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VoIP: DISRUPTIVE INNOVATION IN THE CORPORATE TELEPHONY MARKET

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ABSTRACT

The corporate usage of the telephony services has been transformed by VoIP (Voice over IP), which changed the business model for that market. VoIP is a technological innovation, with high impact on the business of the suppliers of corporate telephony systems and a great potential to introduce new players to the market. This paper provides an analysis of VoIP's impact on the corporate telephony market based on that market's history and the possible changes resulting from the introduction of disruptive innovations, which interfere with strategies, set up by well established companies in the field.

Keywords: VoIP, corporate telephony, strategy

INTRODUCTION

The telephone is an indispensable work tool for any company, which has motivated players in the market to develop dedicated systems in order to support corporate needs. Those systems, usually referred to as PABX's (Private Automatic Branch eXchanges), kept being upgraded, along the time, with new or improved functionalities, in order to increase productivity and product appeal.

The main purpose of telephony has always been transmitting voice, for which some specific requirements regarding the quality of the conveying signal, reliability and availability of the service, among other issues, have very strict constraints, which used to impose huge barriers to anyone who intended to enter the market¹. The high level of investment needed to develop the know-how and the products, themselves, kept the corporate telephony market captive to just a few large companies for many years (SULKIN, 2006).

Especially while voice services were conveyed in analog signals, parallel and distinct networks existed for voice and data, a situation that is still the rule in many cases, in spite of all the fuzz about the convergence of computer and telephony technologies (MEIRELLES, 1994; MESSERSCHMITT, 1996; HUBAUX *et al.*, 1999).

In the mid 1990', Messerschmitt (1996) already called the attention to the integration of different media, such as voice, audio, video, animation, telecommunications and data. At that stage, it was already possible to realize that the traditional sectors of telecommunications and computers were changing one another in an irreversible way. Messerschmitt warned us, however, to the fact that the disciplines remained intellectually separated, sharing equipment and communication means but following distinct agendas and being dominated by different cultures.

Incremental innovations were being introduced to telephony systems little by little, in order to support the sustainability of the products and companies that were competing in the corporate telecom market. Such innovations included the change from analog to digital telephony and the development of the CTI (*Computer Telephony Integration*), which enabled the integration of telephony and IT systems (WETTERAU, 1998).

In the last few years, however, a novelty has been turning the market upside down, regardless of the angle from which one analyzes the telecom industry. It is the VoIP (*Voice over Internet Protocol*)

technology, also known as IP telephony or Internet telephony, which is basically the transmission of voice by means of data networks, finally providing the so expected digital convergence.

The success of this innovation has made large telephone systems' manufacturers such as Alcatel, Avaya, NEC, Nortel and Siemens review their traditional strategies, starting to support the new technology. Parallel to that, however, new players also turned their attention to the VoIP technology, among which companies that were traditionally data communication infrastructure providers (such as Cisco and 3Com) and IT solutions providers (such as Microsoft, IBM, Oracle and HP), in addition to some little "adventurous" companies (SULKIN, 2006). Currently, there are even open source telephony systems available on the web, that promise to do just what the products of the above mentioned companies do, but free of license fees. The best known free software is Asterisk, which can be used to implement new telephony solutions for a fraction of the cost of some proprietary systems, as most of the development effort has already been carried out by the free software community. That makes it much cheaper and easier for entrants to try the market (GRALLA, 2006; SULKIN, 2006).

The objective of this paper is to present the introduction of the VoIP technology as an example of a disruptive innovation, according to the ideas of Christensen (1997), capable of radically changing a market that relied on supporting (incremental) innovations for many years. As the scenario evolves, the effects of the introduction of VoIP on the established competitors, the market as a whole and the competences demanded from the players in order to survive in the market need to be better understood.

The paper will unfold as follows: first, the concept of disruptive innovation (or disruptive technology) will be presented, in order to clarify the difference to incremental or supporting innovation. Then, the evolution of the corporate telephony market and the VoIP technology will be reviewed, to provide the reader with an understanding of the chronology of facts leading to the current situation. After that, based on information obtained from secondary sources, whose selection is briefly described in a session on the methodological approach, the authors analyze the scenario in which VoIP presents itself as a new way to provide an old service². That analysis shows that VoIP's introduction in the market is taking place in a way that resembles all characteristics and the typical behavior of a disruptive technology, as defined by Christensen. At last, some final considerations are drawn, in which it is shown that the corporate telephony market is open for (old and new) players who wish to explore synergy possibilities among the two "worlds" that finally converge: telephony and IT.

