operador en Brasil puede hacer gran ventaja de la RA en la comercialización.

Cristian Tadeu Von Der Hayde; Norberto Tamborlin; Ricardo Roncalho de Souza; Oscar Dalfovo

Feasibility study of implementation of augmented reality in a telecommunications operator

**Conclusiones:** Se sugirió el uso de la RA para el operador investigado como un medio de innovación y diferencial frente a sus competidores. El conocimiento obtenido en este trabajo fue de gran importancia, para proporcionar estudio de RA, a conocer su concepto, sus beneficios y las áreas que se pueden utilizar

**Palabras-clave:** Realidad aumentada; Telecomunicaciones; Tecnología de la información y la comunicación.