THEORETICAL GROUNDS

Disruptive innovation

Fine (1999) highlights the fact that the traditional way of strategically thinking companies leads them to struggle for sustainable competitive advantages. That author considers, however, that sustainable advantages were only possible in the past, when the market evolved at a lower pace. The problem would be that the concept remains being adopted as if it were still applicable, in spite of the different "clockspeed" that characterizes most markets today, preventing sustainability from being obtained. One would only be able to achieve temporary advantages.

Christensen *et al.* (2002) say that most executives believe that significant and sustainable growth is achieved by creating new markets and new ways of competing in the market. However, organizations usually produce products and services that meet the demand of already existing customers. Therefore, such products and services are used in reinforcing circumstances, for which the results are better products, at higher prices and for more attractive customers. The risk of such approach is high, because the sustaining strategy may lead to results that are worse than stagnation (CHRISTENSEN, 2003).

Fine (1999) explains the difficulty of achieving strategic sustainability, stressing that some events may challenge companies of all "kinds"³ and different "evolutionary speeds", such as the possibility of the competitors introducing revolutionary products and services to the market. Two major vectors determine change in sectors of high evolutionary speed, in which temporary advantages prevail: technological innovation and competitive intensity. The fastest the sector's evolution speed, the most transient is the temporary advantage of the companies that lead it.

Christensen's (1997) classification for innovations helps one better understand the effects of innovation in the market. For this author, there are two kinds of innovation: supporting innovation (or supporting technology) and disruptive innovation (or disruptive technology).

Supporting innovation is the one that results in products and services that meet the demand of existing customers. A supporting innovation helps the organization to increase its profit margin, selling better products to its best customers.

The disruptive innovation, in its turn, causes the development of new markets and business models, according to Christensen (1999). It makes the old business model less suitable to the market and, in general, provides the conditions for new players to emerge. The disruptive innovation usually appears in the market in products that have a poorer performance than those based on the currently prevailing technology, at first. That makes it unconceivable for the traditional customers to use it, but may call the attention of new customers, who are not interested in the sophistication (and the costs associated to it) of the products previously available.

Christensen (1999) presents the graph shown in Figure 1 to illustrate what happens with the established technology, when incremental innovations modify it along the time. It is clearly noticeable that there is a trend of offering more than the customers are capable to absorb or willing to pay for, as a result of the incremental improvements that are continuously added to the product, which explains the risk associated to the supporting enhancements that were discussed above. On the other hand, the improvement of the disruptive technology makes it useful also for the customers of the prevailing technology, after some time, causing many to migrate to products that adopt the new technology.

Based on that model, Gilbert (2003) defines three stages for the development of disruptive innovations:

- in the first stage, the innovation creates a new market, different to the one that already existed and less concentrated on quality issues;
- in the second stage, this new market expands, affecting the growth of the traditional market;
- in the third stage, innovation develops in a way that it reduces the difference in value perceived by the customers between the traditional and the disruptive product, which used to favor the traditional product, allowing the disruptive product to challenge the traditional one in its own territory, expanding to its once captive markets.

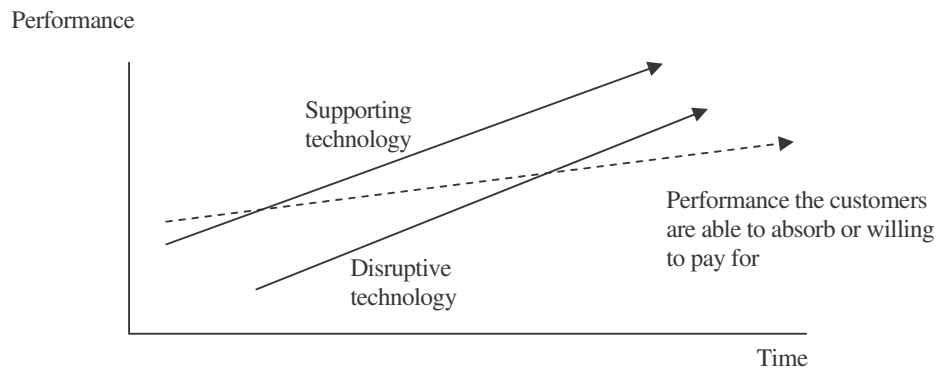


Figure 1 Disruptive innovation model proposed by Christensen (1999)

Gilbert (2003) considers that disruptive innovation has been understood by settled organizations as an attack that needs to be prevented by means of defensive measures. He reminds us that as the expansion of the disruptive innovation originally takes place in a market niche that is not served by the traditional players, they have no reason to retaliate, at the beginning. The new customers are not the same, neither is the way they use the product. Following the same reasoning, Hart and Christensen (2002) point out the key factors for a disruptive technology to be successful: they say that, at the beginning, the disruptive product or service should not be as good as those offered in the settled

markets, in order to avoid the reaction of the traditional players in a time the entrant is still not strong enough to bare it. But that is also the reason why successful companies, pressured to present sustaining growth and high profit margins, do not invest in disruptive technologies. Another condition for the success of the disruptive innovations is stressed by Graeml (2003), who says that the history of an organization, which ensures its success in still times, usually blinds it to changes, when they start happening at a faster pace.

From analog telephony to VoIP: chronology of telephony development – corporate market

Since the introduction of the telephone in the corporate environment, that market has gone through several transformations.

First, calls were completed by operators, who manually switched cables and plugged them to the connectors of the intended users. Such systems were referred to as PMBX (*Private Manual Branch eXchange*). After the introduction of the electro-mechanic switching technology, changes were substantial, especially with respect to the operation of the systems, as switching became automatic, not requiring human operators, anymore. Automatic switching equipment is called PBX (*Private Branch eXchange*) or PABX (*Private Automatic Branch eXchange*) (CHAPUIS and JOEL, 1982).

In the 80's, with the evolution of digital electronics and components' miniaturization, analog switching was replaced by digital switching. The new technology was based on converting the audio signal in a bit stream, transmitted by means of time division multiplexing (TDM). That evolution allowed for the introduction of the SPC PABX (Stored Program Control), still according to Chapuis and Joel (1982).

After telephony was digitized, its evolution has to be analyzed considering parallel advances in IT, as both fields became very integrated to one another.

Messerschmitt (1996) demonstrates the way convergence is taking place in the telecommunications/informatics arena, emphasizing the following issues:

- technology sharing – two technological evolutions made convergence possible: (a) computers started being used for telephony networks control and signaling; (b) after digital and video signals were digitized, it became possible to store them in computers.
- computer networks – the development of dedicated networks for the interconnection of computers, such as the local networks (LANs – Local Area Networks) and the long distance networks (WANs – Wide Area Networks), provided the technological grounds for applications such as e-mail, file transfer, concurrent databases and, at last, the web to appear. Telephony, in its turn, as part of telecommunications, started using concepts of computer network interconnection to remotely carry out control and signaling.

At the beginning of the 80's, a first demonstration of voice transmission over a data network was performed. It used TCP/IP (*Transmission Control Protocol/Internet Protocol*) protocol, which is the protocol based on which the Internet works (LIU and HAJHAMAD, 2005).

Also at that time, the first attempts to integrate data and voice systems started to be developed, by means of CTI (*Computer Telephony Integration*), which consisted on information sharing between data and voice systems (WETTERAU, 1998).

In the middle of the 90's, an Israeli company called VocalTec developed the first VoIP commercial software. But, at that stage, Internet's low speed and the computers' low processing capacity prevented the technology from being effectively deployed. Those limitations resulted in poor voice quality and long delays, noise and echo (LIU and HAJHAMAD, 2005).

Only late in the 90's, with the evolution of the technology and the development of new VoIP solutions it became possible for carrier operators and enterprises to use the technology in a commercial way. Such evolution resulted from the increase of the Internet's transmission speed and the improvement of microprocessors' and signal processors' (DSP – *Digital Signal Processor*) capacity, still according to Liu and Hajhamad (2005).

After that, the strategies that were adopted by different companies to support the new technology were quite distinct. The traditional players, focusing on their installed bases, developed strategies to migrate their TDM products to VoIP, in a more or less aggressive way, depending on their perception of the scenario, adopting hybrid VoIP solutions, which support both technologies. Entrants to the corporate telephony market, in their turn, concentrated in pure VoIP solutions (VANDERMATE, 2006).

The Frost & Sullivan institute (*apud* RAO *et al.*, 2006) remarks that, since 2001, the telephony market has gone through a series of innovations. The concept of network convergence has been applied for voice, video, data and service convergence. In addition to that, the possibility of using out of the shelf components results in many products being based on software and, consequently, on the integration of several previously existing applications, such as unified messaging⁴, presence⁵, collaboration⁶ and conference⁷. (BURTON *et al.*, 2006).

But only after 2004, IP PABXs became more popular than TDM PABXs (MACHOWINSKI, 2005).

Even some free software appeared in the market, for the implementation of PABX services, among which the best known is Asterisk (GRALLA, 2006).

In addition to that, the Internet's increase in speed has helped another player to grow in the market, the *Hosted-PABX*, which previously had a marginal market share (LEWIS, 2006). Telephone carriers had had the Centrex technology available to their users for many years, which emulated a PABX system in TDM public exchanges and allowed the *Hosted-PABX* service to be offered to corporate customers. However, that service was not used very often. With VoIP and Internet high speed access, this kind of service became more attractive (LEWIS, 2006).

More recently, VoIP was also integrated to another innovation that is spreading in the web, which is the *peer-to-peer* technology. The *peer-to-peer* architecture is a technique to structure applications that are distributed in such a way that the participating elements have symmetric roles, opposing to the notion of client-server, where client and server perform different tasks (RAO *et al.*, 2005). Such integration, which was originally implemented by Skype, was intended for public telephony customers. It was quickly adapted, though, to be also used by the corporate telephony market, transforming it in a very interesting service for small companies (BANERJEE, 2006).

Several analysts quote a Gartner Group's paper called *The IP-PBX is a Potential Architectural 'Dead End'*, which states that until 2009, corporate telephony services will migrate from an IP PABX to a distributed voice application model (VANDERMATE, 2006; KASS, 2006). Schulzrinne (2004), who is the creator of the SIP protocol⁸, says that VoIP can be understood in two different ways: (a) there are those who consider it a similar innovation to others that happened in telephony in the past. In that case, the change to package switching, which is taking place now, wouldn't be much different to the change from analog to digital switching, in the past. (b) others believe that VoIP is just another Internet application, which allows for the interconnection of voice legacy systems.

If this second idea prevails, the industry is, in fact, faced with a disruptive technology, which will have severe impact on the business model adopted for the commercialization of corporate telephony services.

METHODOLOGY

As it was mentioned before, the purpose of this study was to explore the effect of the introduction of the VoIP disruptive technology on the corporate telephony market. In order to understand that, the authors evaluated papers, news, white papers and reports that were available in the specialized media.

Information was gathered from secondary sources and accessed by means of Internet search engines, such as (Google Web and Google Scholar), and databases (ProQuest). The search was carried out primarily in English, using combinations of the words *enterprise*, *corporate* and *VoIP*. After gathering the information, the content was classified and analyzed. Priority was given to recent information, with focus on the last two years.

Secondary sources were classified according to the following categories: technical specialized magazines, specialized technical web sites, TI research institutes. Table 1, below, shows where the information came from.

Table 1 – Secondary sources used in the study

Category	Name	Papers	News	Interviews	Total
Specialized magazine	Business Communications Review	3	0	2	5
	America's Network	1	0	0	1
	ComputerWorld	6	0	0	6
Specialized web site	GCN	2	0	0	2
	itWire	2	0	0	2
	SearchVoIP	4	0	0	4
	TelecomWeb	1	0	0	1
	TMCnet	1	0	0	1
	VoIP Loop	2	0	0	2
	VoIP Planet	4	0	0	4
	VoIP magazine	1	0	1	2
Research institute	Forrester	0	2	3	5
	Frost & Sullivan	2	0	0	2
	Infonetics Research	3	1	0	4
	In-stat	1	0	0	1
	Juniper Research	2	0	0	2

Source: table created by the authors, including secondary sources of information used in this paper.

In addition to that, search was also carried out on a database that contains the proceedings of academic events, among which EUROMA, POMS and IAMOT (international) and SIMPOI and ENANPAD (Brazilian). There we could only find papers that addressed the effects of VoIP on telephony carriers and the consumers of telecommunications' services. No paper was found on the consequences of VoIP to the corporate telephony market.

Some information was also collected from the web sites of the players in this industry, such as NEC, 3Com, Huawei, IBM and Cisco.

At last, the web sites of large universities, among which MIT, Harvard, UCLA and UC-Berkeley were also searched. An MBA dissertation on the impact of VoIP on the corporate telephony market was found at the MIT's site and a study on *Hosted PBX* solutions at the Cataluña University's site.

Based on such secondary information, the following analysis was carried out.

ANALYSIS OF VoIP'S IMPACT ON THE MARKET

According to the Frost & Sullivan institute (*apud* Rao *et al.*, 2006), the global market of corporate telephony involved 7.59 billion dollars in 2005, growing ca. 10% in comparison to the previous year. Such growth happens in a non-uniform fashion in the markets of developed countries, such as the US and Europe, where it was around 5%, and the emerging markets, where in some cases it reached 15%.

The Infonetics Research institute (MACHOWINSKI, 2006) estimates slightly different figures for 2005. For this institute, the corporate telephony market was ca. 8.1 billion dollars, which represented an increase of 12% in 2004. The Infonetics Research estimates growth of 43% for that market until 2009, while the forecast for IP PBX revenue growth is 82%, while TDM PABX' revenue will decrease 88%.

The Forrester institute remarked that, in 2005, 12% of the surveyed companies were implementing VoIP and that, in 2006, that figure had reached 40%. Among the North-American companies, 51% expect to have migrated their telephony systems thoroughly to VoIP until 2010 (PIERCE, 2006).

Even with all the innovations that preceded VoIP in this market, a major feature was kept along the time, which was the fact of the equipment used for telephony being dedicated and, as a consequence of that, developed and manufactured by a reduced number of companies. In the large size systems market (more than two hundred extensions), only a few large companies were relevant, among which Alcatel, Avaya (split from Lucent in 2000), NEC, Nortel and Siemens (SULKIN, 2006). In the small and mid-size business solutions market, there were many more players, such as Philips, Panasonic, Mitel (EUA), Agfeo, Auerswald and Elmeg (Europe), Intelbrás and Leucotron (South America), in addition to those previously mentioned.

Table 2 presents the major players in the corporate telephony market and information on their role in this turbulent market.

Table 2 – Players in the corporate telephony market and their strategies

Company	Segment	Strategy for the market
Alcatel	corporate and carriers	It is one of the world leaders. Its major market is Europe. It sells IP PABX exchanges, as well as Hybrid IP ones. It announced a joint venture with Lucent Technologies, early in 2006, which promises to have greater impact on its business in the carriers segment (FROST, 2006; SULKIN, 2006).
Avaya	corporate	Since it split from Lucent Technologies, in 2000, it has only products for the corporate market. It manufactures IP PABX and Hybrid IP exchanges, being one of the leaders in the North-American market. After issuing the results for the second quarter of 2006 it dismissed its CEO. Analysts consider that the company bet on a faster growth of applications and services, which turned up not happening, at least up to now (HAMBLEN, 2006).
NEC	corporate and carriers	The company sells IP PABX and Hybrid IP exchanges, primarily for the Australasian market. Probably as a result of the fuzzy market, NEC is selling IP PBX's produced by Cisco, one of its competitors (SULKIN, 2006a).
Nortel	corporate and carriers	The company produces IP PABX and Hybrid IP exchanges. It is a leader in the PABX world market. It announced a partnership with Microsoft, which is still being analyzed by the market (CORNER, 2006a).
Siemens	corporate and carriers	Siemens originally played in both markets (corporate and carriers). However, the business unit that traditionally played in the carriers market merged with Nokia Networks. The corporate telephony business unit was split from the holding. In June 2006 the company announced its intentions to find a partner for a joint venture in that area or someone interested in buying its operation. It currently commercializes IP PABX and Hybrid IP exchanges. The company has announced a partnership with Intel with the intent of researching and developing VoIP solutions (CORNER, 2006; KRAPF, 2006).
Cisco	corporate	The company is a traditional supplier of data network infrastructure. It entered the VoIP market by acquiring a small company that already had a solution using that technology. It only carries pure IP solutions. It is one of the world market leaders for IP PABX (SULKIN, 2006a; RAO <i>et al.</i> , 2006).
3Com	corporate	Cisco's competitor in the data network infrastructure market, 3 Com launched its first VoIP product in 1998. In 2003 it started a joint venture with the enterprise arm of the Chinese company Huawei, according to information available at the company's web-site. In a partnership with IBM, it announced an integrated IP telephony system, according to press releases available in both companies' web-sites and to Mullins' (2006) comments. Sulkin (2006) alerts to the fact that 3Com is increasing its market share, starting to threaten the traditional suppliers.
Microsoft	corporate	Microsoft announced the launching of its unified communications platform (<i>Unified Communications</i>) for 2007. The company has settled partnerships with most players of the telephony market (WEISS e HAMBLEN, 2006; HETTICK, 2006).
IBM	corporate	IBM is a traditional integrator of IT solutions, whose telephony solution <i>Unified Communication</i> is becoming a threat to traditional players in that market (RAO <i>et al.</i> , 2006). The company announced an alliance with Avaya, in 2005, for the integration of voice to its e-mail and <i>Instant Message</i> solutions. In October 2006, it also announced a joint IP telephony solution with 3Com, according to press releases issued by both companies in their web sites and Mullins's (2006) comments.
HP	corporate	HP has a solution for <i>Hosted-PBX</i> providers, according to the company's web site.
Oracle	corporate	Traditional supplier of IT solutions, the company recently presented its IP PBX solution, which is part of a <i>Unified Communication's</i> system (RAO <i>et al.</i> , 2006).
<i>Open source solution providers</i>	corporate	VoIP open source software solutions can cause considerable impact to this market. Currently there are only free software solutions for small and mid-size companies, but there is the possibility of expansion of such solutions also for large companies (GRALLA, 2006).
<i>Hosted PBX solution providers</i>	corporate	This market niche is becoming more important as Internet connections become faster, because it enables the provision of a telephony exchange service over the web. Particularly for small and mid-size companies, this solution has a strong appeal, because it frees the company of having to manage the system, with which it usually has little or no affinity (LEWIS, 2006).
Integrators	corporate	With the migration of value aggregation in the value chain, from the suppliers of equipment to the sale and integration of software, these players became much more important and have now good potential of growth. In addition to that, the open source solutions increase the need for integrators and reduce the reliance on large providers (GRALLA, 2006).

Source: table created by the authors, based on information obtained from numerous sources.

As can be noticed, the telephony market, which produces nearly 8 billion dollars annually and concentrates in the hands of 5 major companies, has recently received at least 5 other large players from the IT area, as well as many other small entrants. Business models are suffering changes and it is still unclear which ones will be more successful in the future.

Analysis based on the theory of disruptive innovations

The corporate telephony market has been changing for many years as a result of innovations that resulted in better products at higher prices for more demanding customers, which is typical of supporting innovations. In addition to that, the market didn't generate favorable conditions for new players to enter it for a long time. Among the innovations that supported the advantages that had been previously acquired by those who proposed them were the already mentioned electro-mechanical switching exchanges, the digital switching exchanges and the CTI.

VoIP technology, in its turn, is easily understood as a disruptive innovation, as it presented, during its evolution, those circumstances that were pointed out by Christensen (1997) as typical of that kind of innovation:

- it was introduced as a technology with poorer quality than the one used in the market. At the beginning, VoIP presented problems in the quality of voice transmission, as well as with its reliability, availability and safety;
- the VoIP technology isn't a simpler technology than TDM, but, on the other hand, it simplifies the operation, eliminating the need of having two separate networks, one for voice and one for data;
- the new technology allowed new players to enter the market, as it is easily noticed: Cisco, 3Com, IBM, Microsoft and Oracle, as well as Open Source VoIP and Hosted PBX integrators were not part of the exclusive telephony market a few years ago.
- VoIP changed the business model for corporate telephony. The traditional market used to profit from the sale and rental of hardware, in the case of PABXs. The convergence with the data network is causing a migration to the sale of software solutions and services.

The way traditional telephony evolved, based on supporting innovations, is also perfectly well explained by the Disruptive Technology Model presented, next, by Christensen (1999):

- the supporting technology has developed to a stage that it exceeds customers' needs;
- the disruptive technology was ignored by established players because, at first, it was worse than the supporting technology. But, after some time, it improved in a way it presents more advantages than disadvantages for the average customer.

With respect to the strategy of the involved companies, it is noticeable that those companies that were already in the market attempt to keep their positions, offering products that are compatible with the traditional technology, but with the possibility of migrating to the new technology. On the other hand, entrants behave in a way that challenges the old technology.

CONCLUSIONS AND MANAGERIAL IMPLICATIONS

Migration of a market that relied on dedicated hardware (TDM telephony), going through hybrid systems (TDM with access to IP telephony), to pure IP systems as some currently available, doesn't seem to have reached the final stage of disruptive evolution, so far, after which a phase of supporting improvements would begin. The final situation may be the transformation of voice services in a computer service (as it happened to e-mail, for example), which would frustrate the expectations of those who invested and are still investing large sums of money in solutions for this market.

One of the difficulties that were found in carrying out the analysis that was presented in the previous section, and which needed to be taken into account, in order to present robust results, is the fact that the effects of VoIP on the corporate telephony market are still far from stabilizing. The revolution caused by VoIP seems to be just starting. Many adjustments will still take place before this technology can be considered mature. Issues such as safety, availability, reliability, among others, still need to be better

addressed. Time proximity to the events that were studied makes it impossible to keep the object of study as far away as necessary from the researcher in order to ensure that the analysis is not biased by the amplification of superfluous details and the minimization of relevant factors, as usually happens with short-term evaluations. The methodology that was used also has its own limitations. As only those papers, news and reports that were found using the search procedures mentioned above were analyzed, important sources may have been left aside, because they were not reachable using those tools.

Digital convergence, which to a certain extent is levered by the introduction of VoIP, may cause a myriad of other possible changes. There are, therefore, many possibilities for academic studies to be carried out, within the dynamic context in which this sector is involved. This paper didn't analyze, for example, the effect of VoIP in the verticalization or horizontalization of the voice solution market, the influence of lock-in in the path of evolution of the new technology and the standards' "war" which takes place during the establishment of the new technology. The strategy that is adopted by each of the players in this market as well as the achieved results could be the object of several case studies, which could help to explain the perspectives for the market in the future.

It is not easy to anticipate where these innovations are taking us. In many cases it is noticeable that, if on one hand the traditional players of a market are blinded by their own success trajectory, the introducers of disruptive innovations, on the other hand, do not have a clear picture of the changes they are proposing. In an environment where nobody is able to see the future clearly, it is comforting to find theories that, at least, help us better understand what is happening in the present!

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Notes

- ¹ See Porter's (1996) five forces model, which emphasizes the existence of forces that oppose a company's profitability.
- ² Of course, this is an over-simplification, because the new focus on unified communications may introduce new services, such as interactive games played in telephone conferences.
- ³ This author refers to "species" in an analogy to Biology, for which the best fit individuals and species survive in a hostile competition environment.
- ⁴ *Unified messaging* corresponds to the unification of the following types of messaging systems: instant messaging, electronic mail and voice mail.
- ⁵ The term *presence* is used by the 3GPP (Third Generation Partnership Project) in its technical specification 3GPP TS 22.141 V7.0.0 as a reference to a service that allows a user to publish a series of attributes about him/herself, called *Presence Information*, such as status, optional communication address, among others. By means of such resource, it is also possible to determine which users have access to that information, by means of which it is possible to indicate availability and the wish to be found.
- ⁶ The Webster dictionary (www.webster.com) defines *collaboration* as "to work together with others, especially in an intellectual activity".
- ⁷ Norm I.254.1 of the ITU-T (International Telecommunication Union) defines a conference call as a service that allows a user to communicate with several others simultaneously. That expression refers to audio, video, data and multimedia.
- ⁸ See section "Analysis based on the theory of disruptive innovations and lock-in" for a brief explanation of this protocol and the standards' war against H.323.